



INCREASING ACCESS TO AND DEMAND FOR ENERGY EFFICIENCY IN A PERSPECTIVE OF SUSTAINABLE ENERGY FOR ALL

A technical paper financed by the Norwegian Ministry of Environment

ADVANCED COPY

Acknowledgements

Supervision and coordination: Charles Arden-Clarke, Head of the Goods and Services Unit, SCP Branch, Fabienne Pierre, Programme Officer, SCP Branch, and Djaheezah Subratty, Programme Officer, Energy Branch, United Nations Environment Programme (UNEP)

Author: Professor Nigel Lucas, Fellow of the Royal Academy of Engineering, UK

Thanks to Paul Hofseth of the Norwegian Ministry of Environment, Arab Hoballah, Chief of the Sustainable Consumption and Production Branch of UNEP, Mark Radka, Chief of the Energy Branch of UNEP, Martina Otto Head of Policy Unit, Energy Branch, Ms. Garrette Clark, Programme Officer and Adriana Zacarias, Programme Officer, SCP Branch, UNEP, for their inputs and comments.

Layout: Shabani Ely Katembo

Copyright @ United Nations Environment Programme, 2012

This technical paper may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this paper as a source.

No use of this technical paper may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

Disclaimer

The designations employed and the presentation of the material in this technical paper do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing or trade names or commercial processes constitute endorsement.

Contents

1. Energy efficiency and global challenges	1
1.1 The purpose and structure of this paper	2
1.2 Why energy efficiency is important	3
1.3 The present context	4
1.3.1 Sustainable Energy for All	4
1.3.2 Post-Kyoto instruments	6
1.3.3 Energy+	8
1.3.4 The Marrakech process.....	9
1.3.5 Other initiatives	12
2. Energy efficiency and public policy	12
2.1 Why intervention is justified	12
2.1.1 Market failures.....	13
2.1.2 Regulatory failures	16
2.2 Instruments of intervention	17
3. Activities of UNEP in energy efficiency.....	19
3.1 Overview of activities	19
3.2 Mapping of activities.....	24
3.3 Case studies.....	25
3.3.1 Efficient Production	26
3.3.2 Efficient Products.....	28
3.3.3 Sustainable lifestyles.....	32
3.3.4 Innovative Finance	33
3.3.5 Overview	36
4. Assessment of UNEP's position	37
4.1 Criteria and indicators of assessment	37
4.1.1 Effectiveness	37
4.1.2 Efficiency	38
4.1.3 Equity	38
4.1.4 Implementability.....	39
4.1.5 Replicability and scaling-up	39
4.1.6 Trade-offs.....	39
4.2 Assessment of current practice.....	40
4.2.1 Regulations and standards.....	40

4.2.2	Voluntary agreements	43
4.2.3	Financial and fiscal incentives.....	45
4.2.4	Information Instruments	48
4.2.5	Provision of public goods	50
4.2.6	Summary	53
4.3	UNEP's comparative advantages	55
4.3.1	Strengths	55
4.3.2	Weaknesses	55
4.3.3	Opportunities	56
4.3.4	Extending access to energy efficient goods and services	57
5.	Future options	58
5.1	Criteria for choice	59
5.2	Level 1 analysis: Price reform.....	60
5.3	Level 2 analysis: Emphasis.....	61
5.3.1	Options for energy efficiency (price reformed countries).....	61
5.3.2	Assessment of options (price reformed countries)	61
5.3.3	Options for energy efficiency (subsidised prices).....	63
5.3.4	Summary of the assessment of options for energy efficiency	64
5.3.5	Options for extending access to energy efficient goods and services	64
5.3.6	Summary of options.....	68
5.4	Implementation issues	68
5.4.1	Long-term framework.....	68
5.4.2	Donor commitment	69
5.4.3	Private commitment	69
5.4.4	Funding	69
5.4.5	The need for economic expertise	70
5.4.6	Visibility of results	70
6.	Conclusions.....	70
6.1	Firm conclusions.....	70

Acronyms

10YFP	Ten Year Framework of Programmes on Sustainable Consumption and Production
ANME	Tunisian National Agency for Energy Conservation
AREED	African Rural Energy Enterprise Development
CDM	Clean Development Mechanism
CECED	European Committee of Domestic Equipment Manufacturers
CER	Certified Emissions Reduction
CFL	Compact Fluorescent Lamp
CSD	Commission on Sustainable Development
DC	Developing Country
DSM	Demand Side Management
DTIE	Industry and Economics
ESCO	Energy Service Company
ETDE	Energy Technology Data Exchange
GFEI	Global Fuel Economy Initiative
GHG	Greenhouse Gas
IEA	International Energy Agency
IFI	International Financial Institution
IRP	International Resource Panel
LCA	Life Cycle Analysis
LED	Light Emitting Diode
M&T	Monitoring and Targeting
MCDA	Multi-criteria Decision Analysis
MIF	Mediterranean Investment Facility
MRV	Monitoring, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Actions
NCPC	National Cleaner Production Centres
NCPP	National Cleaner Production Programmes
NLTC	National Lighting Test Centre
OECD	Organisation for Economic Cooperation and Development
PCFV	Partnership for Clean Fuels and Vehicles
SCP	Sustainable Consumption and Production
SE4A	Sustainable Energy for All
SEFI	Sustainable Energy Finance Initiative
SME	Small and Medium Sized Enterprise
SSREN	Special Report on Renewable Energy Sources
STEG	Société Tunisienne de l'Electricité et de Gaz
UNDESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme

UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNWTO	United Nations World Trade Organisation
USAID	U.S. Agency for International Development
WEF	World Economic Forum
WSSD	World Summit on Sustainable Development

Executive Summary and Conclusions

Summary

Unprecedented rates of technical change have created much prosperity, but also a range of daunting challenges. Mitigation and adaption to climate change, enhancing resource efficiency, achieving food security, the sustainability of agriculture, forestry and marine resources, demographic imbalances all present risks and challenges to the global economy and to social stability. Response to these complex and interconnected challenges is all the more difficult because of the uneven and growing inequality of income that is visible among countries and within their populations

This paper aims to evaluate how stronger policies towards energy efficiency can contribute to meeting the challenges. It seeks to draw lessons about best practice in energy efficiency policy, picking out key constraints and effective responses to implement energy efficiency. Drawing on this analysis, it assesses the work by UNEP on energy efficiency within the wider practice and on that basis it explores the options for UNEP in positioning its future work in the area. It covers both the implementation of policies for energy efficiency in the economy as a whole and the specific case of ensuring access to energy efficient goods and services in communities recently connected to modern energy systems, normally to electricity distribution and clean fuels for cooking and simple industrial processes.

The analysis is founded in the principle that public policy interventions should be addressed to identified market and regulatory failures that prevent commercial interests from behaving in the socially desirable manner and that the various forms of intervention attempt to correct or compensate for these failures. A market failure frequently observed is the attribution of direct and indirect subsidies to the price of energy and the failure to account for the costs of pollution; in the absence of correct pricing the implementation of policy for energy efficiency is complicated and finally ineffective.

The difficulties experienced in implementing policies for energy efficiency are not confined to developing countries, although they are generally more pronounced in that context. Energy efficiency is a difficult area of policy because energy is used by everyone in almost all human activities; there are many actors to influence and intervention has to cover a very wide ground. The context may also differ from country to country, and even between communities within countries; the response to instruments of intervention is not always as expected. Verification of regulatory compliance is always difficult and again this is especially the case in developing countries, especially where there is incidence of corruption.

UNEP has compiled an impressive portfolio of experience that is relevant to energy efficiency that extends over most forms of public intervention and over a wide range of economic sectors including sustainable production, sustainable products including buildings

and vehicles, sustainable lifestyles and coalition-building in support of innovative finance. Twenty-nine initiatives and projects are reviewed, but this is not intended as an exhaustive list. Of this set, twenty-two are chosen as case-studies, the selection being intended to reflect the coverage of the UNEP portfolio.

The case studies revealed:

- A large volume of high quality work, well-balanced with a good coverage of the spectrum of various aspects of EE and access to energy efficient goods and services
- Generally well-managed projects that mostly achieved the specific results intended
- An impact that without being disappointing often seems a little below what one might have hoped from the quality of the work
- The institutional base, the capacity in UNEP (except for economic analysis) and the networks are in all place for a much larger roll-out with much higher impact
- A weakness in conventional economic analysis – important in real decision-making

Tentative hypotheses why impact was not as great as might have been hoped are:

- Projects are not always as embedded in government policy as is desirable, driven sometimes more by donor interest than government's perceived need
- Projects are often small and not sustained long enough to achieve all the synergies that seem possible on paper. In many developing countries there is frequently little real interest until there are results and by that time the project has ended
- Although technical cooperation agencies do cooperate in many respects, they still have their own agendas and there can still be overlaps, gaps and even conflicts in their approach to a given topic
- The perennial instrument of energy price subsidies conflicts with and effectively blocks results from even the best of programmes

The significance of the activities of UNEP in the context of other international and national programmes is assessed according to the following criteria: effectiveness, efficiency, equity, implementability and replicability. Although generalisations are beset with difficulty, some robust lessons can be deduced and they are summarised in the Table, along with a short note on how UNEP's work has contributed.

The skills that underpin the comparative advantages of UNEP as they emerge from this analysis are:

- Advocacy and communication: especially with consumers and especially in changing behaviour and values.
- Building of coalition and consensus: the environment is intrinsically complex and

context sensitive and the need to cope with these characteristics imposes a temperament that is conducive to coalition building. UNEP has been successful in building partnerships among public and private interests and civil society, but also in negotiating the cooperation of sectoral Ministries in mainstreaming the ideas of sustainability for example in policies for government procurement; it has also developed and maintained a substantial capacity and expertise in working with the private sector and in influencing domestic and international markets.

- Innovative finance: Insufficient private finance in support of energy efficiency is one of the biggest obstacles to implementation and UNEP has found an important niche in this matter. It does not control large funds, but as a non-competitive, independent actor with authority in environmental matters it has been successful in working with the finance industry to determine how commercial deals can be constructed around energy efficiency.
- The multi-disciplinary and multi-dimensional analysis of problems that can provide the intellectual underpinning of smarter and more coherent (joined-up) regulation.

How UNEP decides to build on these skills to position its future work will be conditioned to some extent by what is going on elsewhere. There are many such activities with which links will need to be created, but four that will be especially influential are the UN Secretary General's initiative on Sustainable Energy for All (SE4A); the adoption of Nationally Appropriate Mitigation Actions (NAMA¹s) within the UNFCCC; the proposed Ten Year Framework of Programmes on Sustainable Consumption and Production (the 10YFP) and the Rio+20 conference in June; and the Energy+ initiative that would help make NAMAs effective. The implications for UNEP of these programmes have been assessed and included with some other considerations in a list of criteria by which to judge possible future options for UNEP.

There are strong arguments for differentiating technical assistance according to the extent to which countries have reformed pricing policy for energy. If prices are reasonably cost-reflective then UNEP's strengths would be useful in supporting their implementation of post-Kyoto mechanisms, including NAMAs and sectoral mechanisms. Such a line would be problematic in countries where energy prices are subsidised. In this case UNEP's skills might be better deployed through programmes that stood in continuity with past SCP programmes, but with a particular emphasis on promoting more energy efficient products (as measured along the life cycle), including demand side measures.

Analysis of the way in which UNEP's skills can best support the creation of access to energy efficient goods and services suggests that one effective path would be to promote and implement ideas of SCP suitable for communities that have been newly given access to

¹ Unless the context specifically excludes it, the term NAMAs is taken to cover all post-Kyoto mechanisms including sectoral crediting and sectoral trading

modern energy services. The aim would be to ensure that access to energy is complemented by measures that raise incomes and improve livelihoods in a sustainable manner.

There is also an important role for the advocacy skills of UNEP in raising awareness among public opinion and potential partners to SE4A. Large industrial commitments will be essential if the goals of SE4A are to be achieved; the determining factor will be whether a commercial case can be constructed, but there will also be a need to for innovative and effective campaigns covering fund raising, standards, procurement, training and behavioural change. UNEP's experience, particularly with the UNEP/UNESCO YouthXchange initiative and associated programmes is of value here.

There will also be a comprehensive need for monitoring and verification across all programmes. This will be needed to monitor regulatory compliance in energy efficiency and to ensure that better energy services actually reach the poor. Techniques of regulatory compliance and regulatory risk analysis are well-developed in environmental agencies and although UNEP does not appear to have drawn on this experience in its energy efficiency work, they are practices that could very usefully be deployed here.

Table 1: Summary by criteria with note on UNEP contribution

	Effectiveness	Efficiency	Equity	Implementability	Replicability	UNEP contribution
Regulations and standards	Very effective if regulations are appropriately set and compliance is assured.	Efficient in developed countries. International collaboration could help.	May disadvantage DCs through licence fees or loss of market. Offset by transfer of technology.	There is a threshold of effort (standards setting, testing). Compliance is the main problem.	In principle, but countries may define different standards that cause trade barriers.	Good capacity for coalition and consensus building in support of standards.
Voluntary agreements	Thought to be generally less effective than regulation. Prone to free-riding.	Low cost and low impact. Efficiency hard to judge.	No obvious equity implications.	Easier to implement than regulation and requires less enforcement.	Rare in developing countries.	Mostly done through partnerships with need for scaling up. UNEP has the necessary skill set.
Financial and fiscal incentives	Variable: depends on terms. Essential instrument to leverage private finance. Subject to interest group capture.	Variable. Well-designed programmes can leverage 15 times the volume of private finance.	Progressive – especially when for access or for EE in low-income groups.	Easy to implement; all countries have taxation and budgetary policies.	Programmes must be tailored to national circumstances. General lessons are replicable.	Substantial contribution through coalition building in support of innovative finance.
Information Instruments	Effective when combined with other instruments. Reduced value in isolation.	Efficient when well-combined with regulations or financial incentives.	Progressive as low-income groups have less good access to information or trouble interpreting it	Easy to implement, although impacts on behaviours can only be measured in the long run.	Much information is transferable but often requires adapting to national circumstances. International networks exist.	Good production and dissemination of innovative materials. Strong advocacy work.
Provision of public goods	Essential need for training, research and infrastructure. Effectiveness is project-dependent.	Leverage of expenditure on R&D and training is high. As is also knowledge and technology transfer.	Progressive as tax-payer funded and poorer people pay less tax.	Implementability depends on strength of competence in education, science and planning.	High degree of replicability. Depends on effective international networks.	Contribution to research and innovation through NCPs. Well-directed training effort.

From these considerations a tentative proposal for the future positioning of UNEP is made that would:

- Build on demonstrated competences from UNEP's past work
- Support SE4A in its objective regarding energy efficiency
- Be coherent with the objectives of the SCP programme and the 10YFP
- Build more links between SE4A initiative and the Rio+20 process
- Offer support to a prompt deployment of CDM and sectoral mechanisms

Structurally it would comprise four themes: "Support to NAMAs"; "EE enhanced SCP"; "Advocacy for Access"; "SCP for post-access communities". "Support to NAMAs" is taken here to encompass CDM if appropriate. Two of these themes address the implementation of energy efficiency and two address extending access to energy efficient goods and services. Their relationship to the main themes of UNEP's past programmes is shown in the matrix. The first theme is intended for countries that have cost-reflective energy prices.

Table 2: Linkages of proposed themes to key aspects of past programmes

	Support to NAMAs	EE enhanced SCP	Advocacy for access	SCP for post-access communities
Sustainable production	High	High	Low	High
Sustainable products	High	High	Low	High
Sustainable lifestyles	Low	Medium	High	High
Innovative finance	High	High	High	High

Conclusions

Firm

1. UNEP has a solid portfolio of experience that spans much of the scope of energy efficiency policy and it can build on this experience to make an important contribution to the pressing need to accelerate energy efficiency to cope with climate change and to provide access to efficient modern energy services.
2. In addition to its specific technical achievements, UNEP enjoys a set of managerial skills that are of substantial value to the promotion of the complex interdisciplinary programmes addressing many stakeholders such as are necessary for energy efficiency.

The set includes skills in: building coalitions of interest and consensus on complex technical issues; innovative finance; advocacy and communication.

3. A programme in the framework of the 10 Year Framework of Programmes on SCP (10YFP), or programmes or other global platforms for action on SCP, that emphasised energy efficiency within the general concept of SCP would provide valuable support for SE4A and would create useful links between such a framework or platform and SE4A to the benefit of both.
4. The programme could and should address both the implementation and the access to energy efficiency measures.
5. A long-term framework is essential for such a programme in order: to assure continuity of action on the ground and to provide medium-term visibility to countries and donors of the prospects and needs.
6. Predictable and sustained funding for SCP over a significant (multi-year) period would be beneficial in order to bridge gaps in programme funds and to assure continuity of support to SE4A and to country activities. A period of sustained effort for perhaps ten years is needed to move from policy design, through necessary capacity building up to effective implementation.
7. Equally, if the proposal for Sustainable Development Goals that will be examined by the Rio+20 conference is approved, then the same activities on energy efficiency and access to energy efficient goods and services can support an SDG on Sustainable Energy for All.
8. The introduction of NAMAs into the global framework for mitigating climate change provides an opportunity for UNEP to enhance its contribution to that important effort. The focus of NAMAs on sectoral strategy and policy is particularly amenable to UNEP's capacities. Regulatory compliance is an essential element of environmental management and UNEP is well positioned to develop these techniques as MRV tools and methodologies to support NAMAs in specific sectors, such as buildings (see Section 4.3.3).
9. Delivering energy efficiency on the scale envisaged by SE4A will require very large investments by the private sector and for this to happen there must be a viable business case. As a non-competitive agency, with authority in environmental policy, UNEP is well-placed to work with the financial sector and business to identify opportunities and obstacles and to negotiate with governments and civil society acceptable paths forward. It has already done this successfully in different ways with lighting, electrical equipment and buildings (and in improving specifications of transport fuels) and it is important to continue.
10. Fashioning private sector commitments to improved access to efficient energy services will benefit from skilful advocacy and the creation of favourable public opinion. UNEP's work on sustainable life styles and the supporting networks could be adapted for this

purpose.

11. The particular skills of UNEP need to be evaluated as a part of the total offer of skills from the technical assistance community and particularly other agencies of the UN family. In this respect the multi-disciplinary character of UNEP with authority in environmental policy has advantages. It can, as a neutral and non-competitive actor, organise coalitions of government, manufacturing industry, the financial sector and civil society to deal with complex problems both within a country and internationally. There are many outstanding issues to which this can be applied.
12. To the maximum extent possible, new activities of UNEP should build upon the existing delivery channels. It has in its past activities created effective and appropriate networks and participates in the institutional infrastructure provided by the NCPCs. The emphasis in the future should be on deploying these assets to the best possible effect in pursuit of well-established objectives.

Tentative

13. There is a strong argument for discriminating between activities designed for countries that have successfully reformed prices and those that have not. In the former case, a clear focus on helping countries implement NAMAs and sectoral mechanisms would be a valuable contribution to the global effort of mitigation. In the second case, it may be more effective to concentrate on strengthening capacity to design, implement and monitor policies in parallel with activities (from other programmes) to reform prices.
14. For the implementation of energy efficiency, a dual track comprising a line for “support to NAMAs” and another line comprising “EE enhanced SCP” would meet the differentiated need between country groups. It also has the advantage of demonstrating a clear continuity with the historic SCP activities, whilst still providing for adaptation to new ideas and needs.
15. For extending access to energy efficiency, there are two main lines of action that show promise. One is to extend the ideas and tools for SCP, mainly developed for conventional production processes and products, to the challenges that face communities newly connected to modern energy services. These SCP ideas and tools will provide guidance as to how these communities can ensure that they adopt the most efficient technologies consistent with their needs. The other is to deploy the networks created to further sustainable lifestyles to the new challenge of creating supportive public opinion to the right of universal access to modern energy services.

Increasing access to and demand for energy efficiency in a perspective of Sustainable Energy for All

1. Energy efficiency and global challenges

Unprecedented rates of technical change have created much prosperity, but also a range of daunting challenges. Mitigation and adaption to climate change, enhancing resource efficiency, achieving food security, the sustainability of agriculture, forestry and marine resources, demographic imbalances all present risks and challenges to the global economy and to social stability. Response to these complex and interconnected challenges is all the more difficult because of the uneven and growing inequality of income that is visible among countries and within their populations; this is not only a feature of developing, but also developed countries (OECD, 2011). Many people are largely excluded from the benefits of modern life, yet often suffer disproportionately from its costs. Severe income disparity was identified in a paper produced for the World Economic Forum (WEF) as one of the top global risks, greater both in likelihood and impact than climate change, (World Economic Forum, 2012). Solutions to global environmental challenges must be found that help to remedy and do not exacerbate these disparities.

The WEF study identified rising greenhouse gas emissions as the principle environmental risk with greater likelihood and greater impact than any other. Most authorities would probably concur with this judgement if only because if climate change cannot be mitigated then the consequences for other parts of the environment would be catastrophic with disruption to water systems, loss of biodiversity, desertification and erosion and consequent impacts upon agriculture, forestry and fisheries resources.

Abatement of the greenhouse gases (GHGs) that cause radiative forcing and therefore global warming and climate change can be achieved by: a) using energy more efficiently (energy efficiency); b) by shifting to means of energy supply that cause fewer emissions (low carbon energy); c) by better management of biomass resources to reduce emissions where they occur and to create sinks for carbon where possible (management of terrestrial emissions); d) by changing behaviour towards lower energy lifestyles – which might also be said to be a form of energy efficiency. All these changes in the sources and use of energy can make a fundamental contribution to the achievement of patterns of sustainable consumption and production (SCP).

Shifting to SCP patterns is both an overarching objective and prerequisite for sustainable development (WSSD, 2002). This paper addresses the first and last options, i.e. energy efficiency and behavioural change, examining their contributions in economic, environmental and social terms and also how approaches that have been pursued separately under the different rubrics of SCP and energy efficiency could be merged effectively, in particular by UNEP.

1.1 The purpose and structure of this paper

The aims of this paper are to:

1. Show, based on concrete examples of national and local policies, initiatives and projects, how energy efficiency can be a key driver for market transformation and to demonstrate its social, economic and environmental benefits through clear indicators of success;
2. Position UNEP as a key player in the field of energy efficiency.

The remainder of this first Chapter sets out the background. It summarises why energy efficiency and behavioural change are important and what they can be expected to contribute to the mitigation of climate change and a transition to a green economy. It then reviews some important aspects of initiatives that will bear on future technical cooperation in energy efficiency that will condition the context for UNEP's future work.

Chapter 2 sets out some of the key aspects of public policy intervention in energy efficiency. It analyses why intervention is justified and what instruments have been used to influence productive activities and consumer behaviour and how they have generally performed.

