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Removing Subsidies

Leveling the Playing Field for Renewable Energy Technologies

Thematic Background Paper

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This is one of 12 Thematic Background Papers (TBP) that have been prepared as thematic background for the International Conference for Renewable Energies, Bonn 2004 (renewables 2004). A list of all papers can be found at the end of this document.

Internationally recognised experts have prepared all TBPs. Many people have commented on earlier versions of this document. However, the responsibility for the content remains with the authors.

Each TBP focuses on a different aspect of renewable energy and presents policy implications and recommendations. The purpose of the TBP is twofold, first to provide a substantive basis for discussions on the Conference Issue Paper (CIP) and, second, to provide some empirical facts and background information for the interested public. In building on the existing wealth of political debate and academic discourse, they point to different options and open questions on how to solve the most important problems in the field of renewable energies.

All TBP are published in the conference documents as inputs to the preparation process. They can also be found on the conference website at www.renewables2004.de.

Executive Summary

Direct and indirect financial support ("subsidies") to promote energy supply and access has historically tended to skew the playing field against renewable sources of energy. Globally, subsidies for oil, coal gas and nuclear power have totaled in the tens of billions of dollars annually. Subsidies take a variety of forms, including direct support to consumers, direct payments to investors in large and capital intensive projects, tax exemptions, price caps or ceilings and more subtle and indirect forms such as transmission grid support, regulatory hurdles for small and distributed power and agreements on formulas for risk calculation that emphasize volume of electricity rather than the security of fuel inputs. By quantifying some of these subsidies, including their economic and environmental costs, the paper sets the stage for a series of recommendations on subsidy reform and its implications for renewable energy. Recommendations include:

- creating targeted, soundly based incentives that are practical, transparent, predictable and promote market competition.
- aiming at all aspects of the system – including technical barriers, market impediments, administrative barriers and social and environmental constraints.

However, while it is relatively widely agreed that subsidy reform will significantly level the playing field for renewable energy and will make economic sense, it is evident that the political hurdles to enacting such approaches remain high. Thus, a successful outcome will necessitate not only a precise identification of how to reform the system, but as critically, how to overcome the political barriers to realizing these changes.

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1. Introduction

Modern energy use is increasingly recognized as the culprit in a number of environmental problems. Locally, production and consumption of energy leads to air pollution, water pollution, and land degradation. On a regional scale, without special precautions, emissions of sulfur and nitrogen are distributed for kilometers around fossil fuel combustion plants, while nuclear waste disposal requires sites that can be guaranteed to be safe for millennia. Globally, emissions of greenhouse gases lead to climate change, arguably one of the most serious environmental threats facing the world today.

However, energy also provides fundamental services: lighting, heating and cooling, and mobility all require energy use. Without energy, the standards of modern society for health, education and welfare would be impossible to meet. Thus, a balance must be found that meets the challenge of minimizing the environmental damages caused by energy production and use, while still meeting the demand for energy services to power the economy.

Renewable energy provides one potential response to this challenge. Unfortunately, while renewable energy contributes little to environmental damages, its economic costs[1] are generally higher than those of fossil fuels – leading to limited penetration of renewable sources into the global energy market. However, the cost differential between renewable energy and fossil and nuclear energy has been exacerbated by the long-term support provided by governments to the development of these other sources – support that is ongoing. What is now required is that these government supports be turned away from fossil fuels and toward renewable energy, leading to a transition to safe and clean alternatives to power the growing demand for energy services.

History provides ample evidence of the ability of governments to shape energy transitions dating back to the mid-1800's when UK government subsidies to coal contributed to its rapidly increasing use, and helped fuel the industrial revolution. Similar levels of government support have been found in subsequent energy transitions, including those driving oil and natural gas production and use, as well as nuclear power. In each transition, the focus was on increasing reliability of supply, as well as reducing costs and extending the reach of energy services. Direct financial aid was not the only instrument. For many of these transitions, governments provided technical assistance, guaranteed the purchase of new technologies, placed limits on the liability for accidents, and paid for the research and development needed to overcome technical barriers to implementation. Governments have also set the framework of legal and institutional conditions necessary for the private sector to move new energy technologies into the market.

The result of historic – and ongoing – government subsidies has been to skew the energy playing field against "clean" sources of energy. Collectively, global energy subsidies provided for oil, gas, coal and nuclear power total in the tens of billions of dollars, and help drive the unsustainable fuel mix we see in today's markets.

There is a growing recognition that governments need to reassess their support for certain sources of energy – or at a minimum, that they begin to incorporate the full price to society of the costs that energy use and production impose. With this goal in mind, subsidies that promote the overuse of damaging energy sources, as well as promoting the use of fuels that emit local pollutants as well as greenhouse gases, must be reexamined. It is clear that if pricing were to fully reflect environmental damages, our pattern of energy use – including both how much is used, as well as what sources were used – would change.

2. What are Energy Subsidies and Why Do They Exist?

2.1 Defining subsidies

According to the WTO, the definition of a subsidy contains three elements:
(i) a financial contribution (ii) by a government or any public body within the territory of a Member (iii) which confers a benefit. All three of these elements must be satisfied in order for a subsidy to exist.[2]

While generally subsidies are thought of as cash payments from a government to a producer or consumer, other kinds of subsidies exist as well (see Table 1). Some have a direct effect on price, like grants and tax exemptions, while others act indirectly, for example, through regulations that bias the market in favor of a particular fuel or government-sponsored technology research and development[3]. For a more extensive review of the economics of subsidies, see OECD 1998.

Table 1: Types of Energy Subsidies

Form of Government Intervention	Example
1. Direct Financial Transfer	Grants to producer or consumers, low interest loans
2. Preferential tax treatment	Rebates, exemptions on royalties, tax credit, accelerated depreciation
3. Trade restrictions	Quotas, trade embargoes, technical restrictions
4. Energy related services provided by government at less than full cost	Direct investment in energy infrastructure, public R&D
5. Regulation of energy sector	Demand guarantees, price controls, market access restrictions

Source: UNEP/IEA