Chapter 3 recapitulates some of the past achievements of UNEP that are relevant to energy efficiency and present some selected case studies of activities that may be suitable for a long-term programme. Chapter 4 reviews the lessons of practice in energy efficiency as demonstrated by projects of UNEP, other international agencies and national governments.

Chapter 5 examines options for the future positioning of UNEP's work, taking into account its past experience of energy efficiency, its general mission and capabilities, the development of the field as a whole and the competences of other players. Chapter 6 draws some conclusions.

1.2 Why energy efficiency is important

The international consulting company McKinsey has published a global greenhouse gas abatement curve that ranks in order of cost some 200 measures for abating GHGs up to a time horizon at 2030, (McKinsey, 2009). The analysis is founded in a comprehensive data base compiled from evaluations of the potential and costs of greenhouse gas abatements in 10 economic sectors and 21 regions; it concludes that by 2030, 38 GtCO₂ per year of abatement could theoretically be achieved from energy efficiency, low carbon energy and improved management of terrestrial sources at a cost below €60 per tonne of CO₂ equivalent. This volume of savings would lead to emissions in 2030 that were 35% below those of 1990 or 70% below those predicted for 2030 on a Business as Usual scenario. The reductions would give a good chance of keeping the average global temperature rise below the 2 degrees Celsius that is generally seen as the most suitable compromise between ambition and feasibility, (IPCC, 2007). Of this total, 14 GtCO₂ per year of savings came from energy efficiency measures, 12 GtCO₂ per year from an expansion of low carbon energy supplies and 12 GtCO₂ per year from reduced terrestrial sources.

On top of these technical savings a further 4 GtCO₂ per year might be achieved by behavioural change; the financial cost of these behavioural changes is presumed to be low. As the authors acknowledge, the assessment of the impact of behavioural change was made after the calculation of the impacts of technical changes. There is a degree of ambiguity in what constitutes energy efficiency and what constitutes behavioural change and if the estimates had been prepared the other way around then the partition between the two sets of measures would be different, but the total savings of 18 GtCO₂ per year is probably a fair estimate. This is very nearly one half of the total mitigation potential.

The sheer volume of potential savings is already a strong indicator of the significance of energy efficiency, but there are other factors that contribute to its vital importance. Many energy efficiency savings can be achieved at low (it is sometimes said negative) cost and a part of them can in principle be achieved quickly. These are useful features. Low carbon energy supply is with some exceptions not commercially competitive and depends upon subsidy (in industrialised countries) or donor support (in developing countries). A certain reluctance to recognise the true social cost of GHGs together with the allocational problems that arise in treatment of global common goods means that the rate of development of low carbon energy supply will inevitably be below what is desirable on the basis of global social welfare. A large part of the potential for energy efficiency escapes these problems.

It is not the case that energy efficiency can be deployed overnight. For example, improvement in appliances or industrial equipment is to some extent conditioned by the rate of retirement of

obsolete items. Behavioural change arises out of multiple forms of education and learning and operates over a medium to long term perspective. However, many practices require little or low investment and can be achieved rapidly, like more efficient lighting or better maintenance of heating systems.

According to the IEA, energy demand on present trends will increase by one-third from 2010 to 2035. The dynamics of energy markets are increasingly determined by countries outside the OECD. In the IEA forecast, non-OECD countries account for 90% of population growth, 70% of the increase in economic output and 90% of energy demand growth over the period from 2010 to 2035, (IEA, 2011). It is reasonable to ask, if energy efficiency can be done quickly and pays back without subsidy, why it has not all been done and why such a large potential remains. The reasons are varied and are discussed in the section 2.1.

1.3 The present context

Technical cooperation in sustainable energy and climate change is complex and dynamic. There are many international and national programmes underway. Four initiatives that are especially relevant to the future positioning of UNEP within this effort are summarised here. The first is the Sustainable Energy for All initiative of the UN Secretary General; this is critical as it sets out the vision and the main strategic lines of the UN mission in the areas of energy access, renewable energy and energy efficiency. The second is the post-Kyoto world of instruments to support developing country participation in climate change as these will determine the operational mechanisms that will govern much technical cooperation in this area. The third is the Energy+ initiative sponsored by the Government of Norway that aims simultaneously to support Sustainable Energy for All and to blaze the trail for a wide-scale roll-out of post-Kyoto instruments. The fourth is the Marrakech process and by extension the 10 Year Framework of Programmes on Sustainable Consumption and Production and the Conference on Sustainable Development to be held in June 2012, because this process has determined much of UNEP's past work on SCP and there is a potential in a future 10YFP or other global platform for action on SCP to put in place new policies, incentives and awareness-raising and information tools to increase energy efficiency as a central plank of the shift to SCP patterns. These initiatives are discussed below together with some other programmes that are underway around the world.

1.3.1 Sustainable Energy for All

The risks that the increasing disparities in income pose to the stability of the global system have been noted earlier. In the specific case of energy this takes the form of poor access to poor quality fuels. The World Energy Outlook 2011 of the International Energy Agency estimates that:

- Over 1.3 billion people are without access to electricity and 2.7 billion people are without clean cooking facilities. More than 95% of these people are either in sub-Saharan Africa or developing Asia and 84% are in rural areas.
- In 2009, \$9.1 billion was invested globally in extending access to modern energy services. In the absence of significant new policies, investment between 2010 and 2030 will average \$14 billion per year, but will still leave 1.0 billion people without electricity in 2030; population growth means that 2.7 billion people will still be without clean cooking facilities, (IEA, 2011).

In December 2010, the United Nations General Assembly declared 2012 the International Year of Sustainable Energy for All, recognizing that “... access to modern affordable energy services in developing countries is essential for the achievement of ... the Millennium Development Goals and sustainable development”, (UN, 2011). In response, the UN Secretary-General, with support from UN-Energy and the United Nations Foundation, created a new global initiative - Sustainable Energy for All (SE4A) to engage governments, the private sector, and civil society partners globally. His initiative was first set out in a vision statement that sets goals for the global community in its efforts to cope with the simultaneous needs to extend energy access and to limit emissions of GHGs, (UN Secretariat, 2011) and further developed in a speech to the World Future Energy Summit 2012 in Abu Dhabi during which the International Year of Sustainable Energy for All was launched.

In his vision statement, the UN Secretary General notes that developing countries have the opportunity to leapfrog conventional energy options in favour of cleaner energy alternatives that will drive growth and enhance economic and social development. He proposes three linked objectives to underpin the goal of achieving sustainable energy for all by 2030:

- Ensuring universal access to modern energy services
- Doubling the rate of improvement in energy efficiency
- Doubling the share of renewable energy in the global energy mix

The statement of the Secretary General recognised many barriers to the achievement of these goals that will need to be overcome. Path dependence, or technological lock-in, often mean that policies and politics protect existing institutions and existing practices rather than seek new and better alternatives. There can be financial obstacles, particularly when operating costs are paid directly by consumers and investments are made by third parties, even if lower operating costs would yield net savings in the long run (known to economists as the agent-principal problem). Sources of financing – including multilateral institutions, bilateral assistance,

national development banks, the private sector, and carbon markets – are insufficient and not well coordinated and small-scale renewable energy and energy efficiency projects can be particularly difficult to finance because of their high transaction costs relative to their size. Perverse pricing and regulatory policies and practices that diminish financial rates or return on investment are a major disincentive to private capital. Insufficient recognition of external costs will distort economic analyses. Historic business models based on grid-extension have achieved high rates of energy access in many countries, but they may not be suited to sparsely populated or remote areas. New business models are needed that are commercially viable and innovative financing mechanisms will be necessary to support them.

Despite the magnitude of the challenge and the daunting barriers, Sustainable Energy for All envisages the possibility of success. There are many examples of activities that have overcome the barriers and that have extended access to modern energy services and improved efficiency. The key for future programmes is in scaling up and replicating these successes. To do this will require: better leadership and stronger commitment; stable policy and regulatory frameworks; a greater financial effort; strengthened capacity; increased support for innovation and improved communication and awareness that empowers stakeholders to make more sustainable individual decisions.

Elaboration of the SE4A initiative has been entrusted to a High-Level Group with representatives from the private sector, government, UN/intergovernmental organizations and civil society to develop a global strategy and concrete agenda for action to reach the three objectives. The roadmap should be endorsed at the Rio+20 conference in June 2012. The initiative seeks to engage stakeholders through formal commitments. Governments should commit to develop national energy plans and targets, provide financial support, and reform pricing policies. The corporate sector can employ more fully sustainable and clean production and make new investments in public-private partnerships to expand the offer of sustainable energy products and services. Civil society organizations can enhance outreach and education efforts, encourage transparency and action on the part of government and the private sector, and build capacity among local communities, (UN, 2012).

1.3.2 Post-Kyoto instruments

It is likely that much of the incremental effort to be made in energy efficiency in developing countries over the next 10 years will be in some way linked to or influenced by the new sectoral mechanisms that are slowly taking form within the UNFCCC. The project based Clean Development Mechanism has been the main mechanism until now for linking developing countries into the global mitigation effort. The scheme as originally conceived will run until the end of 2012 although projects registered before the end of that year will continue to receive

credits and the idea of some extension of the CDM has also some support.

The CDM was an enormous step forward in the search for an equitable procedure for distributing the costs of mitigation, but its restricted scope and practical problems, especially in the interpretation of baseline conditions and additionality have limited its effectiveness. The main perceived weaknesses are:

- Take up has been low and dominated by a few countries and a few technologies
- Being a project-based approach, the CDM cannot support policy implementation or mitigation action at the sectoral level that potentially could have far greater impact
- CDM projects do not reduce net global emission reductions because the emission induced in the host country is off-set against the inventory of the purchaser

The COP 17 in Durban addressed the question how best to continue international cooperation in climate change policy after the conclusion of the initial programme under the Kyoto protocol. It agreed to adopt: a) a roadmap to a new legally binding treaty covering all parties on emissions reductions by 2015 to take effect by 2020; b) a second commitment period of the Kyoto Protocol from 1 January 2013; c) a \$100-billion a year Green Climate Fund for developing countries, to become fully operational in 2012. Although much still remains uncertain it is probable that a main instrument of the participation of developing countries will be Nationally Appropriate Mitigation Actions (NAMAs), including specific policies (e.g. on standards for appliances), investments and possibly the introduction of emission trading systems in developing countries.

NAMAs were anticipated in the Bali Action Plan some years earlier that had launched “a comprehensive process to enable the full, effective and sustained implementation of the UNFCCC through long-term cooperative action” (UNFCCC, 2007). The idea of NAMAs was first introduced in this Action Plan and was confirmed by the Cancun Agreements under COP 16, (UNFCCC, 2011). These agreements recognise two types of NAMAs – “unilateral” and “supported”. Unilateral NAMAs are voluntary undertakings that are cost-effective in their own right and do not require financial support from developed countries – these would not be subject to rigorous monitoring, reporting and verification (MVR); in the view of some there would be no MVR at all. Supported NAMAs are those that require technical cooperation with developed countries and / or financial transfers and would normally be appropriate when the costs of the actions exceed the financial benefits. Financial support could come from carbon markets or conventional financial instruments. The tie-in to carbon markets is contentious and would generate a third kind of NAMA – a “credited” NAMA – that would generate emission reduction certificates eligible for trade on a carbon market. The EU is especially interested in

the possibility of sectoral crediting mechanisms and has made provision in the revision of the European Trading Scheme for this possibility, (EU Commission, 2009). The MRV requirement increase in rigour in passing from voluntary, through supported to credited NAMAs. The majority of effort in energy efficiency would probably be mainly, but not exclusively, under voluntary NAMAs because it can be achieved without external subsidy.

Much still remains to be done to make NAMAs operational. Country reporting under existing obligations is patchy and the value of the data is not always clear. If there is to be a change in reporting requirements then there may be an opportunity to merge and simplify existing requirements and focus on information of clear operational value. The data might advantageously be made available on the web. This would release scarce administrative resources in governments of developing countries. UNEP's expertise in specific sectors and its well-established partnerships with the private sector, specifically in the buildings sector, provides unique opportunities to develop the tools necessary to facilitate NAMAs, while supporting capacity building efforts at country and regional levels.

The shift to NAMAs offers richer opportunities than does the CDM to deploy the capacities of UNEP. The CDM revolves around concrete energy efficiency projects with the main actors being developers often supported by development banks. NAMAs depend more upon the implementation of policies, strategies, and programmes initiated by national governments in partnership with the private sector; the expertise of UNEP in coalition building to develop similar environmental activities would be valuable as would its capacity in the monitoring of reporting and regulatory compliance. At a city-wide level, UNEP's efforts to assist in the development of an urban CDM methodology can continue to provide support for large-scale energy efficiency programme by operationalizing CDM for cities.

1.3.3 Energy+

Energy+ is an international energy and climate partnership initiated by the Government of Norway in support of "Sustainable Energy for All". The Partnership aims to ensure access to sustainable energy for all and avoid greenhouse gas emissions through the use of renewable energy and energy efficiency; it was launched in October 2011 by the Norwegian Prime Minister Jens Stoltenberg at a conference entitled "Energy for All: Financing Access for the Poor, (Government of Norway, 2011).

Energy+ recognises the fundamental needs identified in Sustainable Energy for All, to simultaneously provide access to affordable, reliable energy to the several billion people of the developing world that lack access to modern energy services and at the same time to reduce emissions of global greenhouse gases. It notes that current levels of financing and existing

programmes and initiatives are inadequate. USD 7 billion of overseas development aid goes to energy projects, but this does not leverage private investment in the poorest countries. The principle barriers identified in the rationale for the programme are the unattractive risk/return profile and consequently inadequate access to capital. Investment may also frequently be restricted by an inadequate legislative and regulatory framework and the absence of competent technical and administrative agencies.

Energy+ will cooperate primarily with governments to develop commercially viable business opportunities for the private sector and so to leverage private capital. Engagement with countries will be in three stages. The first stage is to provide support for strategic planning, policy and regulatory reforms where needed; this is to be followed by a second stage of capacity building to implement the required policies and incentive mechanisms and to make the monitoring, reporting and verification (MRV) necessary to permit performance-based support at sector level. In the third stage, results-based financing will create and expand markets and leverage private sector investment. Finance will be delivered through carbon-finance triggered by compliance with agreed country-level indicators. The concept is to be tested in pilot countries, selected on the basis of political willingness and a positive assessment of the probability of success.

The procedure is coherent with the idea of credited NAMAs discussed in the previous Section and indeed is intended to accelerate the planning and implementation of NAMAs and to develop a basis of practice for a sectoral approach that can facilitate the development of guidelines for MRV of emission reductions and develop methodology and experiences in establishing new carbon markets.

The government of Norway has declared its intention to focus its clean energy support on a few delivery channels and actors where a high impact potential exists and to improve coordination and cooperation.

1.3.4 The Marrakech process

The Marrakech Process was launched in 2003 with the objectives to support the implementation of policies for Sustainable Consumption and Production (SCP) and to provide inputs for the elaboration of the 10 Year Framework of Programmes on SCP (10YFP). Establishment of this framework was considered by the Commission on Sustainable Development (CSD) during its 2010-2011 implementation cycle. Following the failure of CSD to adopt a formal decision, even though there was an agreed text on the 10YFP, there is now a clear possibility that the 10YFP could be established as one concrete outcome from the United Nations Conference on Sustainable Development, or Rio+20, to be held in June 2012.

The Process depended on an informal partnership of national governments, development agencies, and civil society lead by UNEP and UN DESA. Activities were implemented through seven Marrakech Task Forces; these were voluntary initiatives led by governments, focusing on specific themes of SCP, namely: sustainable products, sustainable lifestyles, education for sustainable consumption, sustainable building and construction, sustainable tourism development, sustainable public procurement, and cooperation with Africa.

The outcomes of the process were reviewed in 2011, (UNEP, 2011). The review found that the broadly-based coalition of stakeholders performed well and was successful in generating synergies, sharing information, transferring knowledge and promoting innovation. The process has helped design and pilot new policies, technical tools, management practices and capacity building activities promoting SCP. It also established national and regional consultation processes based on multi-stakeholder groups to identify needs and priorities for the transition to SCP. These elements could be expanded to support implementation of the 10YFP. The review recognised diverse priorities across countries, a wide range of performance in terms of cleaner production and supply and a general paucity of tools and procedures to raise awareness of SCP in many countries. It warned of the need to focus and to identify priority areas where international cooperation has the greatest impact on resource efficiency and where it can most effectively achieve decoupling of resource use and environmental degradation from economic activities while simultaneously increasing human welfare gains from those activities.

Experience of the process was helpful in identifying gaps in the available support for SCP. These included the following.

- Research and scientific knowledge: There is still a need for relevant and good quality evidence for policy making and for methods of measuring resource efficiency and progress towards SCP goals.
- Coordination and networking: There is a very wide range of programmes and activities dealing with SCP and similar concepts. More effective links within this community would improve efficiency and effectiveness.
- More work on the demand side and lifestyles: Behavioural change and social innovation are as important as technological innovation. Better understanding of consumer values and how better to motivate choices is needed.
- Capacity building and policy tools: There is insufficient awareness of and competence on relevant policy tools including life-cycle analysis, measuring “footprints” of goods and services on the environment; internalizing environmental and social costs; and mobilizing finance for strategic investments.

- Stronger inter-ministerial collaboration and a better integration of SCP into economic and development policies is needed.
- Technology development and transfer. More effective mechanisms for technology cooperation and sharing are needed and more attention should be given to the potential of and means for technological leapfrogging (or tunnelling as it is also known).
- Investments: More engagement of finance and planning ministries, development agencies, and IFIs is needed to mainstream SCP objectives and resource efficiency practices and measures in these policy areas.
- Communication: Cooperation is necessary with mass media, educational institutions and policy makers to shift people towards sustainable lifestyles.

If the achievements of the Marrakech Process are to be sustained and expanded then certain conditions must be met. These include:

- Bringing more political commitment: High-level endorsement is necessary now to mainstream SCP objectives into economic, financial and line Ministries in the productive sectors.
- Delivering a 10YFP: The 10YFP is needed for better coordination and cooperation in the promotion and implementation of SCP, it would also help to mobilize the necessary technical and financial support
- Replicating and Scaling up: The scope of activities to date has been restricted by resources; to achieve a significant impact their scale needs to be much increased.
- Increasing Financial support: Additional financial support is needed for scaling-up and capacity building.
- Measuring Progress: The 10YFP could usefully include more formal measures of success and of the costs and benefits of SCP policies and actions.

There is considerable coherence between these findings and the analysis of obstacles and needs contained within Sustainable Energy for All. The perceived need for high-level endorsement is delivered by SE4A (at least within the energy aspects that are an important part of SCP). SE4A also leans heavily on the fact that there have been many local successes and the need now is for global replication and scaling up, which would be one of the central objectives of a future 10YFP. The aims of SE4A are formulated over the long-term to 2030 and this would be coherent with the clear need detected by the review of the SCP for a long-term framework expressed in the 10YFP. The very high profile of SE4A should promote the adherence of government, the corporate sector and civil society to a long-term framework and to the provision of adequate funding, identified in the review of the Marrakech process as necessary preconditions for successful work in the future. Formal measures of success could be

incorporated in the 10YFP and will be needed also for SE4A; the set should cover not only impacts, but include intermediate indicators of outputs and outcomes. There is therefore significant complementarity between the possibilities, needs and ambitions of the two initiatives and the 10YFP could help support the aims of SE4A and their successful achievement.

1.3.5 Other initiatives

There are many other initiatives that have a similar overall goal either in place or planned, but which it is not possible to cover here in detail. The Asian Development Bank has for some years lead partnership of governments, civil society and the corporate sector to share knowledge, build capacity, and to develop projects that will extend access to modern energy services, (ADB, 2010). The Clean Energy Ministerial is a high-level global forum launched by the U.S. at the Copenhagen Convention on Climate Change with the goal of promoting clean energy technology and sharing lessons learned and best practices, (CEM, 2012). The U.S. government has also instituted a programme of technical assistance led by USAID for the development and implementation of Low Emission Development Strategies, (USAID, 2011). Lighting Africa is a joint programme of the IFC and the World Bank program that supports commercial off-grid lighting markets in Sub-Saharan Africa; it aims to build sustainable markets to provide safe, affordable, and modern off-grid lighting to 2.5 million people in Africa by 2012 and to 250 million people by 2030, (IFC World Bank, 2010). The Energy for the Poor Initiative is a venture by the OPEC Fund for International Development, (OFID, 2010). The Paris-Nairobi Climate Initiative was launched by France and Kenya at the 16th Conference of the Parties in Cancun in December 2010; it aims to promote access to clean energy in Africa and other countries vulnerable to climate change, (MDD, 2012). Access to secure, affordable, clean and sustainable energy services is a main focus of the energy programme set out in the recent Agenda for Change that charts future EU technical cooperation, (EU Commission, 2011).

2. Energy efficiency and public policy

2.1 Why intervention is justified

In most economies of the world the basic paradigm for resource allocation is the market. There are both theoretical and empirical reasons for the convergence on this model. In a free market goods are exchanged by consent, prices adjust to reflect scarcity; competition ensures efficiency and innovation. Of course, the notion of a completely free market is a fantasy and inconsistent with most people's ideas of social justice. On the other hand most alternatives have not proved successful, so we live in a world of regulated markets. The market underlies most exchanges, but there is a superimposed network of regulation.

The normal justification for public policy is that it seeks to correct market and / or regulatory

failures. Public policy should be subject to *ex ante* impact assessment and the first step in this process is to identify and characterise the failure to be remedied; see for example the EU guidelines for policy assessment, (EU Commission, 2009) or those of the UK Treasury (HM Treasury, 2011). Similar tools for developing countries are from the World Bank (2012) and UNDP (2012). The most common market failures can broadly be divided into six groups:

- Market prices do not reflect social and environmental costs
- Insufficient supply of public goods
- Market dominance
- Missing or incomplete markets
- Agent-principal conflicts
- Imperfect information

Regulations are introduced to correct market failures, but they themselves may fail and need revision. Cases of regulatory failure include:

- Inadequately defined property rights
- Poorly defined targets and objectives
- Unintended consequences of regulation such as barriers to entry
- 'Regulatory capture'
- Implementation and enforcement failure

In the case of energy efficiency the failures are numerous and often severe. All classes of market failure and several regulatory failures are present. The most important are reviewed below.

2.1.1 Market failures

Distorted market prices. There are two very important aspects of market failure that have an immense implication for energy efficiency policy. Universally, the market prices for energy fail to incorporate external social and environmental costs and in particular the external costs of energy production, indoor and outdoor pollution and climate change. It is contentious as to what the social and environmental cost of carbon may be, but it is generally agreed that it is high compared to the prices of fossil fuels, see for example the Stern Report, (Stern, 2007). Externalities can be internalised by taxes or by cap-and-trade mechanisms. The EU has made major strides in internalising the costs of CO₂ in the European Emissions Trading Scheme (EU Commission, 2009), but no market in the developed or developing world fully incorporates these costs into prices.

Of more immediate practical significance, many developing countries have heavily subsidised energy prices even in simple financial terms. The IEA, as a part of its annual series of World Energy Outlooks, measures fossil-fuel subsidies; its latest estimates indicate that fossil-fuel consumption subsidies worldwide amounted to \$409 billion in 2010, up from \$300 billion in 2009, with subsidies to oil products representing almost half of the total, (IEA, 2011). Work by the International Institute for Sustainable Development suggests that the IEA methodology provides a lower limit and that true subsidies may be higher (Koplow, 2009).

The ostensible reasons for fuel subsidies are that they alleviate poverty in countries where other redistributive mechanisms are weak or do not exist and that they promote economic development. In fact, where distorted prices exist, revision of prices to reflect economic costs of supply is firmly in the interests of national economies. There is an immense amount of literature on this topic (see for example (IISD, 2006), (Chomitz, 2008), (Lucas, 2009)). The evidence shows that subsidies encourage inefficient use; increase imports of energy (or decrease exports); weaken state budgets; lead to higher GHG emissions and local pollution; encourage smuggling; benefit the well-off more than the poor and distort infrastructure investment. Despite the economic logic, there are certainly political difficulties in raising energy prices, but there is some evidence that if the increases can be clearly associated with improved medical, educational and other social facilities then they can be successfully introduced. In the absence of proper pricing policy for energy the implementation of policy for energy efficiency is extremely difficult and there is little that international technical cooperation can do to remedy this in the absence of domestic political will.

Insufficient supply of public goods. If a good is public then consumption by one person does not reduce the amount available for others and once created it is available to be consumed by all. Few goods are entirely public, but the funding of public research, development and innovation has some of that quality. California for example imposed a public goods charge on electricity from 1997 until it was recently rescinded. The proceeds were used to fund alternative energy research and support innovative industries, (California Public Utilities Commission, 2011). National governments (and international agencies) can contribute to the supply of relevant research and methodology. Many governments in developed countries struggle to maintain public R&D expenditures at the levels that are thought to be optimum and in developing countries it is still more difficult to maintain an adequate level of funding.

Market dominance. This can be an important failure in energy efficiency policy. Integrated state-owned utilities will frequently give priority to their mainstream task, as they see it, of increasing the supply of energy. This is often true even when the marginal supply of energy costs more than the utility receives in revenues and when economic logic would then suggest

that their interest lies in selling less through energy efficiency. In reality their losses are often covered by the state and economic logic does not apply. The picture is not entirely black and white; some utilities have made efforts, but overall their situation is ambiguous and their participation in programmes of Demand Side Management (DSM), Energy Service Companies (ESCOs) and smart grids may be half-hearted; this is regrettable as they are often the major repositories of technical expertise in the area. Integration and state-ownership of utilities does have some advantages in extending grid access because the high costs and low revenues of grid extension can be rolled-up into a universal price for electricity through which urban communities subsidise rural. This not altogether bad, but it is bought at the cost of a serious lack of transparency and cost reflectiveness; there are better ways of proceeding.

Market dominance may also be a concern in smaller markets where one or more suppliers of appliances and equipment dominates the market and can continue to supply inefficient devices. This may be associated also with “regulatory capture”.

Missing or incomplete markets. The markets for finance of energy efficiency investments often do not work well; capital stringency in households and companies may mean that less efficient appliances are bought in full knowledge that the purchase is not cost-effective. Failures in financial markets are especially acute in developing countries where the commercial financial sector is less mature, arising from asymmetric information between borrowers and lenders and high transactional costs (LSE Grantham Research Institute, 2009).

Agent-principal conflicts. These are important in energy efficiency, especially for buildings. The user of a building or plant is often not the owner, for instance in rented accommodation. The owner seeks to minimize the investments in the building, because he does not directly perceive the benefits of energy savings; the user may prefer an efficient solution, but does not have the choice. In theory, if the owner is properly informed he may recognise the problem and find another building, but the conflict of interest does introduce a considerable inefficiency.

Imperfect information. This notion should be generalised to include poor analytical capacity (for example in investment) and a lack of understanding of issues. Even when energy prices are correctly set, people may still choose low-efficiency products. Sometimes this is because they do not have the money (see above), but often it will be because they do not have the information on which to make a more informed purchase or because they cannot process that information. Voluntary or regulatory labelling scheme can overcome this problem as can standards.

It is increasingly recognised that solutions to the interlinked grand global challenges cannot come from technical innovation alone, but will also require social innovation and an adaptation of behaviour. It is necessary to facilitate the dissemination of successful initiatives in this respect, promote the sharing of ideas amongst communities engaged in these experiments and create access by the as yet uninvolved so that they can learn and later contribute. A whole new set of communication tools and information exchange is needed to support these processes.

2.1.2 Regulatory failures

The main regulatory failure that affects energy efficiency is the simple problem of implementing the energy efficiency regulations themselves. Relatively straightforward instruments such as mandatory energy audits, labelling, standards, energy reporting or even following up on the correct use of grants can be challenging for developing countries. This is an important failing for which the obvious remedy is capacity building and methodology transfer. There are some parallels here with ensuring environmental compliance and UNEP's experience in that field could be usefully transferred.

The second main regulatory failure is the difficulty of mainstreaming ideas of SCP (and in particular energy efficiency) across Ministries. Ministries operate under all kinds of political and financial stress and they naturally tend to be restrictive in their perception of their responsibilities. So, for example Ministries of Transport tend to see their responsibilities as managing congestion, operating the licensing of activities and providing infrastructure. Sustainability and energy efficiency are secondary and the regulations that they promulgate will not normally give priority to the objectives of sustainability.

There are also inevitably conflicts between regulations in different fields. The installation of solar water-heating in communal dwellings for example may infringe building regulations or may be impeded by property rights to the roof space. This kind of constant adjustment and accommodation is inevitable in regulated markets and probably no more serious for energy efficiency than elsewhere, but still needs to be addressed.

There are some dangers of regulatory capture. It is always a possibility that utilities have disproportionate influence over their regulator and that this could inhibit energy efficiency regulation. There does not appear to be much evidence for this in practice at present, although participation in obligations imposed by the regulator may be half-hearted. Another area affected by such influence is the adoption of new standards for appliances. Such a move could be conceived by incumbent manufactures as a threat to their markets because they do not have the resources to redesign and restructure assembly lines and do not have the technology to match new requirements; they therefore fear the loss of their markets to foreign imports

from multi-nationals already equipped and enjoying significant economies of scale. The domestic manufacturers might well put pressure on local officials and politicians to resist the introduction of standards. This can sometimes be countered by providing protection through a requirement for local content, but there may be implications for free trade legislation.

2.2 Instruments of intervention

There is a variety of instruments by which governments can intervene to correct market and regulatory failures. The background paper for discussion at the High-Level Intersessional Meeting of the Commission on Sustainable Development in Panama in 2011 identifies five tool sets: (1) administrative instruments, laws and regulations; (2) fiscal and economic instruments; (3) planning and public investment in infrastructure; (4) information and analytical tools; and (5) voluntary tools and approaches, (UNDESA / UNEP, 2011). A somewhat similar taxonomy was used by UNDP in their analysis of key points of the Bali Action Plan, (UNDP, 2008).

We adopt the UNDP classification, with a slight change of titles for the classes. The characteristics of each class are summarised in the Table below. The categories are by no means water-tight, for example, labelling, which is an instrument to provide information is introduced by regulation; information programmes in general can be seen to be public goods and so on, but some categorisation is useful as a means of organising the discussion.

Table 3: Policies to encourage energy efficiency

Regulations and standards	
Standards for appliances	Standards for appliances and equipment. Can be introduced as minimum energy performance standards (MEPS) for specified classes of product or as an obligation for the entire range of a manufacturer's output.
Building standards	Buildings are an important special case because they account for 40 per cent of primary energy in most countries and consumption is rising fast.
Mandatory audits and reporting requirements	Industry can be obliged to undertake energy efficiency by mandatory measures. These can be cover: auditing, management, measurement and reporting; training; compliance with norms.
Obligations on suppliers	Obligations can be placed on suppliers in competitive markets to demonstrate programmes that save specified amounts of energy related to their total supply volume.

White certificates	White certificates are issued by an authorized body to certify energy savings; they are used to demonstrate compliance and may be traded.
Energy agency	Regulatory responsibility must be assigned to appropriate institutions; some activities can often be handled by existing institutions, but a specialised energy agency may be created.
Voluntary agreements	
Agreements to reduce energy use	Agreements are negotiated with major users of energy, or trade associations to reduce energy use below some specified target. They may be associated with incentives or threats of regulation.
Agreements to raise efficiency of products	Agreements can also be made with associations of appliance manufacturers to improve efficiency.
Financial and fiscal incentives	
Fiscal incentives	Fiscal incentives reduce the cost of an investment in energy efficiency through tax rebates; they are not directly funded, but still constitute a diminution of state revenues from taxation.
Grants	Funds from central government budgets have historically been common sources for energy efficiency and are still widely used. They have a wide range of applications: to encourage audits, to build capacity, as seed finance for ESCOs; to support investment; to encourage technical and social innovation; to explore lifestyle changes.
Concessional finance	Concessions include low interest rates and/or interest-free grace periods; concessional finance is helpful if banking sector activity in the energy efficiency sector is weak and/or where bank liquidity is poor.
Loan guarantees	Under a loan guarantee the guarantor to pay in the event of default by the borrower. There is evidence that this instrument exerts strong leverage on private finance.
Public procurement	Public procurement is a large part of final demand. There are direct impacts on energy efficiency and high potential to transform the market and encourage. At the same time, governments must ensure value for money and observe world trade rules.
Information Instruments	
Dissemination of best practice / training	This is a very common instrument in which technical assistance (TA) has played a large part. It tends to be low cost,

	but is most effective when it supports other incentives.
Networking	Stimulation of information exchange within a community (as opposed to didactic transfers) is very important and can benefit from modern media and ICT.
Labelling	Labelling compensates for asymmetric information between users and suppliers of equipment.
Debate on life-style changes	Economic behaviour is largely determined by social values; revision of those values is in the long-term essential to sustainability.
Provision of public goods	
Planning and public investment in infrastructure	More than half of the global population now live in cities; the nature and extent of public infrastructure has a huge impact on energy use and poor practice is difficult to reverse.
Research and Development (R&D)	Research and development into new technologies and new methodologies for assessment contribute to the stock of public goods through spillovers. Research should cover also social innovation and lifestyle changes.

3. Activities of UNEP in energy efficiency

The logic of this paper is that the legitimacy of UNEP's activities in public policy (as for any other actor) must be assessed by the extent to which they contribute to the design of effective and efficient tools of intervention to correct the perceived failures in the way in which the economy works at present.

This section therefore comprises: first, a brief overview of the activities, structured on a programmatic basis; second, a mapping showing how all those activities in principle make sensible interventions or contribute to the design of future interventions; third case studies to demonstrate the practical value of selected activities within each category of tool.

3.1 Overview of activities

UNEP is involved in various ways in numerous projects that have a bearing on energy efficiency and access to clean energy. In many cases energy is a prime focus of the work, generally in the wider context of sustainability; in other cases the emphasis is on a broader approach, where energy is one aspect among many and in a few cases the relationship to energy is relatively weak. The following Table provides a summary of projects and programmes that are relevant.

Table 4: Non-exhaustive catalogue of UNEP work in energy efficiency and access to energy efficient goods and services

Title of the initiative / project	Scale	Description and relevance
National Cleaner Production Centres	Global, regional, national NCPCs in 40 countries	UNEP and UNIDO launched the International Project on establishment of National Cleaner Production Centres (NCPCs) in 1995; there are now Resource Efficient and Cleaner Production services in more than 40 developing countries and economies in transition. Energy efficiency is a priority along with other aspects of environmental and resource use. http://www.unep.fr/scp/cp/
Resource Efficient and Cleaner Production / UNEP-UNIDO joint programme	Global, regional, national Ethiopia and Vietnam	In 2009 UNEP and UNIDO launched a new Joint Resource Efficient and Cleaner Production (RECP) Programme as a framework for collaboration with and support to NCPCs/NCPPs. Energy efficiency is a priority along with other aspects of environmental and resource use. http://www.unep.fr/scp/cp/
Sustainable product design / Design for sustainability	Global	UNEP promotes design for sustainability and other product related interventions such as product service systems to implement more sustainable consumption and production patterns. Energy efficiency is one consideration, assessed through life-cycle analysis. http://www.unep.fr/scp/design/
Task Force on Sustainable Products	Global	The Task Force focused on: science, policy, and convergence towards standardised test procedures (to measure energy performance and to introduce harmonized energy efficiency labels and standards). This led to the establishment of the IEA Implementing Agreement for a Cooperating Programme on Efficient Electrical End-Use Equipment. http://www.iea-4e.org/ http://esa.un.org/marrakechprocess/tfsusproducts.shtml
Lifecycle thinking / assessment	Global	Life cycle assessment assesses the direct and indirect resource use (including energy) of products and practices. http://www.unep.fr/scp/lifecycle/
Sustainable Lifestyles	Global	Most activities have been developed under the Marrakech Process Task Force on Sustainable Lifestyles. They explore ways to engage, exemplify, enable and encourage people, civil society organizations and governments to further sustainability in people's everyday lives. The projects are diverse and some have a strong component of energy efficiency and increasing access to energy efficient goods and services. http://www.unep.fr/scp/marrakech/taskforces/lifestyles.htm
Sustainable Public Procurement	Global, regional and national - Costa Rica, Uruguay, Mauritius, Tunisia, Chile,	Developed under the Marrakech Process. Sustainable public procurement is a tool which allows governments to leverage public spending (between 15 to 25 % of GDP) in order to promote the country's social, environmental and economic policies. Energy efficiency is one of many aspects to be considered, and would normally be a significant feature. http://www.unep.fr/scp/procurement/

	Colombia, Lebanon	
Buildings and Construction	Global	UNEP is working on the development of baselines for sustainable practice in the sector through the implementation of the pilot projects and interactions with other stakeholders. Energy efficiency is one of many aspects to be considered, but would normally be a significant feature. UNEP-SBCI is also developing the tools needed to meet MRV requirements to facilitate building sector-specific NAMAs. http://www.unep.fr/scp/bc/
Sustainable Tourism	Global, regional and national	Many activities were developed under the Marrakech Task Force on Sustainable Tourism, and are now continued under the Global Partnership on Sustainable Tourism. Energy efficiency is one of many aspects to be considered and is in many cases a feature. http://www.unep.fr/scp/tourism/
Energy Management and Performance Related Energy Savings (EMPRESS)	National	The EMPRESS project, funded by the GEF, was undertaken from 2003-2006, to promote Monitoring and Targeting (M&T), in the Czech Republic and Slovakia. A direct bearing on energy efficiency in the process industries. http://www.unep.fr/energy/activities/empress/index.htm
Industrial Energy Efficiency through a Cleaner Production Framework	Global and national China, Vietnam, India, Hungary, the Czech Republic and Slovakia	The project helped participating NCPCs integrate energy efficiency activities as a part of their core programmes. http://www.unep.org/climatechange/mitigation/EnergyEfficiency/Activities/CPEEProject/tabid/29342/Default.aspx
Developing Financial Intermediation Mechanisms	National Brazil, China and India	The project aimed to substantially increase investments in energy efficiency by the domestic financial sectors in. Important and direct bearing on energy efficiency. http://www.unep.org/climatechange/mitigation/EnergyEfficiency/Activities/FinancialIntermediationMechanisms/tabid/29343/Default.aspx
Sustainable Energy Finance Initiative	Global	SEFI was the UNEP Sustainable Energy Finance Initiative - a platform providing financiers with the tools, support, and global network needed to conceive and manage investments in clean energy technologies, including for energy efficiency applications. The work of SEFI has now been taken over by UNEP's Frankfurt School Collaborating Centre. Important and direct bearing on energy efficiency. http://sefi.unep.org/english/home.html
Training for Energy Efficiency in Buildings (UNEP-FI)	Financial institutions	The objective of the Course is to promote the transition towards a low-carbon economy, through the financing and investment in energy efficiency projects, specifically in Buildings. Important and direct bearing on energy efficiency. http://www.unepfi.org/training/energyef_training/index.html
Mediterranean Investment Facility (MIF)	Egypt, Macedonia, Montenegro, Morocco, Tunisia	The MIF develops and tests different options to increase available financing for renewable energy and energy efficiency systems, such as Solar Water Heating and Compact Fluorescent Lamps in Morocco. Direct bearing on energy efficiency. http://climatefinanceoptions.org/cfo/node/282

Energy Efficiency and the Finance Sector (UNEPFI)	Financial Institutions	A survey of lending activities and policy issues of energy efficiency in financial institutions. Direct bearing on energy efficiency. http://www.unepfi.org/fileadmin/documents/Energy_Efficiency.pdf
Improving Energy Efficiency in Industry in Asia	Bangladesh, China, India, Indonesia, Mongolia, Philippines, Sri Lanka, Thailand, Vietnam	This report was prepared as part of UNEP's Energy Efficiency Guide for Industry in Asia - emphasis is on financing. Important and direct bearing on energy efficiency. http://www.energyefficiencyasia.org/docs/tools/training_materials/Financing_EE_Review_2006.pdf
The Partnership for Clean Fuels and Vehicles (PCFV)	Global	The Partnership for Clean Fuels and Vehicles (PCFV) assists developing countries to reduce vehicular air pollution through the promotion of lead-free, low sulphur fuels and cleaner vehicle standards and technologies. Mainly aimed at reducing pollution, minor implications for energy. http://www.unep.org/transport/pcfiv/
The improvement of urban planning to promote inter-modality	Global	Facilitates a shift from private motorization to public and non-motorized transport modes in urban areas by raising awareness and building institutional capacities. Long-term bearing on energy efficiency and access to energy efficient goods and services. http://www.unep.fr/energy/transport/activities/
UNEP Handbook for drafting laws on Energy Efficiency and Renewable Energy Resources	Global	Helpful initiative of direct relevance to energy efficiency. http://www.unep.fr/energy/efficiency/documents/pdf/UNEP_Energy_Handbook.pdf
Energy Efficiency Technologies Knowledge Base	Global	Designed to promote and disseminate information on efficient industrial technologies. Intended to stimulate and initiate energy efficiency market transformation. Direct relevance to energy efficiency. http://62.160.8.20/eetkb
En-lighten Initiative (Global Market Transformation for Efficient Lighting)	Global National : Morocco, Vietnam	Aims at Global phase out of inefficient incandescent lamps by 2016 and creation of mechanisms for disseminating efficient lighting technologies (CFLs, LEDs). Important and direct emphasis on energy efficiency. www.enlighten-initiative.org
Technology Needs Assessment	Global	Aims to identify and support deployment of mitigation and adaptation technology priorities of countries. Energy efficiency is only a part of the coverage, but likely to be important. http://climatetechwiki.org/
Supporting Action on Climate Change through regional networks	Regional: South East Asia, Central Asia, Latin America and the Caribbean	Supports the development and exchange of knowledge among climate change professionals. Strong focus on promoting energy efficiency. http://www.unep.org/climatechange/mitigation/sean-cc/
Integrated Approach for Zero Emissions Project Development in the New Town of Boughzoul, Algeria	National : Algeria	Uses the design and development of a new town as an opportunity to introduce best practices in architecture and urban planning including energy efficiency and renewable energy. Large GEF project with UNEP as implementing agency. Potentially important.
Global Solar Water Heating	Global	Aims to accelerate commercialization and market transformation of solar water heating. UNEP

Market Transformation and Strengthening Initiative		contributes global knowledge management; UNDP implements country programmes.
Greenhouse Gas Emission Reduction from Industry in Asia and the Pacific (GERIAP)	Regional	Development of the Energy efficiency guide for industry in Asia and capacity-building of the national focal points and industrial plants; implementation of cleaner production and energy efficiency options; dissemination of the project results and findings; and sharing of knowledge across national boundaries. http://www.energyefficiencyasia.org/aboutgeriap.html
Sustainable Alternatives Network	Global	United Nations initiative that offers an advisory service with access to local experts and online information resources, including case studies of businesses that have successfully switched to cleaner technologies.

3.2 Mapping of activities

The manner by which the activities of UNEP contribute to the formulation and implementation of viable instruments of intervention is summarised in the Table 3.

Table 5: Mapping of projects and instruments of intervention

	Regulations and standards	Voluntary agreements	Financial and fiscal incentives	Information Instruments	Provision of public goods
Resource Efficient and Cleaner Production UNEP / UNIDO joint programmes	Input through advice and evidence to the elaboration of regulations.	Helps support application of third party building certification schemes through active partnerships with Green Building Council		Many innovative training materials. Contribution to IEA implementing agreements on EE.	Generates information tools and research that are public goods.
Lifecycle assessment	LCA aids clarity of thought in the design and assessment of regulation.				The dissemination of LCA increases the stock of public tools for analysis.
Sustainable product design	Contributes to improved design that underpins new generations of standards			Potentially influential in transferring ideas	As non-protected ideas the innovative design principles contribute to the public domain of knowledge
Sustainable Lifestyles	In the long-run such work may affect what are perceived as acceptable standards and regulation			Provides information and support to the exploration of new ideas and contributes to social transformation	Contributes to public understanding of social innovation in ways that could reduce energy use.
Sustainable Public Procurement	Helps support manufacturers in meeting more		Provides funding directly to manufacturers and indirectly finances		

	demanding standards		market transformation		
Buildings and Construction	Helps inform the construction of regulations and standards – the social housing aspect are especially useful			Contributes to the dissemination of knowledge about energy use in buildings and its control	
Sustainable Tourism		Helps foster voluntary compliance to certain standards of sustainable (and energy efficient) practice		UNEP's work on sustainable tourism has focused a lot on information instruments, awareness-raising campaigns	
The Enlighten Initiative	This is a multi-instrument activity that includes regulation.	This is a multi-instrument activity that includes agreements with business	Provides recommendations for financial incentives to overcome barriers	This is a multi-instrument activity that includes much dissemination of information	
Energy Management and Cleaner Production	Can contribute to mandatory practices of EE	Encourages voluntary improvements in production practices		Strong emphasis on the dissemination of best practice	Information tools contribute to the stock of public goods
UNEP Finance Initiative	Informing regulation	Led by financial institutions, with UNEP as Secretariat	Influencing financial institutions on investment choices and innovative financial mechanisms.	Innovative training courses	Good empirical work – increasing public understanding
Energy Finance	Activities in countries may result in domestic regulations	Influence business activity and partnerships	Partnerships or advocacy with Governments and private sector to build innovative financial mechanisms	Many training materials Including by collaborating centre	

3.3 Case studies

3.3.1 Efficient Production

National Cleaner Production Centres. Since 1995 UNIDO and UNEP have cooperated to establish and support National Cleaner Production Centres and Programmes (NCPCs/NCPPs) and they now operate in more than 40 developing countries and economies in transition. They cover not only energy efficiency, but a range of topics pertinent to Clean Production including Health and Safety, Hazardous Waste Management, Environmental Management Systems and Environmental Technology Assessment. Energy efficiency has nevertheless been a central aspect of their activities and the technical expertise of the centres has been important for the execution of several of the specific energy efficiency projects discussed below. Implementation of energy efficiency projects normally proceeds through specific time-limited project agreements with a donor and selected host countries. For example with the projects with GEF, SIDA and the Government of Norway that are described below. An independent evaluation in 2008 noted that there was no overarching programme strategy and implementation agreement between UNIDO and UNEP, (UNIDO-UNEP, 2008).

The evaluation enquired through a survey of a fairly small group stakeholders as to the relative applicability and interest of the various areas of work and found that energy efficiency and renewable energy was rated as 'high' potential by 18 respondents and 'medium' by the remaining 5 respondents. The achievements of the Centres are diverse and vary among countries, but there are some interesting features. The assessment of information dissemination for example found the outputs to be generally between "good" and "excellent", but the outcomes to be less impressive and the impacts to be "unknown", "unavailable" and "weak"; the picture is very similar for training and for policy advice.

Following this review UNIDO and UNEP introduced in 2009 a new programme entitled Resource Efficient and Cleaner Production in Developing and Transition Countries. This extended somewhat the remit of the Centres and provided a comprehensive strategic and coherent framework intended to facilitate the scaling-up and mainstreaming of activities and results. This framework included, inter alia, a medium-term budget plan of 70 M€ over five-year period, 75% of which would come from development partners, (UNIDO-UNEP, 2009).

Energy efficiency guide for industry in Asia. This was a principal output of the Greenhouse Gas Emission Reduction from Industry in Asia and the Pacific project funded by the Swedish International Development Cooperation Agency and coordinated by the United Nations Environment Programme. It was implemented in Bangladesh, China, India, Indonesia, Mongolia, the Philippines, Sri Lanka, Thailand and Viet Nam. The Guide comprises a variety of information materials about energy efficiency in process plants and is available in English and several Asian languages; it includes a methodology for auditing, case studies for more than 40 Asian companies in 5 industry sectors, technical information for 25 types of energy equipment, training materials and a contact and information database.

One of its principal features is the presentation on a CD ROM and the possibility to interact with the material. This has some advantages when dealing with senior management who may wish to feel more in control of the dialogue than they would be with more conventional presentations structured around a linear exposition according to the external logic of the presenter. A formal evaluation of the guide found that the work had largely achieved its objectives through: the development of the Guide; capacity-building; implementation of cleaner production and energy efficiency options; dissemination of the project results and findings; and sharing of knowledge among countries, (Bhattacharya, 2006). The cost of the project was a little under \$2 million and according to the evaluation a little over 1 million tonnes of CO₂ emissions were saved per year. At a nominal value of \$20 / tonne that implies remarkable social cost-effectiveness. The evaluation noted that the coordinated network of national focal points had strength in implementation, although the involvement of government authorities and industry representatives was less than expected and this reduced dissemination and impact. In general terms the project shows what immense potential exists for emission reductions through relatively simple measures, but underlines the great difficulty of getting the information to the potential users, even after it has been prepared.

The PRE-SME project. The PRE-SME project is somewhat similar to the above, but is aimed at supporting Small and Medium Sized Enterprises. It was piloted in Vietnam and Ethiopia. The objective is valid because SMEs contribute substantially to the economies of developing countries and are important sources of innovation and growth, but often struggle to justify allocating time and resources to discretionary activities such as energy efficiency whilst they face many problems in their core business. The PRE-SME project aims to provide the NCPCs with convenient tools to help SMEs improve the overall efficiency of their production processes from a life cycle perspective. The tools include interactive software tools for diagnosis and management; operational indicators, sector specific benchmarks and training materials. They are well-designed and imaginative and the project web-site lists some companies in which they have been applied. The project appears not to have been formally evaluated and it is hard to estimate with certainty the impact, but it seems to have been modest. The dissemination of tools seems not to have been associated with national programmes, but to have been rather restricted. The impression is of a good and interesting project that has not been sufficiently exploited.

Energy Management and Performance Related Energy Savings (EMPRESS). EMPRESS was a three year project that began in October 2003 and was funded by the Global Environment Facility (GEF); it was designed to promote Monitoring and Targeting (M&T) of energy use in industrial companies in the Czech Republic and Slovakia in association with an adapted financial model using the business model of an Energy Service Companies (ESCO). In this model the ESCO takes the capital risk for an energy efficiency investment in exchange for a

share in the cash flow accruing from energy savings. Private sector financing had not been used before in Central and Eastern Europe in this manner. Monitoring and Targeting is a proven, low-cost energy management tool that is almost indispensable in any programme of industrial energy efficiency. ESCO finance is more problematic and its success depends on certain pre-conditions in the financial sector of the host country.

The independent evaluation of the project was positive, although the evaluator noted (with some justification) that buildings are an easier ESCO prospect than industry and that the project would have been better directed to that market. After a slow start, because of the unfamiliar nature of the financial instrument, project objectives were partly met. The numbers of service providers and service contracts were within specification, but GHG emission savings were about half the target. The total investments made were nearly \$27 million, of which a little more than \$0.5 million was public finance (UNEP and host governments). This is an excellent level of leverage. The project developed a simplified M&T tool that was then made available to National Cleaner Production Centres elsewhere, (Lahbabi, 2010).

Industrial Energy Efficiency through a Cleaner Production Framework. The objective of this GEF-funded project was to reduce emission of Green House Gases (GHGs) in SMEs in six countries – China, India, Vietnam, Czech Republic, Hungary and Slovak Republic - through energy auditing and consequent associated investments. The total cost of the project was \$2.7 million and the aim was to reduce the emission of carbon dioxide by 225,000 tons/year. The independent evaluation determined that the emission target was reached and that 87 audits were accomplished by participating NCPCs out of the planned target of 90. Most audit recommendations were for either low cost or no cost measures that were financed in-house. The total investment for projects executed within the project was a little over \$7 million, of which a large proportion was in India. The financial leverage does not appear to have been calculated, but it was apparently rather low. Training greatly exceeded expectations and the project supported the publication of a CP-EE manual by UNEP-DTIE and the NCPC in India. This is good material, freely available as a CD-ROM manual with hyperlinks that helped contribute to knowledge exchange networks amongst the participating NCPCs during the duration of the project, (Karrir, 2008).

3.3.2 Efficient Products

Priority Products and Materials: Assessing the Environmental Impacts of Consumption and Production. This study is one of a series of scientific assessments published by the International Resource Panel (IRP) of the United Nations Environment Programme (UNEP). The objective is to assess the state of scientific understanding of the origins of environmental impacts within the economy in a global perspective and to identify priorities among industry sectors, consumption categories and materials. One of the most interesting results of the study is the insight that it gives into the way consumption patterns drive

production and how they vary between developed and developing countries. In industrialized countries housing, mobility, food and manufactured products typically determine over 70% of the impacts of household consumption. Government consumption, although significant, and investment in infrastructure is less determinant. For developing countries outside Asia, the public sector is often a large part of the economy and government procurement can be important for the life cycle impacts of final consumption. Many emerging economies in Asia currently make large investments in infrastructure, which makes this final expenditure category influential, (UNEP, 2010). Such analysis can help to determine regional priorities for technical cooperation.

The International Task Force on Sustainable Products: This activity was led by the Government of United Kingdom. The Task Force focused its work on three aspects of globally-traded energy consuming products: science, policy, and convergence towards standardised test procedures (to measure energy performance and to introduce harmonized energy efficiency labels and standards). Specific networks were established for: lighting; home entertainment products; electronic motors; and market surveillance and compliance. Collaboration within the Task Force helped to establish International Energy Agency Implementing Agreement for a Cooperating Programme on Efficient Electrical End-Use Equipment ("4E"), which is now the principal mechanism for international collaboration on the topic (IEA-4E, 2011). The Implementing Agreement brings together electrical equipment and energy efficiency policy makers from the industrialised countries and the large emerging economies together to identify and tackle barriers in the efficiency of electrical equipment and the implications for global trade and harmonisation; 4E can consequently provide informed policy advice to member governments. The Implementing Agreement has been especial influential in motor systems, stand-by power and solid-state lighting. The Task Force also organised jointly with the IEA a workshop intended to share best practices on compliance and enforcement against product standards. This is a very important topic where UNEP with its broad experience of regulatory compliance and regulatory risk management could contribute more.

Sustainable government procurement: The work on this topic has mainly been performed under the Marrakech Task Force on Sustainable Public Procurement launched by the government of Switzerland in 2005. The basic idea is that public procurement should take sustainable environmental, social and economic considerations into account. By this means governments can directly affect their own impacts on the environment, but also contribute to a transformation of the market towards less damaging products by underwriting through their purchases some of the costs of retooling and restructuring distribution. To do this requires tools that accurately reflect the cumulative environmental impacts along the value chain and for this purpose Life Cycle Analysis is an appropriate scientific tool, but a management tool to implement the procurement process is also needed. As no suitable existing tool was found, the task force created a new tool building on the methodology of

the UK Sustainable Procurement Task Force; this was then disseminated within a training and guidance package and the approach is currently being tested in 11 pilot countries. Although no formal evaluation of the project has been undertaken the Activity Report of the Task Force presents a convincing account of its achievements, (UNEP / FOEN, 2011). The work accomplished is substantial and provides an excellent basis for replication; the potential impact could be high.

Design for Sustainability (D4S) a practical approach for Developing Economies: This is a good treatment of how life-cycle analysis can be used in practice to reduce lifetime energy costs through an appropriate focus at the design stage, (UNEP TU Delft, 2006). In the longer-term this is a critical input into making more energy efficient products. Good design is not necessarily expensive and can have a big influence on energy use. The guide is based on an earlier review published as “Design for Sustainability: A Global Guide”, (UNEP, 2006), but modified for the specific needs of small- and medium-sized companies in developing economies; it identifies and describes a practical, step-by-step approach through needs assessment, redesign and benchmarking; reference information and case studies are also provided. The manual is the product of a long-term partnership between UNEP, Delft University of Technology and a range of international experts. The intention was to disseminate the D4S concept through the NCPs, but it is unclear whether that ever happened. There seems not to have been the follow-up which the importance of the topic and quality of the work deserve.

Sustainable Buildings and Climate Initiative. The UNEP-SBCI is a partnership between public and private sector stakeholders in the building sector, working to promote sustainable building policies and practices worldwide. It has a variety of goals and objectives including: advocacy within and outside the building community; the development of tools for performance assessment; the support of policies for sustainable buildings; piloting of tools. One of its principle outputs was the release at COP 15 of the report, “Buildings and Climate Change: a Summary for Decision-Makers”, (UNEP SBCI, 2009). Buildings account for more than 30 percent of worldwide energy use and the rate of construction in developing countries is very high - especially in Asia, but also Latin America and South Africa. Buildings generate 8.6 billion tons of CO₂eq per year and this will double over the next two decades.

There are substantial possibilities to reduce energy consumption in existing buildings, but especially in the design of new stock. None of these findings are new, but the report does propose practical actions for creating a carbon-neutral building sector involving national and international policy makers, municipalities, the construction and finance industries and civil society; it also makes recommendations for realistic and potentially effective actions post-Kyoto such as: performance-based indicators to use for project approval and monitoring; the development of performance-based baselines for different types of buildings; devising means to support activities aiming at providing poor people with access to energy to meet

their basic needs for shelter; using statistical means of MRV rather than direct measurement. In these matters, bearing on what the international community can do to support better performance in buildings, the report is innovative and significant.

en.Lighten Initiative: This is a partnership initiated in 2009 between the United Nations Environment Programme (UNEP), OSRAM AG and Philips Lighting with the support of the Global Environment Facility (GEF); the National Lighting Test Centre (NLTC) of China joined in 2011. The objective is to reduce energy use in lighting through a global market transformation achieved by a coordinated global strategy and by providing technical support. A core activity of the partnership is the conduct of Country Lighting Assessments to demonstrate to decision-makers the financial and environmental benefits of improved lighting and in particular the replacement of incandescent lights by CFLs with equivalent light output. The annual global savings in emissions from phasing out incandescent lamps is roughly equal to that from the electricity sectors of the United Kingdom and Denmark combined.

The partnership seems to have had some policy influence; regional seminars in 2011 for South East Asia, Latin America and the Caribbean and the Middle East and North Africa attracted government representatives from 56 countries and gave support to the concept. To support the process UNEP has created a Centre of Excellence on Efficient Lighting, comprised of international experts from some 30 countries to provide guidance and technical support. A toolkit to provide guidance for countries on how to transform their markets to efficient lighting is expected to be published in early 2012. In 2011, at the Durban Climate Change Conference UNEP and GEF jointly announced that the en.Lighten initiative had set a target of 2016 for the global phase-out of incandescent lamps and at the same time the South African Government committed to a 2016 phase-out of incandescent lighting, becoming the first African nation so to do.

The Partnership for Clean Fuels and Vehicles: This partnership was launched at the WSSD in Johannesburg in 2002 and now has over 90 partners from government, research institutions, international agencies and civil society. It is primarily intended to help developing countries to reduce vehicular air pollution from lead and combustion products and has been especially successful in phasing-out leaded petrol, (Todd & Todd, 2010). This is relevant to the determination of pertinent skills for energy efficiency because it shows how the multi-disciplinary nature of UNEP permits it to build coalitions of industrial and regulatory interests to determine effective, but commercially viable routes to environmental goals. Recently the PCFV has extended its activities to include fuel economy and is a participant, along with the IEA, the FIA Foundation and the International Transport Forum in the Global Fuel Economy Initiative (GFEI) that aims to improve automotive fuel economy in developing countries by the collection and distribution of best-practice. In particular the GFEI: collects and analyses data pertaining to fuel use by country and region;

supports national and regional policy-making efforts; conducts outreach and awareness raising to stakeholders. This is a vital initiative because the global vehicle fleet on recent trends will triple by 2050 and over 90% of the increase will be in developing and transition countries. The initiative has defined a “50by50” goal (an improvement of 50% in average worldwide new car fuel economy by 2030, leading to a 50% improvement in average worldwide on-road fleet fuel economy by 2050), (GFEI, 2011).

3.3.3 Sustainable lifestyles

YouthXchange climate change and lifestyles guidebook. A Task Force on Sustainable Lifestyles was created in 2005 by the Swedish Ministry of the Environment as part of the Marrakech Process; its aim was to engage with governments and civil society to further sustainable lifestyles by gathering and disseminating best practice. The Task Force formally concluded in 2009, although some activities continue. The output of the Task Force is prolific and covers 43 regions and 11 different languages, (MoE Sweden UNEP, undated). Most of it has some connection to energy efficiency, but sometimes peripheral. One of the most interesting activities in relation to energy efficiency and access to energy efficient goods and services is the UNEP/UNESCO “YouthXchange” programme and in particular the Climate Change and Lifestyles Guidebook, (UNESCO and UNEP, 2011a). The idea preceded the Swedish funding and was initiated jointly by UNEP and UNESCO in 2001 with an original target audience of young people in developed countries. The main target of the Swedish funding through the Task Force was youth in developing countries and the tools have consequently been revised and implemented in Asia Pacific, Europe, Latin America and the Caribbean and West Asia and are currently being adapted for Africa.

The objective is to empower youth to take action on sustainable lifestyles through information that respects local culture. It is a complex project using a range of ideas to reach young people including peer-to-peer communication, a variety of media, celebrity endorsement and high visibility events. The concept seems useful and potentially influential over the long-term; middle-class young people in developing countries can have high carbon footprints and they act as role models for the less fortunate. If their attitudes can be shifted to a stronger emphasis on sustainability then it will be important. The problem is that accurate measurement of impact is hard to make. The internal evaluation of the project recognised the difficulties, but concluded that many people in many countries have been reached, capacity and partnerships have been built, and lessons learnt. The empowerment of local organisations that have put significant voluntary time and effort into the project has leveraged further spontaneous initiatives.

Sustainable Tourism: Excellence in Energy for the Tourism Industry. UNEP has a substantial body of work on sustainable tourism, much of which quite correctly addresses biodiversity and local environmental pollution, but there are some elements that also bear on resource efficiency. The project “Marketing Assistance to Nepal for Sustainable Tourism Products”

was to demonstrate that sustainable tourism can be a market asset; it was very successful in that respect and had immediate impact through reduced waste flows, lower electricity bills and higher incomes among women, (UNEP, 2009). A separate project 'Excellence in Energy for the Tourism Industry', promotes energy efficiency and the rational use of energy resources in hotels. A user-friendly tool for benchmarking and capacity building for energy efficiency in the hotel sector has been developed in conjunction with the UNWTO and Intelligent Energy Europe. The target groups are hotels, hotel associations, national tourism bodies, tour operators, suppliers and manufacturers in the field of energy efficiency and renewable energy use. The notion is good, but there seems to have been no systematic evaluation and no published evidence about the effectiveness of the project.

African Rural Energy Enterprise Development (AREED) Programme. The AREED Initiative was implemented by UNEP to extend access to energy among the rural poor of five countries of Western and Southern Africa, (Ghana, Mali, Senegal, Tanzania and Zambia). The aim was to foster new sustainable energy enterprises supplying clean, efficient, and renewable energy technologies. The initial phases of the programme from February 2000 to December 2002 offered technical assistance, but a later phase offered start-up financing to local organizations and SMEs engaged in social enterprises and sought participation by microfinance institutions and local banks. The independent evaluation found that despite initial difficulties the project was successful in building capacity among local partners, particularly local NGOs and SMEs. There was evidence of a range of successful enterprises including rural photovoltaic lighting (energy saving when it replaces kerosene lamps); efficiency stoves, efficient light bulbs and LPG stoves that replace charcoal, wood and dung, (N'Guessan, 2009).

Global Network on Energy for Sustainable Development. This is a world-wide network facilitated by UNEP and designed to analyse energy options and policies that can help meet the Millennium Development Goals (MDG). It comprises 9 institutions in Africa, Asian and Latin America. Work on particular aspects is contracted to member institutions and reviewed in regular meetings. Considerable work has been done on ways of extending energy access to the urban and peri-urban poor. An independent mid-term review found that the network was financing pertinent research in several important niche areas and that the quality and relevance of outputs was high although the target audience for the outputs was not always clearly defined. The evaluation found anecdotal evidence that there had been some influence policy processes, but that there needed to be a more sustained and sophisticated strategies of dissemination and better access to policy making circles, (Mann, 2010).

3.3.4 Innovative Finance

Sustainable Energy Finance Initiative (SEFI). UNEP has created a partnership the (UNEP Finance Initiative) with some 200 financial institutions and a variety of partner organisations

to develop and promote linkages between sustainability and financial performance. The Sustainable Energy Finance Initiative is a joint venture of the UNEP Finance Initiative and the Energy Branch to create a platform for financiers that will provide them with the tools, support, and global network needed to further their investment strategies for clean energy technologies. Its functions are to provide timely information, to facilitate the negotiation of deals, to develop partnerships, to catalyse public-private alliances and to mainstream sustainable energy within the energy investment community. Its main activities are networking and the publication of detailed and timely reports drawing of the pooled expertise of its network members; the 2006 report on financing energy efficiency is especially pertinent, (BASE SEFI, 2006).

Developing Financial Intermediation Mechanisms for Energy Efficiency Projects in Brazil, China and India: This was an ambitious project designed to stimulate increases in energy efficiency investments by the domestic financial sectors in Brazil, China and India, the three largest economies in the developing world. It sought to identify and to overcome barriers to finance of energy efficiency investment and to identify financial mechanisms adapted to each country's conditions. It started in November 2002 and finished in 2006. An independent review of the project concluded that the level of investments in energy efficiency has been improved through the project activities, at least in Brazil and India, but that it was not possible to make quantitative estimates because the records of the financial institutions were not adapted to such an investigation. In Brazil, several public and private banks have integrated energy efficiency within their portfolios as a result of the project; in India the project encouraged five banks to draft dedicated credit lines for energy efficiency and three were actually implemented; in China, a pilot project was launched to convince banks to adopt EE financing schemes and to demonstrate a project appraisal methodology, but the banks would not finance any of the 12 projects identified by the project. The main recommendation of the evaluation was that in future similar projects concerned with the design of financial instruments it is essential to include monitoring tools to document the volume of investments, the foreseen energy savings, and the GHG emissions reduction, (Morel, 2008).

Energy Efficiency Financing in Buildings Online Course: The UNEP Finance Initiative runs several on-line training courses for the financial sector. The buildings training course is designed to enhance the capacity of financial institutions to investment in energy efficiency projects, specifically in buildings and to encourage a greener outlook its clients generally. It is an innovative project with apparently a very high capacity for replication, but there seems to be no public evaluation of its success or measurement of its impacts.

Using Carbon Finance to Promote Sustainable Energy Services in Africa (CFSEA). This project was designed to accelerate the implementation of CDM projects in Africa; it was funded by UNEP and the Carbon Finance Unit of the World Bank and implemented in Ghana,

Mozambique, Zambia, Mali and Cameroon. According to the independent evaluation, Designated National Authorities were established in all the countries together with the legislative framework and operational capacity and four CDM projects were registered, but no Certified Emissions Reduction (CER) deal flow was established, (Frydenberg, 2010).

Mediterranean Investment Facility (MIF). This is a joint initiative of UNEP and the Italian Ministry for Environment Land and Sea that aims to introduce financial mechanisms in Mediterranean countries (Tunisia, Egypt, the Former Yugoslav Republic of Macedonia, Montenegro and Morocco) to support renewable energy and energy-efficiency systems, such as solar water heaters, photovoltaic systems and compact fluorescent lamps, and to ensure their sustainability by strengthening the capacity of local stakeholders. Money provided by the Italian government was used to support financial intervention by UNEP in a variety of contexts; the value of project was modest, \$10.2 million, but in some cases the results were substantial.

In Tunisia, the MIF project supported the very successful Prosol project for solar water heating through a loan facility arranged jointly by the MIF, the Tunisian National Agency for Energy Conservation (ANME) and the Société Tunisienne de l'Electricité et de Gaz (STEG). Under the arrangement the investments in solar water heating benefitted from a 20% subsidy plus a credit line from the electricity utility over five years repaid through the electricity bill. This had a strong impact; by 2009, 400,000 m² of solar collectors had been installed in the residential sector and 5,000 m² in the tertiary sector; 45 manufactures had been approved and more than 1000 installers. The success of the financial intervention owed much to the strong government policy and the high competence of the Tunisian Energy Agency. The success of the Prosol project has led to similar approaches in 11 other countries. The project shows very clearly how financial support can be determinant when combined with supportive and sustained government policy and locally competent institutions.

Cleaner Production Financing. In 1999 UNEP started a four-year project aiming at stimulating investments in cleaner production through demonstration projects designed to help local experts in cleaner production to develop creditworthy investment proposals. The project, focused on five demonstration countries: Guatemala, Nicaragua, Tanzania, Vietnam and Zimbabwe and was conducted under a trust fund created by the Norwegian Government. The intentions were: to demonstrate how to initiate and facilitate the financing of cleaner production investments through case studies of these countries; to develop financing instruments along with strategies for supporting public and private financial institutions and the industrial community to adopt them; to motivate key decision-makers.

Core teams of national experts were created in each country and trained to facilitate the preparation of cleaner production investments. Portfolios of cleaner production loan applications were prepared in each country and some have since been financed. Reviewing the experience, a UNEP staff member concluded that the project demonstrated that: cleaner production is frequently an investment with a return; prevention of loss of materials or products is a mainstream business concern; cleaner production is concerned with long-term profitability; it is a strategy that requires a change in attitude and behaviour, (UNEP DTIE, 2002). It is not clear which if any of the financed projects were intended for energy efficiency, but in any case the same lessons apply.

3.3.5 Overview

This review reveals:

- A large volume of high quality work, well-balanced with a good coverage of the spectrum of various aspects of EE and access to energy efficient goods and services
- Generally well-managed projects that mostly achieved the specific results intended
- An impact that without being disappointing often seems a little below what one might have hoped from the quality of the work
- The institutional base, the capacity in UNEP (except for economic analysis) and the networks are in all place for a much larger roll-out with much higher impact
- A weakness in conventional economic analysis – important in real decision-making

The reasons for the problematic impact are hard to determine. Tentative hypotheses might be:

- Projects are not always as embedded in government policy as is desirable, driven sometimes more by donor perceptions and interest than government's perceived need
- Projects are generally not sustained long enough and do not achieve all the synergies that seem possible on paper. In many developing countries there is often little real interest until there are results and by that time the project has ended, so that there is often insufficient transmission of knowledge to local counterparts.
- Although technical cooperation agencies do cooperate in many respects, they still have their own agendas and there can still be overlaps, gaps and even conflicts in their approach to a given topic
- The perennial tool of energy price subsidies conflicts with can effectively counteract or nullify the effect of even the best of programmes

Some of these issues could be resolved in an agreed long-term donor-country-agency programme as intended for the 10YFP, especially if technical assistance was made conditional on price reform.

4. Assessment of UNEP's position

This section assesses the significance of the activities of UNEP in the context of completed and continuing international and national programmes. It first defines the criteria and indicators of assessment, and then it reviews the experience of UNEP and other actors under the various categories of instruments. It concludes by identifying strengths and weaknesses of the UNEP programmes in this area, the opportunities and possible threats.

4.1 Criteria and indicators of assessment

The terms indicators and criteria are sometimes used interchangeably, but strictly a criterion is the rule or principle on which a judgement is made and an indicator is a property that can be measured qualitatively or quantitatively to demonstrate whether or not the criterion is met. Performance of policy interventions should be assessed against the objectives of the policy and against relevant criteria and indicators of success.

The criteria adopted by the Multilateral Development Banks to assess and prioritize proposed programmes and projects are described in the guidelines of the Clean Technology Fund, (CTF, 2009). They are:

- Potential for GHG Emissions Savings
- Cost-effectiveness
- Demonstration Potential at Scale
- Development Impact
- Implementation Potential
- Additional Costs and Risk Premium

The set is broadly consistent with the five criteria used by the Special Report on Renewable Energy Sources of the IPCC to judge the success of policies in renewable energy, i.e. Effectiveness, Efficiency, Equity, Implementability and Replicability, (SRREN, 2011).

The criteria employed by SRREN seem better adapted to the assessment of strategies and policies so that is what will be used here.

4.1.1 Effectiveness

This is the extent to which the intended development objectives of a policy are achieved. It is distinct from cost-effectiveness which measures the relationship between impact and inputs and is included within the criterion of efficiency.

The objective of energy efficiency policy might be to save energy or alternatively to reduce the amount of energy used per unit of output. To convert these criteria into suitable indicators is not straightforward. It is necessary to separate the influence of the policy

measure from all other factors and it is also necessary to be able to compare the impact of the measure with the potential.

4.1.2 Efficiency

Efficiency measures the relationship between the resources employed and the results achieved. An efficient policy will achieve its objectives with minimum resources. It will need to be measured differently for different instruments. For example in measuring the efficiency of using public funds to provide concessional financing important criterion will be the extent to which public money leverages private funding. The large volumes of investment necessary for wide-scale adoption of energy efficiency will need to come mainly from private investment; the necessary leverage is best achieved by targeting public funds at key obstacles to deployment.

4.1.3 Equity

Sustainable development is not simply a matter of solving technical problems of depleting resources; it also depends on building fair and equitable societies. As noted at the beginning of this paper societies are not becoming more equitable, rather the reverse, to the point where in the view of some the consequent threats to global socio-economic system are as serious as those of climate change. Equity can be pursued through policies designed explicitly for that purpose, but it should also be a criterion of policy design in general.

The optimal technical design of a regulation may need to be modified, or compensating mechanisms introduced if it threatens to impose costs disproportionately on those who are already poor. Equity is sometimes distinguished as horizontal or vertical. "Horizontal equity" measures the extent to which people in similar income groups are affected by a new tax or measure. "Vertical equity" measures how the burden is distributed among different income groups. In this case a measure that affects the rich more than the poor is "progressive," and a measure that does the reverse is "regressive".

If public funds, that might be used to improve housing in poor areas or to provide health care and education, are instead used to subsidise energy efficiency investments in the middle-class then there may be negative impacts in terms of equity. Because the wealthy use more energy than the poor there is a general danger that expenditures on energy efficiency policy that are funded by consumers will be regressive. This needs to be balanced by programmes aimed specifically at the needs of those who are less well-off and the least likely to afford energy efficiency improvements. This is not only an issue for developing countries; in 2009, about 21 per cent of all UK households were in fuel poverty according to the official definition, (DECC, 2011). Programmes that are funded from taxation have a tendency to be progressive, because the rich should, but do not always, pay proportionally more tax than the poor.

4.1.4 Implementability

Policies are not necessarily transferable from one country or sector to another. Reforms may not survive without continual support from technical cooperation. Implementability reflects the extent to which an intervention is viewed as legitimate, gains acceptance and is adopted by the target country or community. Certain pre-conditions favour implementability. A policy is more acceptable if it is likely to help achieve pre-existing policy objectives and targets. It is more likely to succeed and to be sustainable if there is clear ownership in the host country and the institutional capacity to continue to satisfy the technical and administrative needs of the measure over the long-term, (CTF, 2009).

4.1.5 Replicability and scaling-up

Technical cooperation projects should stimulate lasting changes in the structure or comportment of market. They should ideally be capable of spontaneous replication by commercial entities, or failing that they should be replicable and capable of up-scaling with rapidly decreasing needs for external intervention. The Clean Technology Fund has formalised the concept of “transformation potential” to mean the extent to which the deployment, diffusion and transfer of technologies and the implementation of policy reforms result in significant reduction in emissions growth against a national, regional or sector baseline, (CTF, 2009). UNEP’s contributions to the development of sector-specific MRV methodologies and the promotion and demonstration of NAMAs, for example in the building sector, could provide potential for considerable scale-up and replicability regionally and globally.

4.1.6 Trade-offs

Normally, no policy will be superior in all respects; there will be trade-offs to be made and the criteria are non-commensurate. There are three main ways by which non-commensurate criteria can be managed. The first is by establishing clear interpretations as to what is sought under each criterion and then reaching a consensus through debate. This can work when the community involved is rather small and shares common values and ideas, but there is a practical limit to the number of criteria than a decision-maker can successfully consider together.

Analysis of large, complex systems is facilitated by scientific techniques such as Life Cycle Analysis, but the results will be take the form of a set of quantitative and qualitative indicators that may be discontinuous, non-linear, and constrained. To process this information and come to a decision is probably beyond the capacities of most people. One option is to monetise some of the otherwise non-commensurate quantities – environmental externalities have been much studied in this respect. Utility theory has theoretical attraction in this respect, but there are few practical applications.

Multi-criteria Decision Analysis (MCDA) is another tool that can be combined with LCA as for

example in the NEEDS project funded by the EU. In a first stage of this methodology several hundred individual stakeholders completed an iterative MCDA analysis of their preferences regarding energy technologies. These final choices were then used to map how the sustainability performance of different technological options varied based on stakeholder preference profiles with the aim of providing to a decision-maker a consolidated account of the positions of the various groups affected by the available options. It supports decision-making, but it still leaves the decision-maker to make a final judgement, (NEEDS, 2009).

4.2 Assessment of current practice

There is a vast quantity of experience of policy instruments for energy efficiency that cannot be easily summarised and assessed. This section reviews some of the main practices and indicates where they have been successful and the factors that make them successful. An important reference for this analysis is the Policies and Measures Databases held by the IEA; information in the database for IEA members is reviewed by national governments; there is also some information on Brazil, China, India, Mexico, Russia and South Africa, but this is not reviewed; most developing countries are excluded (IEA, 2012).

4.2.1 Regulations and standards

Equipment standards: The main regulations and standards used to promote energy efficiency are standards and labels for appliances, mandatory measures for industrial practice and obligations laid upon utilities. We exclude other instruments that are implemented by regulation such as labels (which come under information instruments) and fiscal incentives that also reviewed separately.

There are two approaches to setting standards for appliances and equipment. One way is to establish minimum energy performance standards (MEPS) for different classes of products (e.g. refrigerators of a certain size and design), so that every unit within a certain class has to meet or exceed that standard; the second way is to set an average performance for the entire range of a manufacturer's output; compliance is more difficult because it involves aggregating across classes of product and requires more market information and more extensive testing. The first approach is more common. Standards have been an important and wide-spread instrument of policy. The IEA database lists 165 standards in place in 30 countries including Brazil, China, India and Russia.

There has been relatively little post hoc evaluation of MEPS. One difficulty is that programmes take effect over a long period and it is not obvious what would have happened if the standards had not been introduced. A detailed examination of standards for refrigerators in Australia and the UK concluded they had been effective and efficient, (Lane, Harrington, & Ryan, 2009). It is possible that performance in developing countries would be less, given the weaker enforcement. The general conclusion that standards work and are cost-effective probably still holds, but some clear evidence to that effect would be helpful.

The GEF Climate Change focal area strategy and strategic programming for GEF-4 from 2007 – 2010 listed the promotion of energy-efficient technologies and practices in appliances and buildings as the number one long-term objective, (GEF, 2007). The GEF has subsequently financed very many projects of this kind, but there seems to have been no consolidated evaluation of the efficiency and effectiveness and this would be useful to have.

The efficiency of standards in developed countries is high, because the costs of testing and monitoring are spread over large markets and because regulatory compliance is generally efficient. This may not be true of developing countries where test facilities are more difficult to arrange and regulatory compliance is often poor, with serious problems of smuggling and sale of non-compliant equipment to the detriment of honest manufacturers. There is a tendency for donors to support the establishment of standards, but not the test facilities and the monitoring. The implementability is very dependent on the ability to fund the testing facilities and to achieve regulatory compliance.

Better international cooperation on energy performance standards, (ECEEE, 2008) could improve efficiency, effectiveness. It would be helpful to have an international alignment of testing procedures and protocols, comparable definitions and common approaches to establishing specifications. This would support developing countries and reduce the chances of creating non-tariff trade barriers. Regional testing facilities could also reduce costs, but countries tend to prefer to control their own processes.

The costs of standards normally fall on the consumer; the higher costs of the more efficient products are passed on by the manufacturer. In the long-run, most consumers should save money, because the operating costs of the appliances are lower. Lower income groups have higher implicit discount rates so standards have a slight tendency to be regressive, but it is unlikely that the effect is significant.

In terms of international equity, standards may disadvantage DCs in the short-term through payment of licence fees to make the more efficient models, retooling costs or production lines and loss of markets if they do not match standards. In the longer-term, higher standards should improve the competitive position of the industry internationally. Much depends on how the industry responds and state help for retooling and innovation is a useful adjunct to standards.

UNEP has contributed to this area through its Task Force on Sustainable Products, in particular through its work on the IEA Implementing Agreement for a Cooperating Programme on Efficient Electrical End-Use Equipment. UNEP's particular contribution was the creation support of a global network that developed consensus around the idea and a coalition of interests to promote it. UNEP has also contributed to recommendations for

strengthening enforcement and monitoring compliance which is an area that still needs more work. The en.Lighten initiative is another example of the capacity of UNEP to develop partnerships of critical mass to implement global agreements, in this case on the phasing out of inefficient lighting.

Building Standards: Buildings are an important special case because: the way they are built will largely determine their energy use throughout their life; large improvements in the energy efficiency of buildings can be achieved at low cost; developers may not make those improvements because of capital stringency and the principal-agent dilemma. Building standards are widely applied across the developed world. The IEA database list 127 measures in 29 countries.

The matter is especially important for developing countries because the present of construction is very rapid. The Asia Business Council scrutinised building regulations and practice in Asian countries including China, India, Indonesia, Japan, Hong Kong, Malaysia, Philippines, Taiwan, Thailand and Singapore. This analysis is a valuable resource that provides an accurate diagnosis of the failings of energy efficiency programs in these countries; it identifies the main problems as poor enforcement of regulations. While all eleven economies covered in the study have building energy standards on paper, most have failed to produce significant energy savings; the Chinese government itself has estimated half of new buildings do not comply with official energy standards, (Asia Business Council., 2007).

UNEP has made a substantial contribution to this debate through the work of the Sustainable Building and Climate Initiative and in particular the “Buildings and Climate Change: a Summary for Decision-Makers”, (UNEP SBCI, 2009). This study proposes practical actions that would engage central and local governments, the corporate sector and civil society. It also makes recommendations for realistic and potentially effective mechanisms for project approval and monitoring, identified by the Asia Business Council as the main problem in improving practice. Further UNEP-SBCI efforts to develop the MRV tools for the building sector, specifically in the Asia region, will contribute to additional practical actions and engagement with governments.

Mandatory measures for industry: Such regulation would normally include an obligation to make energy audits at regular intervals (for enterprises exceeding a defined threshold of energy consumption); it may also require reporting to government at various levels of detail; mandatory appointment of energy managers; mandatory comparison to reference values (norms, benchmarking) for energy use in typical unit processes. Mandatory measures have not been common within OECD countries although they do exist in Japan and Australia and strongly interventionist measures such as mandatory audits and reporting are envisaged in the most recent proposal of the EU for an Energy Efficiency Directive, (EU,

2011). The Japanese energy law imposes very strict obligations including norms for processes; it has been influential elsewhere in Asia (Thailand and China). Mandatory measures are demanding to administer; compliance needs to be monitored and this is demanding in administrative and technical terms.

Supplier obligations: In liberalized energy markets an obligations may be placed on suppliers to invest in energy efficiency. These are mainly used in European countries; The IEA database notes ten schemes in five countries all members of the EU. For example, the Energy Efficiency Commitment in the UK placed on suppliers of gas and electricity an obligation to demonstrate programmes for domestic consumers that saved specified amounts of energy related to their total supply volume. The supplier is motivated to achieve this target at least cost and therefore the programmes should be efficient. Failure to comply is penalized. The UK scheme has since been replaced by the Carbon Emissions Reduction Target, which is a similar commitment for a reduction in carbon emissions generated by the domestic sector. The most recent extension to the programme also encompasses access to energy efficient goods and services as it requires that 40% of savings must be delivered within a priority group of lowest income households; the impact assessment indicates that benefits are around twice the costs, (DECC, 2010). White certificates (used for example in France) are somewhat similar; suppliers are obliged to demonstrate that they either accomplished energy savings directly or have bought certificates from others who can show they have made savings. The proposal for a new Energy Efficiency Directive of the EU would require national energy efficiency obligation schemes in all Member States. The Impact Assessment associated with the proposal found this to be both an efficient and effective option, (EU, 2011b).

An earlier evaluation of the experience of white certificates in Europe addressed the question of their value in developing countries, (Lees, 2007); it judged that trade in white certificates required financial infrastructure and knowledgeable and skilled market players that might be lacking. White certificates and efficiency obligations work best in competitive electricity markets and these are uncommon in developing countries.

4.2.2 Voluntary agreements

Voluntary agreements between government and industry allow industry a more flexible response than that which can be achieved by regulation and they avoid the adversarial relationship implied by regulation. Industry will often agree to voluntary agreements to avoid regulation and for the administration they are much less arduous to develop than legislation and can reduce the compliance costs. Agreements can be about equipment or plant performance. In the former case, government and representative bodies of appliance manufacturers agree specified improvements in the performance of appliances; the approach has also been extended to vehicles. In the second case individual process industries agree to specified improvements to their own on-site energy performance.

Voluntary agreements have been widely used in the IEA member states. The IEA database records 158 such measures that cover fairly evenly appliances, buildings, industry and transport. They are widely used in North America. The character of the measures is very variable and it is hard to generalise on their effectiveness. There are significant problems of “free-riding” from those who stay outside of the scheme. For example, in the case of appliances, the EU Commission entered into a series of agreements with the European Committee of Domestic Equipment Manufacturers (CECED) that covered 90 per cent of the market for washing machines, refrigerators and freezers, dishwashers and water storage heaters. The concept lost some credibility when CECED decided not to renew the agreements in 2007 and declared a preference for binding standards, because they felt that free-riding non-CECED importers were gaining an unacceptable market share, (CECED, 2007).

A rather inconclusive assessment of voluntary agreements for industrial practice was made by the Joint Research Centre of the European Commission, that the lower costs of preparation and implementation meant that voluntary agreements were in many ways more effective and efficient than a mandatory approach, (Bertoldi & Rezessy, 2010). This conclusion is somewhat at variance with the proposal for a Directive subsequently developed by the Commission, which as noted above, leans towards a mandatory approach.

In developing countries, voluntary agreements are rare. An early pilot project in China was implemented to test the viability of voluntary agreements through a trial in two iron and steel companies in Shandong Province, but it does not seem to have prompted replication. While the general concept of a negotiated agreement was apparently acceptable in principle, it was difficult to reconcile with the traditional practice of annual quotas for energy consumption that were accompanied by fines and penalties if exceeded, (Price, Worrell, & Sinton, 2003).

A study for the UNEP-Sustainable Buildings and Construction Initiative of policy instruments for buildings also concluded that the effectiveness of voluntary agreements was hard to judge, because the evidence was disputed and complicated by the tendency of companies to accept voluntary agreements in order to avoid regulatory measures which tends to contradict the idea of voluntary. Overall, the study concluded that although voluntary agreements could have an impact, mandatory regulations for buildings were more effective, (Koeppel & Urge-Vorsalz, 2007).

There would be few equity implications because of the voluntary nature of the agreements.

4.2.3 Financial and fiscal incentives

Fiscal incentives: These are delivered through the taxation system, either through relief on corporate or personal taxation or as dedicated taxes designed to shift from environmental harmful activities towards cleaner and more sustainable alternatives. Subsidies accorded directly or through the tax system to encourage producers and consumers to choose the inputs and goods that have favourable properties are often included under the heading of fiscal incentives.

Fiscal incentives reduce the cost and therefore indirectly the risk of investing in energy efficiency. Direct subsidies to investment by fiscal means may be effective if they are large enough, but they create little incentive to operate plant efficiently. Performance-related incentives that are linked to savings encourage efficient operation and may be preferred, but they are less likely to reduce perceptions of risk. This is generally less of an issue with energy efficiency than with renewable energy because operational issues are less critical.

Compared to regulations, taxes and other market-based instruments should be efficient; in principle they induce a reduction in impact to the point where the cost of the impact equals the tax and permit the subjects of the tax to adjust their behaviour in the most cost-effective manner. Despite these advantages, tax instruments will generally not be sufficient alone because they cannot cope so easily with market failures other than external costs, e.g. failures in information or market dominance. They will generally need to be complemented by other fiscal instruments, (Kosonen & Nocodeme, 2009).

Tax credits have also the advantage that they are flexible and can be adjusted as markets develop and can be targeted to specific technologies and applications. They are relatively straightforward to implement, all countries have taxation and budgetary policies, and are available to all who qualify according to the terms of the exemption; there is no application and award process. For this reason, they are preferred by some as being less susceptible to corruption and to political manipulation. Their effectiveness depends on the prevailing level of taxation; tax levels in developing countries tend to be low and this limits the effectiveness. For the same reason tax concessions can be criticised as inequitable because they only benefit those who pay tax.

Financial incentives: These divide into investment subsidies and concessional finance; investment subsidies change the perceived cost of an investment and concessional finance changes the financing conditions. The successful development of energy efficiency projects starts with an initial audit then moves through successive stages of project identification, feasibility study, planning and design, construction and operation and finally, evaluation. Instruments to provide support from public finance should be adapted for the special needs of the different stages of the process. Effectiveness depends on the volume of funds made available, the extent to which they leverage private investment and the extent to which

they are used wisely. The efficiency will depend also on the leverage achieved and the appropriate allocation.

The World Bank has estimated that its lending programmes in energy efficiency and renewable energy leverages five dollars from elsewhere (World Bank, 2006). The Norwegian Public Finance Mechanism (NorFund) aims to achieve an approximate 10:1 direct leverage effect, (NORAD, 2008). UNEP found that the leverage on public funds could range from 3 to 15, (UNEP and partners, 2009), (UNEP-SEFI, 2008). Credit lines had a relatively poor performance with a leverage of 3 or 4 to 1; the leverage potential of equity funds is medium to high; loan guarantees have variable performance depending on how they are structured. When effectively structured GEF funds can directly leverage USD12–15 of commercial investment into EE projects; technical assistance programmes in general remove contingent barriers to investment and consequently may leverage disproportionately large amounts of commercial financing.

There is much available literature on the need for financial support for energy efficiency and the best way to provide it. A detailed description of experience with public financing instruments throughout the investment cycle was provided by the Basel Agency for Sustainable Energy on behalf of UNEP Sustainable Energy Finance Initiative, (BASE SEFI, 2006). UNEP has also published an analysis of risk implications in renewable energy projects in developing countries that is relevant in many ways to energy efficiency, (UNEP, 2006). The World Bank GEF Energy Efficiency Portfolio Review and Practitioners' Handbook is also interesting because GEF has funded much work in energy auditing, energy service companies and revolving funds across the world, (World Bank, 2004).

The general theme of most of this work is that the difficulty in scaling-up the volumes of investment in energy efficiency in developing countries arises not from any absolute shortage of funds, but from the reluctance of lenders to make those funds available under acceptable conditions. Banks in developing countries have difficulty in recognising that savings in energy constitute a revenue stream as surely, if not more surely, than a new source of sales. They often lack the technical ability to assess risks and benefits from investments in energy efficiency. The relatively small size of projects may also be a disincentive because it increases the proportional cost of the transaction between the bank and the customer. Banks are similarly cautious about the concept of Energy Service Companies (ESCOs); they typically require equity investment from the ESCO that it may be unable to make because often such companies are very often consulting companies whose balance sheets cannot support substantial investment. The means to overcome these obstacles include the training of banks, the provision of performance norms for typical energy efficiency projects, standardised contracts, proven methodologies of assessment and the provision of guarantees for credit risk.

In equity terms there is no prejudice to the poor. Public funds come from taxation and that is paid disproportionately by the wealthy. The leveraged private funds have no unambiguous equity implication. In so far as financial incentives make money available to those who find it hard to raise finance otherwise, the programmes are slightly progressive. They are highly progressive if directed to support of low income groups.

In this context the Sustainable Energy Finance Initiative of UNEP is relevant. It provides precisely the tools that financiers need to understand better the problems and to stimulate the necessary investment. The joint programme with the World Bank to stimulate increases in energy efficiency investments by domestic banks in Brazil, China and India provides a successful application of the ideas. The partnership between UNEP and private finance networks has intensified since and has delivered a series of reports elaborating the scale of the need, the practicality of meeting the need and innovative private finance mechanisms to do so, (UNEP and partners, 2009), (UNEP-SEFI, 2008).

Public procurement: The public sector is responsible for a substantial share of GDP and can influence energy directly and indirectly by its purchases. If it procures efficient equipment then it has a direct bearing on its own consumption, but maybe more importantly, by procuring equipment at the cutting edge of technological development it can reduce the risks of innovation in design and manufacture and can affect the offer of efficient equipment throughout the market. In that sense it can be seen as a form of public financial support.

A detailed study of public procurement practices world-wide has been published by the World Bank, (Singh, Limaye, Henderson, & Shi, 2010). It includes a range of case studies, overwhelmingly from the developed world. Sustainable public procurement has been practised in a somewhat disorganised manner in the EU and its member states for some time and the Joint Research Centre of the European Commission has reviewed the experience, (JRC, 2010). The review concluded that in most cases energy efficiency was subsumed within wider concepts of sustainability and it was therefore difficult to make an accurate assessment of the impact on energy use. However, the proposed new EU Directive on energy efficiency focuses strongly on requirements on the public sector to renovate buildings it owns and apply high energy efficiency standards to the purchase of buildings, products and services.

Use of public procurement in this way in developing countries is relatively rare although the opportunities are large, as identified in the UNEP project on Priority Products and Materials. The reasons for the limited application are not difficult to find. There is little incentive to cost-reduction in public agencies; little expertise in assessment; complex procurement processes; severe budgetary stringency and limited borrowing capability. The Marrakech Task Force on Sustainable Public Procurement has prepared the ground for implementation

through the tools that it has developed and the training performed. Procurement programmes at scale would benefit from linkages to the sustainable finance initiative to overcome some of the funding constraints.

4.2.4 Information Instruments

Technical information: Providing information to people who would otherwise not have easy access is a form of public good, but it is normally seen as a separate activity. It is an important promotional activity in policy for energy efficiency and is widely undertaken. A study by UNDP and the GEF of policies for energy efficiency in buildings recognised that one of the main reasons for the slow spread of energy efficiency is the lack of consumer awareness of what can be done and the costs and benefits of different actions, but the study also listed some reservations. There are few evaluations of the efficiency and effectiveness of general information campaigns, but what there is indicates that public information programmes are less effective than regulatory instruments and are most effective when they complement other initiatives, such as financial incentives, (GEF / UNDP, 2010). This view receives some support from an evaluation of the UK Energy Efficiency Commitment programme which concluded that the information and marketing skills of the suppliers were a valuable adjunct to the subsidies from the programme, (Oxera, 2006).

Equity implications are generally positive as the funds come from the state (or from private companies under an obligation or voluntary programme) and the less well-off will have a tendency to have poorer access to information than more prosperous groups. The impact will be more progressive when directed specifically at low-income groups, but then the information needs to be complemented by financial incentives.

It is possible that manufacturing industry is a little more proactive than the owners of buildings, but it is likely that the provision of general information will be relatively ineffective, and its impact of short duration, unless accompanied by other initiatives such as financial incentives or obligations. In this respect the materials produced by UNEP such as the *Energy Efficiency Guide for Industry in Asia*, the *PRE-SME Project* and materials developed under the project on *Industrial Energy Efficiency through a Cleaner Production Framework* have the advantage that they can be disseminated within the context of the NCPCs and their continuing work.

Labelling: Labelling is intended to overcome the market failure caused by asymmetric information. Users of equipment may not have the skills and information to understand the consequences of their choice. Manufacturers may not have an incentive to provide this information if their products are less efficient than their competitors.

Labelling is virtually universal throughout the industrialised world, but there have been some difficulties in introducing it into developing countries. The negotiation of agreements

on specifications and legislation may come up against the interests of local manufacturers. The investment and training required for testing and the organization and verification of compliance are big challenges. For example, monitoring and compliance was a problem with the voluntary scheme in China; experience with a voluntary scheme in Thailand suggests that manufacturers and distributors choose not to label their products if they achieve a poor rating; in Egypt (and other countries) suitable testing facilities were not be available and needed to be built.

The transfer of energy-efficient technologies has been a main strategic objective of the GEF since its inception. From the third replenishment of the GEF Trust Fund the strategy has emphasised market-based solutions in buildings, appliances, and industry; the promotion of standards and labelling has been an important part of this work with the UNDP as the main implementing agency. Projects have been implemented in very many countries with the aim to transform the markets of household and office appliances (refrigerators and air-conditioners); electric motors and fans; and lighting products (CFLs and ballasts). Some evaluation of the programme has been made, but the consolidated report is disappointingly anecdotal with no real attempt to assess efficiency and effectiveness, (GEF, 2010).

Nevertheless, labelling appears, on the face of things, to be an effective low-cost measure, certainly for industrialized countries. Current standards and labelling schemes within the OECD are credited with reducing total energy bills across the residential sector by between 10 and 20 per cent, (Waide & Bernasconi-Osterwalder, 2008). Better evidence of their impact in developing countries would be useful.

UNEP has been engaged in 4-year project starting in 2007 that promotes eco-labelling in Brazil, China, India, Kenya and the South East African Region, Mexico and South Africa. (UNEP DTIE, 2011). The Marrakech Task Force on Cooperation with Africa has also promoted the idea of an eco-labelling mechanism for Africa to allow it to compete more effectively for niche markets in the industrialised world and to meet the requirements of retailers wishing to demonstrate environmental compliance along their value chains, (UNEP ARSCP, 2012). Eco-labels are voluntary; qualified participants are licensed to certify their products meet the requirements of a given agency for a particular product category based on life-cycle considerations; they are not primarily aimed at energy efficiency, but at a range of considerations. They do not employ the same kind of testing equipment and test protocols as are need for appliance energy efficiency labelling programmes.

Advocacy: A feature of the UNEP to its portfolio of outputs under sustainable and clean production has been the contribution of the Task Force on Sustainable Lifestyles and its efforts to engage with governments and civil society to further sustainable lifestyles among young people in developing countries, notably through the support given under the UNEP/UNESCP YouthXchange initiative. There seem to be few other initiatives of this sort

within the world of technical cooperation, perhaps because lifestyle change is considered too difficult to address and especially in developing countries where the environmental footprint of most people is far too small to be a threat. It is however important. There is a young elite set in developing countries that is strongly consumption-oriented and that has a significant environmental impact. More importantly they are the group from which many leaders of the future will be drawn and they are frequently role-models for other less well-off young people. It is therefore very important to influence them.

Similarly, the Creative Communities for Sustainable Lifestyles project deals with social innovation through grass-roots it contrasts and relates European experience with that from emerging economies like China, India and Brazil and, in particular, their poorer urban populations, (UN DESA, 2012). The impacts of these efforts are rather difficult to evaluate, but they are relatively inexpensive and potentially may be very effective. They are also rather relevant to extending access to energy efficient goods and services because advocacy efforts of this kind could also be deployed to support the commitments that are sought under SE4A.

4.2.5 Provision of public goods

Research, development and Innovation: The extent to which research related activities are public goods depends on to what extent the results are reserved through intellectual property rights, but also to what extent they are successfully disseminated to potential users. In developed countries, pure science tends to have less direct commercial application than applied science and is closer to a ‘public good’; applied science relies more on private research. In developing countries where commercial research may be weak; there is also a role for government funds in applied research. Governments can stimulate research on energy efficiency either through “demand pull” that creates incentives to improve performance by imposing efficiency standards and regulations or through “technology push” that encourages research through R&D funding dedicated to the purpose. Often a combination of the two approaches is effective. There is some possibility that obliging developing countries to adopt energy efficient practices will lead to a greater dependence on technology from the developed world to the detriment of local manufacturers. Equity considerations suggest that the process should be accompanied by adequate technology transfer and support for local innovation.

Whilst recognising the inherent difficulties in assessing the beneficial consequences of research, the Stern Review examined the role of R&D in climate change and concluded that it was effective and government has an important role to play. It recommended also that international co-operation can help to reduce the costs and accelerate the process of innovation, (Stern, 2006) .

UNIDO has conducted a comprehensive study of the state of research in energy efficiency in developing countries, (UNIDO, 2011) and concurred with the Stern review that international cooperation on research and development (R&D) can support sharing knowledge, coordinating R&D priorities and pooling risk. International cooperation, as UNIDO recognises, is not confined to developed and developing country interactions, but there is increasing R&D cooperation between developing countries also.

The efficiency of public funds in R&D depends on the leverage exerted on private investment and the quality of the work done. Both are hard to assess. The EU *ex ante* Impact Assessment of the new research framework programme – Horizon 2020 – finds value of between 1.7 and 0.4, depending on the industry and time scale. There are also knowledge spillovers that definitely exist, but are also hard to quantify, (EU, 2011). Despite the difficulties of measurement, all industrialised countries see publically funded research as an essential public function. More stimulation of R&D and innovation is needed in developing countries to ensure innovative capacity that can respond to modern challenges. Energy efficiency and renewable energy are two areas that would benefit.

The technology cooperation programme of the IEA is an important contribution to linking energy R&D networks and to fostering collaboration with stakeholders in finance and business. The IEA has several Implementing Agreements designed to help share the results of technology research among members and non-member countries. The most relevant to energy efficiency are the Implementing Agreements for Efficient Electrical End-Use Equipment (4E) and for the Establishment of the IEA Energy Technology Data Exchange (ETDE). The IEA4E agreement was reached within the work of the Task Force on Sustainable Products. The ETDE database includes over 4.3 million research literature citations and links to full research documents. The facility is increasingly used by developing countries; the number of requests from non-member countries, which was only 465 in 2007, rose to 9,967 in 2009, (IEA, 2010).

The work of the NCPCs is potentially very relevant here as they provide an institutional base to contribute to technology transfer, to share best practice and to contribute to cooperation among the countries where they are located. The work of UNEP has also contributed to methodology development of LCA and its dissemination to user groups in developing countries. This is a valuable activity as it strengthens the understanding and negotiating position of developing country sub-contractors to international companies in dialogue over the life-cycle reduction of environmental impacts. The work done under the Design for Sustainability is also a strong contribution to the dissemination of ideas on efficient design.

Provision of efficient infrastructure: More than half of people now live in cities, and according to UN Habitat (2008) by 2030, it will be 60 per cent. The population in cities of the developing world increases by an average of 5 million every month, i.e. by the

equivalent of one large city. Cities consume enormous amounts of energy and have great inertia; road systems and land use decided now will influence energy use for a hundred years, Transport in cities creates a third of total greenhouse gas emissions. Promotion of public transport options is critical.

Massive renewal of existing cities cannot be realistically considered, but new planning should recognise the relationship between spatial configuration and energy use and design to reduce it, (Theys, 2008). Transport use per capita in different cities can vary from one to 100; cities in the U.S. are the least efficient with per capita consumption four to six times higher than in Europe. Asian cities achieve levels roughly half of Europe. Research is needed to identify effective decision-making strategies regarding the management of urban space (in the developed world) as well and on how social needs interact with spatial organization.

There seems to be no systematic programme of technical cooperation to improve planning in developing countries with an aim to reduce energy use, although there are many specific infrastructure projects that include improved energy use in their justification.

Training: It is disputable whether training is a public good, because in publically funded training programmes, taxpayers are bearing the costs of training the main benefits of which may accrue to an individual or a firm. On the other hand, investments in public infrastructure are generally considered as public goods and investment in human capital can be seen in the same way. There are also spillovers from training just as there are from R&D and the provision of training materials through public funds can leverage subsequent privately-funded training.

There is remarkably little evaluation of the efficiency and effectiveness of training in general as a policy measure, although plenty of evaluations of specific training activities. It seems to be generally assumed that publically-funded training is a valuable activity necessary for the successful execution of other policies. Trained people are necessary for the design and implementation of regulations, for the design and building of efficient investments, for the construction of financial incentives and contracts and indeed all other measures.

Nevertheless it would be useful to have a training needs assessment for technical cooperation, perhaps along the same lines as that prepared by the Lawrence Berkeley National Laboratory for the Department of Energy in the US, (LBNL, 2010). The conclusions of that analysis for the U.S. do seem intuitively to be relevant also for developing countries. They include:

- Provide energy efficiency education and support targeted at building and construction contracting and trades people
- Coordinate and track training efforts; share best practices

- Increase funding to “train the trainers”
- Increase access to on-the-job training for mid- and senior-level engineers and managers

Against these criteria the UNEP training activities show some strength. Almost all of the activities included in catalogue in Table 2 contain significant training components. Many of the projects also produce good, innovative materials for use by others that constitute a useful basis for training trainers. The existence of the NCPCs provides continuity and helps share best practice; there is a strong emphasis on training of managers and professionals including financiers.

4.2.6 Summary

The Table contains a summary of this assessment according to the criteria identified earlier along with a short note on UNEP’s contribution under each heading. For some important instruments it is not possible to generalise about effectiveness because much depends on the way that the initiative is designed and the extent to which it is congruent with national circumstances. This is especially true of the financial instruments. The identification and transfer of best-practice is important, whilst recognising the need for flexibility and adaptation to local circumstances.

It is also clear from the Table that a set of instruments may work better than just one. The dissemination of information by itself is unlikely to change much, but new regulations establish new obligations, then information as to how to comply will be useful. If there is also financial help to make the adjustment that will be better still.

Table 6: Summary by criteria with note on UNEP contribution

	Effectiveness	Efficiency	Equity	Implementability	Replicability	UNEP contribution
Regulations and standards	Effective if regulations are appropriately set and compliance is assured.	Efficient in developed countries. In DCs compliance is a difficulty. International collaboration could help.	May disadvantage DCs through licence fees or loss of market. Offset by transfer of technology. Slight tendency to be regressive.	There is a threshold of effort (standards setting, testing). Compliance is the main problem.	In principle, but countries may define different standards that cause trade barriers.	Good capacity for coalition and consensus building in support of standards. IEA4E is a case in point.
Voluntary agreements	Thought to be generally less effective than regulation. Prone to free-riding.	Low cost and low impact. Efficiency hard to judge.	No obvious equity implications.	Easier to implement than regulation and requires less enforcement.	Rare in developing countries	No substantial contribution.
Financial and fiscal incentives	Variable: depends on volume, leverage and wise use. Leverage requires good design. Appropriate use can be helped by regulation and information.	Variable. Well-designed programmes can leverage 15 times the volume of private finance.	Progressive – especially when for access or for EE in low-income groups.	Implementation of highly leveraged programmes depends on interest of the financial sector. May be low. Advocacy and training of the sector should help.	Programmes must be tailored to national circumstances. General lessons are replicable.	Substantial contribution through coalition building in support of innovative finance.
Information Instruments	Effective when combined with other instruments. Reduced value in isolation.	Efficiency is enhanced when well-combined with regulations or financial incentives.	Progressive as low-income groups have less good access to information.	Easy to implement. Much information is available from technical assistance programmes.	Much information is transferable. International networks	Good production and dissemination of innovative materials. Strong advocacy work. Contribution to eco-labels
Provision of public goods	Essential need for training, research and infrastructure. Effectiveness is project-dependent.	Leverage of expenditure on R&D and training is high	Progressive as tax-payer funded and poorer people pay less tax.	Implementability depends on strength of competence in education, science and planning.	High degree of replicability. Depends on effective international networks.	Contribution to research and innovation through NCPCs and IEA Implementing agreement on efficient electrical equipment. Well-directed training effort.

4.3 UNEP's comparative advantages

4.3.1 Strengths

UNEP's comparative advantage lies not so much in its technical skills, although these are not insignificant, but more in its capacity to conceive and mount multi-disciplinary and multi-dimensional initiatives that embrace a wide range of actors and ways of thinking. This is an advantage that can be traced directly to its fundamental mission to "provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations". The promotion of energy efficiency and access to energy efficient goods and services fit comfortably within that scope.

UNEP's portfolio of activities as summarised and assessed in the preceding Sections mainly depends upon the creation of coalitions of interest among more specialised agencies, governments, manufacturing industry and the financial sector, together with civil society to define in partnership common goals and mechanisms to achieve those goals. These strengths in building coalitions and consensus are important in defining policy for energy efficiency where political will, technical competence, money, public and private interests and administrative compliance have to be combined to achieve results. The work done with the financial services sector on innovative finance mechanism for energy efficiency is a case in point.

UNEP's capacities extend throughout the project cycle from conception and design, through management to dissemination and communication. The materials for dissemination are imaginative and innovative and embrace a variety of media (web-sites, publications, CD ROMs). This is true both of technical materials designed for professional actors, but also for the materials intended to influence final consumers. The emphasis on personal values and personal behaviour in the lifestyle materials, that is something of a hallmark of the environmental community, is also refreshing.

4.3.2 Weaknesses

There is local evidence of successful application of conventional economics and cost-benefit analysis, for example in the Mediterranean Investment Facility and in en.lighten, but it seems not to be systematically applied across the portfolio. This is a weakness because decision-making in real life is much influenced by economic ideas. The reasons were given earlier; economic and financial analysis employs a single numeraire (a currency) that simplifies decision-making and that is congruent with budgetary disciplines that are expressed in the same unit. So a decision maker knows how much something will cost, how long he has to wait to get a return and what part of his budget it represents. LCA is a powerful tool for diagnosis, but it is not of direct value for decision-making. Often the most valuable insights come from

contrasting the scientific and the economic perspectives to identify where the economic analysis is distorting and therefore where correction may be needed.

Another weakness, detected earlier, is the lack of continuity and coherence among the various activities. This has had some advantages in that it has allowed many options to be explored and competence to be developed over a wide field. The view that now prevails and is articulated in SE4A is that focus and programmes at scale are now what is needed. In this context there needs to be some selectivity and a more visible coherence.

It also appears to be the case that although websites are well-designed and functional, they are not always updated as the projects proceed. Information is often available only in English which reduces the target audience and this is often the case for publications. A web-based search tool that could access project results on SCP and possibly results from other agencies is in preparation and this is commendable.

4.3.3 Opportunities

The comparative advantages of UNEP as exhibited in its work on energy efficiency are its skills in:

- Advocacy and communication: especially with consumers and especially in changing behaviour and values
- Building of coalition and consensus: this covers partnerships among public and private interests and civil society, but also in negotiating the cooperation of sectoral Ministries in mainstreaming the ideas of sustainability for example in policies for government procurement. UNEP has developed and maintained a substantial capacity and expertise in working with the private sector and in influencing domestic and international markets
- Innovative finance: Particularly important are the partnerships around finance for energy efficiency and SCP in general. Insufficient private finance in support of energy efficiency is one of the biggest obstacles; UNEP has done valuable work with the finance industry to identify how the commercial prospects of energy efficiency can be grasped through innovative financial arrangements
- The multi-disciplinary and multi-dimensional analysis of problems that can provide the intellectual underpinning of smarter and more coherent (joined-up) regulation

These advantages arise naturally from UNEP's broad environmental mission in which such skills are fundamental. There is another skill present in UNEP that does not seem to have been deployed extensively in the energy efficiency work and that is the monitoring and assurance of regulatory compliance. This is a demanding task in any country, but especially in developing

countries. Indeed UNEP in its policy review associated with the Energy Efficiency in Asia programme found that “the structures to enforce legislation, including energy conservation laws, are limited”, (UNEP, 2006). Better MRV will be needed to make sectoral mechanisms work. Regulatory compliance is best developed for taxation and environment and it would be good to apply UNEP’s experience in regulatory compliance and regulatory risk assessment to EE.

UNEP has, in the past, been much involved in disseminating best practice in environmental management, including regulatory compliance, at the level of pollutant, industry and country; see for example (UNEP, 1996). More recently, the Division of Environmental Law and Conventions has been active in supporting compliance with Multilateral Environmental Agreements through a series of manuals, including an on-line version, (UNEP, 2007), (UNEP, 2006), (UNEP, 2012) and the Dams and Development Project has produced guidelines for monitoring environmental compliance (Environmental Law Institute, 2007). There has been some application to energy; the Renewable Energy and Energy Efficiency Investment Advisory Facility (now closed) addressed the issue from the perspective of commercial banks and private investors considering investments in sustainable energy, mainly for renewable energy, but also for ESCOs, (UNEP, 2012). A substantial study on the harmonization of energy efficiency standards for air conditioners and refrigerators in South East Asia conducted by UNEP and the International Copper Association also touches upon compliance, (ICA, 2011). These activities have been sporadic, but are applicable to the MRV requirements of NAMAs and sectoral mechanisms and also to the successful completion of access projects.

4.3.4 Extending access to energy efficient goods and services

SE4A aims to mitigate climate change through greater resort to energy efficiency and energy substitution by renewable energy, but it also aims to extend access to modern energy services. What constitutes access is controversial, but certainly includes household access to affordable electricity and clean cooking facilities. A definition might also include the idea that consumption can increase over time at affordable prices and that it might extend to some productive activities. The High Level Group appears to include productive activities in its concept of access, because of their implications for economic growth and employment.

It is clear from the simple idea of “access” that efficiency is secondary to supply. There can be no access without a supply. The reason that there is no supply in most cases will be because it is not commercial and so requires financial support. Much rural electrification is in some way subsidised, often cross-subsidised by other consumers. In this sense, creating access to energy is unlike implementing energy efficiency where energy supplies are easily available. Energy efficiency for urban households, large buildings, factories is in large part commercial or can be

made commercial if the proper legislative, regulatory and market framework is in place. Different instruments will be needed to extend access to energy efficiency to those that are required to implement energy efficiency in communities that have enjoyed access for a long time.

This does not mean of course that energy efficiency has no place in extending access to modern energy services. Some cases are obvious; efficient lighting is practically essential for any power-limited supply as well as being cost-effective and in general any solution to provide access should be as efficient as possible. It does mean however that some analysis is required to extrapolate from UNEP's experience with implementing energy efficiency projects to what it might contribute to extending access to energy efficient goods and services

The substantial financial requirement will mean that the private sector will be critical in ensuring success. Governments will have to work with business to identify barriers, design solutions and provide the pricing strategies and incentives to implement solutions. They will have to develop advocacy packages to attract the participation of the private sector and civil society organisations. UNEP's expertise in advocacy and in working with the financial sector to create innovative financial mechanisms for energy efficiency will be relevant here. It will be necessary also to ensure compliance with regulations and financial conditions; UNEP's experience with environmental regulation and environmental risk management could be useful in establishing appropriate monitoring mechanisms of both technical and financial compliance.

It appears that the High Level Group will recognise the importance of productive uses of energy and the opportunities that they create for income generation in local industry and agriculture. Access to modern energy services will also increase the range of possibilities for community development in schools, hospitals and other communal facilities. Such activities should be consistent with the norms of sustainable clean production and it may be useful for UNEP to develop guidelines for best-practice in those sorts of relatively simple applications.

5. Future options

The preceding Sections demonstrate that UNEP has acquired a strong portfolio of competences in energy efficiency, mainly through its work on SCP and Climate Change that can form the basis of a substantial and coherent long-term programme to implement energy efficiency on a large-scale in the interests of mitigating climate change. It is also a partner within many networks and can coordinate other relevant actors in agencies, governments and the corporate sector; as a partner in the NCPCs it has an institutional basis in many client countries. Some of the same skills and assets could also make a valuable contribution to ensuring that when access is created for new users this is done in the most efficient way.

This Section examines the options available to UNEP to develop activities to promote energy efficiency and improve access to energy efficient goods and services within its future programmes. It sets out criteria for choice; it defines and assesses options according to the chosen criteria; it considers the balance of activity between implementing energy efficiency policies in countries that have well-developed access to modern energy services for a long time and improving access to energy efficient goods and services in those that and finally it considers some particular aspects of implementation.

The analysis is performed at two Levels: Level 1 considers whether there is a case for discriminating among countries according to whether prices are reasonably cost-reflective; Level 2 defines and assesses some thematic options.

5.1 Criteria for choice

A judgement among future options must be based on objective and transparent criteria. The criteria used here are set out in the Table below along with a brief discussion of the meaning and interpretation.

Table 7: Criteria for future activities

Criterion		Comment
Conformity with SE4A	with	Conformity can be measured by the extent to which actions support the objectives of reducing GHG emission and promoting access to modern energy services, i.e. electricity and clean fuels
Conformity with Rio+20	with	The focus of UNEP's activities in SCP has been the Rio conference and the envisaged 10YFP; future activities must progress this agenda
Builds on competences	on	Future programmes must use the acquired skills; acquisition of new competences if needed is not excluded
Congruent with country needs	with	Technical cooperation will not succeed (in the short-term) unless it responds to needs of government that are perceived and for which solutions are sought.
Congruent with donor preferences	with	Donor preferences are set by contingent national attitudes, but must be accommodated. They may also be influenced.
Mobilisation of the private sector		The participation of the private sector is fundamental. The volume of investment that is required can come from nowhere else.
Mobilisation of the consumer		Has a critical role to play, given the interest in maximising the contribution of demand side measures, and the growing interest and engagement of civil society in climate change and other environmental issues related to energy.
Effectiveness		The option should deliver large savings in GHG emissions or substantially improve access to energy efficient goods and services
Efficiency		The value of the impact should be much less than the costs of the actions

5.2 Level 1 analysis: Price reform

Pricing policy for energy is the main factor that determines the commerciality of energy efficiency. Technical cooperation in support of energy efficiency in countries with subsidised prices is less likely to succeed than in countries with market-related prices. It is therefore logical that different programmes of cooperation should be envisaged according to the prevailing level of energy prices, because the needs are simply different. Prices might be judged against a threshold (say 90% of the opportunity cost) to determine whether a country met the criterion. The first-level analysis therefore examines whether activities should or should not be composed of two tracks, one for countries with prices that broadly reflect costs and one for countries where they do not.

- **Conformity with SE4A:** a programme that discriminates among countries on this basis may deliver the objectives of SE4A better than one that does not as it will enable programmes to be tailored more closely to country circumstances
- **Conformity with Rio+20:** this criterion does not appear to discriminate strongly. It may favour the non-discriminatory option in that it appears to permit a stronger focus on pure SCP activities, but the discriminatory option may deliver EE more effectively and this is an important part of SCP
- **Builds on competences:** UNEP would be competent to implement either option equally
- **Country needs:** There is little point for the countries in trying to implement programmes that cannot function commercially at prevailing prices; it is at best a distraction and a diversion of scarce technical skills
- **Donor preferences:** There is increasing concern among donors that in the absence of price reform policies for energy efficiency will be difficult to implement. It is likely that donors would accept this discrimination
- **Private sector:** The involvement of the private sector is fundamental to the roll-out at scale of energy efficiency, but it will be very difficult to engage the public sector unless there is a commercial case and in the absence of price reform this will not be easy
- **Consumer mobilisation:** the consumer is the ultimate user of energy and whatever regulation might be in place will generally have some scope for choice that will affect energy use; it is important that consumers make sound choices; this can be supported by participative decision-making processes and strong advocacy
- **Effectiveness:** Impacts will be restricted to specific cases where there is donor support; there will be little spontaneous replication
- **Efficiency:** the conversion of inputs into results will be easier if the commercial environment is supportive

The majority of indicators appear to favour adapting activities according to the status of the country with respect to price reform.

5.3 Level 2 analysis: Emphasis

The second level analysis addresses the options for the principle emphasis of the programme. It is assumed that a future programme aiming at the twin objectives of efficiency across the economy and access to energy efficient goods and services would have separate components with those goals, although of course many of the skills and facilities would be shared. The two concerns are therefore considered separately.

5.3.1 Options for energy efficiency (price reformed countries)

We consider three options for the first track (for countries that have achieved price reform). These are designated O1, O2 and O3 and are defined below:

- **O1: Support for NAMAs:** In this option the emphasis is on engaging with countries in the implementation of unilateral or voluntary NAMAs. These actions would require no financial support and little or no MRV, but would benefit from UNEP's experience in: regulations and strategy; internal monitoring and verification; working with the local finance sector to understand the commercial possibilities of energy efficiency (Section 4.3.3). Conventional financial and economic methodology would provide the main analytical tools.
- **O2: EE enhanced SCP:** The second alternative is not to engage directly in the implementation of NAMAs, but to concentrate on laying the basis for policy for energy efficiency through design of regulations, capacity building (regulatory, financial and technical), much as in the recent past, but with more focus and a more sustained effort established within a long-term programme.
- **O3: Donor driven:** The third option is continue with a policy that is shaped by short-term donor preferences and that is adapted to country needs and circumstances as donor preferences shift.

5.3.2 Assessment of options (price reformed countries)

- Conformity with SE4A: O1 conforms best as it will aim directly at GHG mitigation; O3 conforms least as coordination and focus will be hard to achieve
- Conformity with Rio+20: O2 conforms best as that is its main focus; O1 conforms least because its pragmatic focus will distract from some of the longer-term aims of SCP
- Builds on competences: O2 is best as it stands in closest continuity with the past and O3 conforms least as it requires continual adaptation to new donor concerns. UNEP can

though make a strong contribution to the implementation of NAMAs and O2 is a strong second.

- Country needs: Given that participants are those that have already reformed prices there is likely to be strong country intent to implement energy efficiency; O1 is therefore best; O3 is the least easily adaptable to country needs.
- Donor preferences: This is hard to judge, but it is possible donors prefer to be unconstrained by external objectives and that O3 conforms best. Most donors attach high importance to GHG mitigation so O1 comes next.
- Private sector: The private sector will respond best to a commercial framework, best provided by O1 and then by O2 because of the likely greater transparency and continuity.
- Consumer mobilization: Price reform needs flanking measures through welfare policies as noted, but also policies that can ease the adoption of efficient goods and services will be helpful. Programmes that are better adapted to the prevailing price environment should provide more effective mobilisation of consumers.
- Effectiveness: O1 will have highest effectiveness in mitigating GHG. O2 will be more effective than O3 because of the continuity.
- Efficiency: O1 will convert inputs into results well because of the good commercial framework; O2 will be more efficient than O3 because of the continuity.

The results are summarised in the Table. Three stars indicate the best conformity.

Table 8: Assessment of policy options for energy efficiency (price reformed countries)

Criterion	O1 Support for NAMAs	O2 EE enhanced SCP	O3 Donor driven
Conformity with SE4A	***	**	*
Conformity with Rio+20	*	***	**
Builds on competences	***	***	*
Country needs	***	**	*
Donor preferences	**	*	***
Private sector	***	**	*
Effectiveness	***	**	*
Efficiency	***	***	*

The conclusion of this analysis is that the “Support for NAMAs” option has many attractions, but that the “EE enhanced SCP” approach is also largely acceptable according to the chosen criteria.

5.3.3 Options for energy efficiency (subsidised prices)

In this case we also consider three options. An option to support the implementation of NAMAs has little sense because prices will not allow successful implementation of voluntary NAMAs and donors are unlikely to collaborate in supported NAMAs in an environment of price subsidies. The proposed options in this case are:

- **O1 Support to price reform:** The logic of this option is that as this is the main barrier to efficiency it is the appropriate focus of activity.
- **O2: EE enhanced SCP:** as above
- **O3: Donor driven:** as above

We eliminate the donor-driven approach as it will suffer from the lack of coherence and continuity identified above. The assessment therefore is of options O1 (Support to price reform) and of O2 (EE enhanced SCP).

- Conformity with SE4A: O1 may be favoured under this option as if successful it would contribute to GHG mitigation
- Conformity with Rio+20: A1.2 conforms best as that is its main focus
- Builds on competences: A1.2 is best as it stands in closest continuity with the past; it is not at all clear that UNEP alone has strong capacities in this field. A serious programme of price reform needs to be associated with improved welfare services (health, education, social security) that would extend far beyond the scope of UNEP's SCP work. It is an important activity, in which UNEP could usefully participate, but it is not an appropriate focus for a UNEP led programme.
- Country needs: Price reform would correspond strongly with country needs (but maybe not perceived needs by government for whom the social and political opposition to price reform would be a source of apprehension)
- Donor preferences: Donors are unlikely to see this as a suitable vehicle for price reform and are likely to prefer continuity with the SCP work
- Private sector: If successful the price reform option would conform well to the need to mobilise private finance
- Consumer mobilization: A programme aiming at price reform will not easily mobilise consumers in support without the flanking policies in education, health etc. The SCP option can do this if it is designed to engage consumers as many of the previous programmes have successfully managed to do.
- Effectiveness: It is unlikely that a programme of price reform mounted from a perspective of SCP would succeed
- Efficiency: As above, it unlikely that activities to cause price reform would be efficient

The results are summarised in the Table. Three stars indicate the best conformity.

Table 9: Assessment of policy options for energy efficiency (unreformed prices)

Criterion	O1 Price reform	O2 EE enhanced SCP
Conformity with SE4A	***	**
Conformity with Rio+20	*	***
Builds on competences	*	***
Country needs	***	***
Donor preferences	*	***
Private sector	**	**
Consumer mobilisation	*	***
Effectiveness	*	**
Consumer mobilisation	*	***
Efficiency	*	***

The analysis suggests that, important as price reform may be, it is unlikely to be achieved within an energy efficiency programme led by UNEP and situated within SCP.

5.3.4 Summary of the assessment of options for energy efficiency

Taken together, the two previous assessments define a programme of energy efficiency that is based in two tracks:

- A track supporting the implementation of NAMAs that is designed for countries with reformed prices where successful implementation can be expected
- A track designed to create an enabling environment (i.e. legislation, regulations, institutions, technical and financial capacity) for energy efficiency policy that will complement programmes of price reform supported by other technical cooperation activities

The first track should be confined to countries with cost-effective prices; the second track could be open to all.

5.3.5 Options for extending access to energy efficient goods and services

The decisions that need to be made in establishing priorities for work in this area are unlike those that apply to promoting energy efficiency in the bulk of the economy. The interventions required to promote better access to energy efficient goods and services will often involve

subsidy regardless of the pricing structure. The distinction that is observed in energy efficiency, between countries with cost-reflective pricing that have the option for commercially viable programmes and those that do not, is not of the same significance in this matter and differentiation of programmes according to the degree of price reform is less likely to be useful. In fact countries with poor access will often be those that have wide-scale subsidies, because the two things are correlated with poverty. Subsidies are a mechanism for redistribution of wealth in the absence of a working welfare system. It is not a good mechanism, but it may be operational where other tools are not.

In the case of energy efficiency, its large-scale deployment is generally agreed to be the cheapest, fastest solution to the most pressing global environmental challenge. Therefore, to give to energy efficiency some priority within the wider idea of SCP is acceptable. This argument does not transfer to the question of extending access to energy efficient goods and services. Whilst it is obvious that the systems constructed to provide access should be efficient, the amounts of energy consumed by the target groups are generally a small part of the national energy balance and impact on the mitigation of climate change is low. Too strong a focus on energy efficiency may miss some of the intricacies of a rural economy. In rural communities there is an intimate interaction between agriculture, water, materials and energy that is not easily understood by focussing on a single component; more may be lost than is gained by privileging energy efficiency within SCP. Accordingly, one way of distinguishing options in this area would be as “creating access to energy efficiency to energy efficient goods and services” or “creating access to SCP goods and services”. The second option implies that UNEP would extend its work on SCP to encompass the kinds of systems and technologies that would follow the creation of access. This might be seen as an opportunity or it might be seen as an excursion into rural development where other players are better established.

UNEP has certain skills that could be of immediate service. These are: its ability to work with the financial sector to develop innovative financial mechanisms consistent with SCP; advocacy (important to create the commitments in the private sector) and monitoring and verification. Novel indicators would need to be constructed that measured welfare benefits rather than energy saved. Taken together these constitute a solid package of support for the creation of the necessary financial mechanisms and private sector commitment. Emphasis on these contributions would constitute an “enabling” option – using UNEP’s skills to the most effect to create a coalition of support of value to many actors beyond UNEP itself.

A second option would be to stay more within the core activity of SCP and to work towards the construction of sustainable communities following on from the connection to modern energy services. This tactic would probably eschew the sole focus on energy efficiency and take a

wider SCP-based view. Such an approach would be congruent with the findings of the recent UNDP review of seventeen energy access projects across Asia and the Pacific, (UNDP, 2011). The review confirmed that the access projects had reduced the energy costs of communities and improved health, education, communication, access to information and women's empowerment, but determined that the impact on livelihoods and incomes was less visible. The study attributed this weakness to the fact that most projects focussed on meeting basic needs and only a few went on to complement the energy service with measures that raise incomes and improve livelihoods through improving access to information, market linkages, business development services, access to micro-credit and activities that generate cash incomes.

It is probable that one of biggest impacts that UNEP can have is in ensuring that these new productive activities follow SCP patterns and are consistent with global objectives in mitigation. Specific concepts to include would be design of low-carbon transport and buildings, land-use planning to optimise production of food, fuel and materials, and determination of the preferred cooking practices in a given rural context.

The UNDP study identified several aspects of good practice to all of which UNEP, in conjunction with other agencies, could contribute. In particular, good practice involves the creation of commercially viable markets for energy products and services and this should be done in a manner that is sustainable within the constraints of the community. The review also stressed the need to monitor projects through indicators and measureable targets and to this also UNEP can contribute. Among its relevant skills are: its ability to work constructively as a non-competitive partner with the financial services industry; advocacy (important to create the commitments in the private sector) and monitoring. Taken together these constitute a solid package of support. Emphasis on these contributions would constitute an "enabling" option – using UNEP's skills to the most effect to create a coalition of support of value to many actors beyond UNEP itself.

A second option would be to stay more within the core activity of SCP and to work towards the construction of sustainable communities following on from the connection to modern energy services. This approach would probably eschew the sole focus on energy efficiency and take a wider SCP-based view. The options can be described as:

- **O1: Advocacy for access:** deploying the tools that UNEP has developed within its SCP energy programmes to mobilise business and civil society to the practical implementation of providing access to energy efficient goods and services
- **O2: SCP post-access:** elaborating the ideas of SCP to fit the post-access communities

Following the same procedure as before:

- Conformity with SE4A: O1 is favoured by this criterion as it contributes immediately to the direct objectives of the initiative
- Conformity with Rio+20: O2 conforms best as it promotes SCP in the longer-term
- Builds on competences: Both options build on existing competence in different ways. O1 through the relevant tools noted above and O2 through past work on SCP
- Country needs: Both options would be important to the countries
- Donor preferences: There is no obvious reason why donors would have a preference
- Private sector: O1 would conform better to this initiative as it is designed to stimulate private sector involvement; O2 in itself would probably not attract so much interest
- Consumer mobilization: Advocacy as conceived here is advocacy at the level of corporates. O2 that envisages the design and dissemination of guidelines for communities with recent access to modern energy services may engage the consumer more effectively
- Effectiveness: O1 is likely to be effective in the short-term; O2 if properly done would be effective over the long-term
- Efficiency: There is no obvious preference here; they would both be efficient, but with different inputs and outputs

Table 10: Options for promoting access to energy efficient goods and services

Criterion	O1 Advocacy for access	O2 SCP for post-access communities
Conformity with SE4A	***	*
Conformity with Rio+20	**	***
Builds on competences	***	***
Country needs	***	***
Donor preferences	***	***
Private sector	***	*
Consumer mobilisation	*	***
Effectiveness	***	***
Consumer mobilisation	*	***
Efficiency	*	***

The analysis shows that both options have important strengths; they are not mutually exclusive – indeed they are complementary. Both should be retained.

5.3.6 Summary of options

From these considerations we can construct a proposal for a substantial effort in implementing energy efficiency and extending access to energy efficiency. It would:

- Build on demonstrated competences from UNEP's past work
- Support SE4A in both of its objectives regarding energy efficiency
- Be coherent with the objectives of the SCP programme and the 10YFP
- Build links between SE4A and the Rio+20 initiative
- Offer support to a prompt deployment of NAMAs under the post-Kyoto arrangements

Structurally it would comprise four themes two of which address the implementation of energy efficiency and two that address extending access. Their relationship to the main themes of UNEP's past programmes is shown in the matrix.

Table 11: Linkages of proposed themes to key aspects of past programmes

	Support to NAMAs	EE enhanced SCP	Advocacy for access	SCP for post-access communities
Sustainable production	High	High	Low	High
Sustainable products	High	High	Low	High
Sustainable lifestyles	Low	Medium	High	High
Innovative finance	High	High	High	High

5.4 Implementation issues

5.4.1 Long-term framework

The time from accepting the need for policy and seeing the results and impacts can be long. Support for planning, policy and regulatory reform needs to be followed by building capacity, institutions and coalitions of interest to implement the instruments and to provide for regulatory compliance. Finally, the commercial and market environment is created that permits private investment at scale. Continuity between these stages is at present imperfect; different stages will often depend on different donors, maybe on conflicting time-schedules and often with conflicting advice. To some extent this is inevitable, but it would be improved if there were a long-term indicative framework broadly agreed by countries, donors and agencies

along which individual initiatives were aligned. In the case of SCP, a 10 Year Framework Programme is envisaged to be agreed at the Rio conference in June. This would be a major advance and it would greatly strengthen the effort in energy efficiency if it were included within this long-term frame.

5.4.2 Donor commitment

The budgets of donor agencies are not generally defined in a long- or even medium-term perspective. Volumes, and especially preferences, can change. It is therefore difficult for donors to make long-term commitments. A compromise between this practical problem and the idea of a longer-term vision is that the 10YFP be constructed in stages of say 3+3+4 years, with review after each stage. This would give greater visibility to long-term plans of the programme and could improve the articulation with donor support.

5.4.3 Private commitment

The papers on SE4A note quite correctly that the volumes of investment required go far beyond what can be expected from budgets for technical cooperation and will require that private capital be committed. Even finding the money to facilitate the creation of the correct commercial and market environment that will release private investment is a challenge. SE4A has ambitious aims of obtaining commitments from the private sector in support of the aims. Much energy efficiency is cost-effective and if the conditions are right private capital will follow. The challenge is greater for extending access to energy efficient goods and services in new communities because often the conditions are not propitious for private investment. The private sector will not normally engage in activities that do not contribute to profit. There is of course a growing tendency to private philanthropy and the private sector is certainly capable of taking a broad view of where its interests lie in terms of new markets and products, but the main focus of private companies (correctly) is the interests of their shareholders. The conception of these interests has been broadened in the past and most companies recognise a corporate responsibility towards the environment, child labour, human rights and other social concerns. This shift has been brought about partly by legislation, but in large part also by public opinion to which legislation responds. Obtaining commitments for the private sector for extending energy access will be helped by supportive public opinion and strong advocacy. UNEP's work on sustainable lifestyles and creating networks of sustainable communities could contribute significantly to this process.

5.4.4 Funding

Present funding for SCP is relatively low and unpredictable, depending on irregular provision of funds from individual donors for much programme activity. Substantially greater funds and improved medium-term clarity on funding is desirable. A long-term programme would

facilitate these aims.

5.4.5 The need for economic expertise

The present work on SCP is often unsupported by good economic analysis. Policies designed to cause change through inducing people to invest (as most energy efficiency policies aim to do) must be based on sound economic analysis. This will be especially necessary if the work programme is to include support to NAMAs, because they will need to be economically viable at the level of the country and of the individual or firm. A central economics department servicing different programmes is probably not the best arrangement. The economic thinking needs to be close to the realities on the ground and linked to the specificities of the particular interventions.

5.4.6 Visibility of results

The websites for the various components of the energy efficiency related work are well-designed and attractive, but do not see always to be updated with results. Better visibility of results would be helpful and contribute to the overall impact of the work. It is a key aspect of UNEP's support to technical and social innovation. A web-based clearinghouse for SCP is in preparation and this is a useful start. A tool with a search function covering all UN operations on energy efficiency would be a very helpful contribution.

6. Conclusions

Conclusion are divided into a set of firm conclusions that relate to the capacities of UNEP and a second set of tentative conclusions that pertain to the possible character of future work and that are intended mainly to promote dialogue among concerned stakeholders.

6.1 Firm conclusions

1. UNEP has a solid portfolio of experience that spans much of the scope of energy efficiency policy and it can build on this experience to make an important contribution to the pressing need to accelerate energy efficiency to cope with climate change and to provide access to efficient modern energy services.
2. In addition to its specific technical achievements, UNEP enjoys a set of managerial skills that are of substantial value to the promotion of the complex interdisciplinary programmes addressing many stakeholders such as are necessary for energy efficiency. The set includes skills in: building coalitions of interest and consensus on complex technical issues; innovative finance; advocacy and communication.
3. A programme in the framework of the 10 Year Framework of Programmes on SCP

(10YFP), or programmes or other global platforms for action on SCP, that emphasised energy efficiency within the general concept of SCP would provide valuable support for SE4A and would create useful links between such a framework or platform and SE4A to the benefit of both.

4. The programme could and should address both the implementation and the access to energy efficiency measures.
5. A long-term framework is essential for such a programme in order: to assure continuity of action on the ground and to provide medium-term visibility to countries and donors of the prospects and needs.
6. Predictable and sustained funding for SCP over a significant (multi-year) period would be beneficial in order to bridge gaps in programme funds and to assure continuity of support to SE4A and to country activities. A period of sustained effort for perhaps ten years is needed to move from policy design, through necessary capacity building up to effective implementation.
7. Equally, if the proposal for Sustainable Development Goals that will be examined by the Rio+20 conference is approved, then the same activities on energy efficiency and access to energy efficient goods and services can support an SDG on Sustainable Energy for All.
8. The introduction of NAMAs into the global framework for mitigating climate change provides an opportunity for UNEP to enhance its contribution to that important effort. The focus of NAMAs on sectoral strategy and policy is particularly amenable to UNEP's capacities. Regulatory compliance is an essential element of environmental management and UNEP is well positioned to develop these techniques as MRV tools and methodologies to support NAMAs in specific sectors, such as buildings (see Section 4.3.3).
9. Delivering energy efficiency on the scale envisaged by SE4A will require very large investments by the private sector and for this to happen there must be a viable business case. As a non-competitive agency, with authority in environmental policy, UNEP is well-placed to work with the financial sector and business to identify opportunities and obstacles and to negotiate with governments and civil society acceptable paths forward. It has already done this successfully in different ways with lighting, electrical equipment and buildings (and in improving specifications of transport fuels) and it is important to continue.
10. Fashioning private sector commitments to improved access to efficient energy services will benefit from skilful advocacy and the creation of favourable public opinion. UNEP's work on sustainable life styles and the supporting networks could be adapted for this purpose.
11. The particular skills of UNEP need to be evaluated as a part of the total offer of skills from the technical assistance community and particularly other agencies of the UN

family. In this respect the multi-disciplinary character of UNEP with authority in environmental policy has advantages. It can, as a neutral and non-competitive actor, organise coalitions of government, manufacturing industry, the financial sector and civil society to deal with complex problems both within a country and internationally. There are many outstanding issues to which this can be applied.

12. To the maximum extent possible, new activities of UNEP should build upon the existing delivery channels. It has in its past activities created effective and appropriate networks and participates in the institutional infrastructure provided by the NCPs. The emphasis in the future should be on deploying these assets to the best possible effect in pursuit of well-established objectives.

Tentative

13. There is a strong argument for discriminating between activities designed for countries that have successfully reformed prices and those that have not. In the former case, a clear focus on helping countries implement NAMAs and sectoral mechanisms would be a valuable contribution to the global effort of mitigation. In the second case, it may be more effective to concentrate on strengthening capacity to design, implement and monitor policies in parallel with activities (from other programmes) to reform prices.
14. For the implementation of energy efficiency, a dual track comprising a line for “support to NAMAs” and another line comprising “EE enhanced SCP” would meet the differentiated need between country groups. It also has the advantage of demonstrating a clear continuity with the historic SCP activities, whilst still providing for adaptation to new ideas and needs.
15. For extending access to energy efficiency, there are two main lines of action that show promise. One is to extend the ideas and tools for SCP, mainly developed for conventional production processes and products, to the challenges that face communities newly connected to modern energy services. These SCP ideas and tools will provide guidance as to how these communities can ensure that they adopt the most efficient technologies consistent with their needs. The other is to deploy the networks created to further sustainable lifestyles to the new challenge of creating supportive public opinion to the right of universal access to modern energy services.

BIBLIOGRAPHY

- ADB. (2010). *Energy for All Flyer*. Manila: ADB.
- Asia Business Council. (2007). *Building Energy Efficiency: Why green buildings are key to Asia's future*. Asia Business Council.
- BASE SEFI. (2006). *Public Finance Mechanisms to Increase Investment in Energy Efficiency*. Basel Agency for Sustainable Energy.
- Bertoldi, P., & Rezessy, S. (2010). *Voluntary agreements in the field of energy efficiency and emission reduction*. Joint Research Centre of the European Commission.
- Bhattacharya, S. C. (2006). *Greenhouse gas emission reduction from industry in Asia and the Pacific (GERIAP): Terminal evaluation reportm*. Retrieved from UNEP: http://www.unep.org/eou/Portals/52/Reports/GERIAP_K0652160.pdf
- California Public Utilities Commission. (2011, March). *CPUC Responsibilities for Renewable and Energy Efficiency Resource Commitments by Investor-Owned Utilities and Ratepayers*. Retrieved from www.energy.ca.gov/reports/1999-12_400-99-020.html
- CECED. (2007, March 21). *Top Executives Discontinue Voluntary Energy Efficiency Agreements for Large Appliances*. Retrieved from CECED: www.cecet.be
- CEM. (2012, January 26). Retrieved from Clean Energy Ministerial : <http://www.cleanenergyministerial.org/index.html>
- Chomitz, K. (2008, December). *Climate Change and the World Bank Group, Phase I: An Evaluation of World Bank Win-Win Energy Policy Reforms*. Retrieved June 10, 2009, from www.siteresources.worldbank.org/EXTCLICHA/Resources/cc_eval_launch.ppt
- CSD. (2011). *Commission on Sustainable Development: Report on the nineteenth session (14 May 2010 and 2-13 May 2011)*. Retrieved from UNited Nations: http://www.un.org/esa/dsd/csd/csd_pdfs/csd-19/report-CSD19.pdf
- CTF. (2009, February). *Clean Technology Fund Investment Criteria for Public Sector Operations*. Retrieved from Climate Investment Funds: http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/CTF_Investment_Criteria_Public_sECTOR_revisedFeb9.pdf
- CTF. (2009). *Clean Technology Fund Investment Criteria for Public Sector Operations*.
- DECC. (2010). *Extending the Carbon Emissions Reduction Target to December 2012*. London: Department of Energy and Climate Change.
- DECC. (2011). *Annual Report of Fuel Poverty Statistics*. London: UK Department of Energy and Climate Change.
- ECEEE. (2008). *Global Product Efficiency 2008: Getting global agreement on defining energy efficient products*. Brussels: European Council for an Energy Efficiency Economy.
- Environmental Law Institute. (2007). *Compendium of Relevant Practices for Improved Decision-Making, Planning and Management of Dams and Their Alternatives: Compliance*. United Nations Environment Programme.
- EU. (2011). *Impact Assessment Accompanying the Communication from the Commission 'Horizon 2020 - The Framework Programme for Research and Innovation'*. Brussels: European Commission.

- EU. (2011). *Proposal for a Directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC*. Brussels: European Commission.
- EU. (2011b). *Impact Assessment accompanying the Proposal for a Directive of the European Parliament and of the Council on energy efficiency SEC(2011) 779 final*. Brussels: European Commission.
- EU Commission. (2009). *Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community*.
- EU Commission. (2009). *Impact Assessment Guidelines: SEC (2009) 92*.
- EU Commission. (2011). *Increasing the impact of EU Development Policy: an Agenda for Change*. Brussels: European Commission.
- Frydenberg, B. (2010, October). *Terminal Evaluation of project Using Carbon Finance to Promote Sustainable Energy Services in Africa (CFSEA)*. Retrieved from UNEP Evaluation Office: http://www.unep.org/eou/Portals/52/Reports/CF-SEA_TE_Final.pdf
- GEF / UNDP. (2010). *Promoting Energy efficiency in buildings: Lessons Learned from International Experience*. United Nations Development Programme.
- GEF. (2007). *Climate change focal area strategy and strategic programming for GEF-4*. Global Environment Facility.
- GEF. (2010). *Investing in Energy efficiency: the GEF experience*. Global Environmental Facility.
- GFEI. (2011). *50by50: Prospects and Progress*. London: Global Fuel Economy Initiative.
- Government of Norway. (2011, October). Retrieved from Energy for All: <http://osloenergyforall2011.no/energy.cfm>
- HM Treasury. (2011). *The Magenta Book: Guidance for evaluation HM Treasury*. London.
- ICA. (2011). *Harmonization of Energy Efficiency Standards for Air Conditioners and Refrigerators in South East Asia*. International Copper Association.
- IEA. (2010). *Energy Technology Initiatives: Implementation through Multilateral Co-operation*. Paris: International Energy Agency.
- IEA. (2011). *World Energy Outlook 2011*. Paris: IEA.
- IEA. (2012, January 23). *Policies and Measures Databases*. Retrieved from International Energy Agency: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0370:EN:NOT>
- IEA-4E. (2011, January). *Annual Report 2010: Implementing Agreement for a Co-operative Programme on Efficient Electrical End-Use Equipment (4E)*. Retrieved from IEA-4E: http://www.iea-4e.org/files/otherfiles/0000/0164/4E_2010_Annual_Report.pdf
- IFC World Bank. (2010). *Lighting Africa: Annual Report FY 2009-2010*. Washington D.C.: World Bank.
- IISD. (2006, November). *Focus on Energy Subsidies*. Retrieved from International Institute for Sustainable Development: The Global Subsidies Initiative: http://www.iisd.org/subsidies/gsi_nov_2006.htm.
- IPCC. (2007). *Climate Change 2007: IPCC Fourth Assessment Report*. UK and New York: Cambridge University Press.
- JRC. (2010). *Energy Efficiency in Public Procurement – Member States' experience, barriers/ drivers and recommendations*. the Joint Research Centre of the European Commission.
- Karrir, N. (2008, February). *Terminal Evaluation of the UNEP Project Promoting Industrial Energy Efficiency through a Cleaner*. Retrieved from UNEP Evaluation Office: http://www.unep.org/eou/Portals/52/Reports/Energy_Efficiency_Report_FINAL.pdf

- Koeppel, S., & Urge-Vorsalz, D. (2007). *Assessment of policy instruments for reducing greenhouse gas emissions from buildings*. Budapest.: Central European University.
- Koplow, D. (2009). *Measuring Energy Subsidies Using the Price-Gap Approach*:. Retrieved from http://www.iisd.org/pdf/2009/bali_2_copenhagen_ff_subsidies_pricegap.pdf
- Kosonen, K., & Nocodeme, G. (2009). *Taxation Papers: The role of fiscal instruments in environmental policy*. Brussels: European Commission .
- Lahbabi, A. (2010). *Terminal Evaluation of the UNEP/GEF Project on Energy Management and Performance Related Savings Scheme (EMPRESS)*. Retrieved from UNEP Evaluation Office: http://www.unep.org/eou/Portals/52/Reports/EMPRESS_Final_Evaluation.doc
- Lane, K., Harrington, L., & Ryan, P. (2009). *Evaluating the Impact of Energy Labelling and MEPS: A retrospective look at the case of refrigerators in the UK and Australia*. ECEEE.
- LBL. (2010). *Energy Efficiency Services Sector: Workforce Education and Training Needs*. Berkeley, California: Lawrence Berkeley National Laboratory.
- Lees, E. (2007). *European Experience of White Certificates: WEC ADEME project on energy efficiency policies*. London: WEC.
- LSE Grantham Research Institute. (2009). *Meeting the Climate Challenge: Using Public Funds to Leverage Private Investment in Developing Countries*. London.
- Lucas, N. J. (2009). *The Lessons of Practice: Domestic Policy Reform as a Way to Address Climate Change*. Winnipeg: International Institute for Sustainable Development.
- Mann, P. (2010, November). *Mid-term Evaluation of project CP/4040-03-16 (3430) of the*. Retrieved from UNEP Evaluation Office: http://www.unep.org/eou/Portals/52/Reports/GNESD_MTE_Final.pdf
- McKinsey. (2009). *Pathways to a low-carbon economy*. McKinsey and Company.
- MDD. (2012, January 26). *Paris-Nairobi Climate Initiative Clean Energy for All in Africa*. Retrieved from Ministère du Développement durable lance: http://www.developpement-durable.gouv.fr/IMG/pdf/110228_note_de_concept_EN.pdf
- MicroFinance Transparency. (2011). *Pricing certification report: Grameen Bank*. Lancaster, US: MicroFinance Transparency.
- MoE Sweden UNEP. (undated). *Task Force on Sustainable Lifestyles*. Futerra sustainability communications.
- Morel, A. (2008, September). *Terminal Evaluation of Project on Developing Financial Intermediation Mechanisms for Energy Efficiency Projects in Brazil, China and India*. Retrieved from UNEP Evaluation Office: http://www.unep.org/eou/Portals/52/Reports/Energy_Efficiency_in_Brazil-China-India.pdf
- N'Guessan, M. (2009, January). *African Rural Energy Enterprise Development (AREED) Programme: terminal evaluation*. Retrieved from UNEP Evaluation Office: http://www.unep.org/eou/Portals/52/Reports/AREED_Terminal%20_Final_version.pdf
- NEEDS. (2009). *Deliverable D10.2 - RS2b: Final report on sustainability assessment of advanced electricity supply options*. Retrieved from Needs-project: www.needs-project.org
- NORAD. (2008). *Leveraging Private Investment to Clean Energy Projects*. Norwegian Agency for Development Cooperation.
- OECD. (2011). *Growing Income Inequality In OECD Countries: What Drives It and How Can Policy Table*

It?. Paris.

- OFID. (2010). *OFID and Energy Poverty Challenges*. Vienna: OPEC Fund for International Development.
- Oxera. (2006). *Policies for Energy Efficiency in the UK Household Sector: REport prepared for Defra*. Oxera Consulting.
- Price, L., Worrell, E., & Sinton, J. (2003). *Voluntary Agreements in the Industrial Sector in China*. Ernest Orlando Lawrence Berkeley National Laboratory.
- Singh, J., Limaye, D., Henderson, B., & Shi, X. (2010). *Public Procurement of Energy Efficiency Services Lessons from International Experience*. Washington D.C.: The World Bank.
- SRREN. (2011). *Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 11: Policy, Financing and Implementation*. IPCC.
- Stern, N. (2006). *Stern Review on the Economics of Climate Change*. London: HM Treasury.
- Stern, N. (2007). *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.
- Theys, J. (2008). *Reported in Towards a Post-Carbon Society: European research on economic incentives and social behaviour*. Brussels: European Commission.
- Todd, D., & Todd, H. (2010). *Outcome and Influence Evaluation of the UNEP Partnership for Clean Fuels and Vehicles*. UNEP Evaluation and Oversight Unit.
- UN. (2011). *Resolution adopted by the General Assembly: 65/151. International Year of Sustainable Energy for All. 16 February 2011*. New York: United Nations.
- UN. (2012, January 22). *Call for Commitments*. Retrieved from Sustainable Energy for All: <http://sustainableenergyforall.org/commitments>
- UN DESA. (2012, February). *Creative Communities for Sustainable Lifestyles*. Retrieved from UN DESA: http://esa.un.org/marrakechprocess/pdf/CCSL_brochure.pdf
- UN Habitat. (2008). *State of the World's Cities 2008/2009: Harmonious cities*. London: Earthscan.
- UN Secretariat. (2011). *Sustainable Energy for All*. United Nations.
- UNDESA / UNEP. (2011, January). *Background Paper #2. 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP): Identifying Potential Programmes*. Retrieved from UN Department of Economic and Social Affairs: http://www.un.org/esa/dsd/csd/csd_pdfs/csd-19/Background-PaperDocumentPanama2_Programmes.pdf
- UNDP. (2008). *The Bali Road Map: Key Issues Under Negotiation*. New York: UNDP.
- UNDP. (2011). *Towards an 'energy plus' approach for the poor: A review of good practices and lessons learned from Asia and the Pacific*. Bangkok: United Nations Development Programme, Asia-Pacific Regional Centre.
- UNDP. (2012, January 22). *Library Toolbox: A tool for Governance Assessment*. Retrieved from Governance Assessment Portal: http://www.gaportal.org/toolbox/tools_of_gov/all
- UNEO DTIE. (2011, January). *Capacity building and technical assistance for industries and governments in developing economies*. Retrieved from Division of Technology, Industry, and Economics: <http://www.unep.fr/scp/ecolabelling/>
- UNEP / FOEN. (2011, May). *Marrakech Task Force on Sustainable Public Procurement led by Switzerland: Activity Report*. Retrieved from UNEP: <http://www.unep.fr/scp/procurement/docsres/ProjectInfo/MTFonSPPReportCSD19FINAL.pdf>

- UNEP. (1996). *Industry and Environment, Vol.19 No.1, Industry Compliance*. Paris: United Nations Environment Programme.
- UNEP. (2006). *A Policy Review as part of the Energy Efficiency Guide for Industry in Asia*. Retrieved from Energy Efficiency in Asia: <http://www.energyefficiencyasia.org/docs/Energy%20Efficiency%20Policy%20Review.pdf>
- UNEP. (2006). *Assessment of Financial Risk Management Instruments for Renewable Energy Projects in Developing Countries*. Paris: United Nations Environment Programme.
- UNEP. (2006). *Design for Sustainability: A Global Guide*. Paris: United Nations Environment Programme.
- UNEP. (2006). *Manual on Compliance with and Enforcement of Multilateral Environmental Agreements*. Paris: United Nations Environment Programme.
- UNEP. (2007). *Compliance Mechanisms under selected Multilateral Environmental Agreements*. Paris: United Nations Environment Programme.
- UNEP. (2009, December). *2008-2009 Evaluation Synthesis Report*. Retrieved from UNEP Evaluation Office: <http://www.unep.org/eou/LinkClick.aspx?fileticket=TACjAEu29rQ%3D&tabid=2256&language=en-US>
- UNEP. (2010). *Priority Products and Materials: Assessing the Environmental Impacts of Consumption and Production*. Paris: United Nations Environment Programme.
- UNEP. (2011). *Global Trends in Sustainable Energy Investment 2010*. Paris.
- UNEP. (2011). *Paving the Way for Sustainable Consumption and Production*. Paris.
- UNEP. (2012, February). *Energy Branch*. Retrieved from RE/EE Investment Advisory Facility (IAF): <http://www.unep.fr/energy/activities/iaf/>
- UNEP. (2012, January). *Manual on Compliance with and Enforcement of Multilateral Environmental Agreements*. Retrieved from Division of Environmental Law and Conventions: <http://www.unep.org/dec/onlineManual/Home/tabid/36/ctl/Terms/Default.aspx>
- UNEP and partners. (2009). *Catalysing low-carbon growth in developing economies: Public Finance Mechanisms to scale up private sector investment in climate solutions*. Paris: United Nations Environment Programme.
- UNEP and partners. (2009). *Catalysing low-carbon growth in developing economies: Public Finance Mechanisms to scale up private sector investment in climate solutions - Case Study Analysis*. Paris: United Nations Environment Programme.
- UNEP ARSCP. (2012, February). *Ecolabelling – as a potential marketing tool for African Products*. Retrieved from Marrakech Task Forces: Cooperation with Africa: <http://www.unep.fr/scp/marrakech/taskforces/africa.htm>
- UNEP DTI. (2002, December). *Seventh International High-level Seminar, Prague*. Retrieved from Industry and Environment: http://www.unep.fr/shared/docs/review/vol25no3-4/I&E25_34.pdf
- UNEP SBCI. (2009). *Buildings and Climate Change: a Summary for Decision-Makers*. Paris: UNEP DTIE.
- UNEP TU Delft. (2006). *Design for Sustainability: a practical approach*. Paris: United Nations Environment Programme.
- UNEP-SEFI. (2008). *Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation*. Paris: UNEP.
- UNESCO and UNEP. (2011a). *YouthXchange: Guidebook on Climate Change and Lifestyles*. Paris:

UNESCO.

UNFCCC. (2007). *Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007*.

UNFCCC. (2011). *Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010*.

UNIDO. (2011). *Industrial Development Report 2011: Industrial energy efficiency for sustainable wealth creation*. Vienna: United Nations Industrial Development Organization.

UNIDO-UNEP. (2008, May). *Independent Evaluation of the UNIDO-UNEP Cleaner Production Programme*. Retrieved from United Nations Environment Programme,; http://www.unep.org/eou/Portals/52/Reports/Evaluation_of_UNIDO-UNEP_Cleaner_Production.pdf

UNIDO-UNEP. (2009). *Joint UNIDO-UNEP Programme on Resource Efficient and Cleaner Production in Developing and Transition Countries*. Retrieved from UNEP: <http://www.unep.fr/scp/cp/pdf/RECP%20Programme%20Flyer%20April%202010.pdf>

USAID. (2011). *Enhancing Capacity for Low Emission Development Strategies*. Washington D.C.: USAID.

Waide, P., & Bernasconi-Osterwalder, N. (2008). *Standards, Labelling and Certification*. Winnipeg: International Institute for Sustainable Development.

WEF. (2010). *Green Investing 2010: Policy Mechanisms to Bridge the Financing Gap*. Geneva: World Economic Forum.

World Bank. (2004). *World Bank GEF Energy Efficiency Portfolio Review and Practitioners' Handbook*. Washington D.C.: World Bank.

World Bank. (2006). *Clean Energy and Development: Towards an Investment Framework*,". Washington.

World Bank. (2012, January 22). *Tools for Evidence-Based Policy Making*. Retrieved from World Bank: <tp://go.worldbank.org/Q2SRQY5YX0>

World Economic Forum. (2012). *Global Risks 2012, Seventh Edition*.

WSSD. (2002). *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August- 4 September 2002*. New York: United Nations.

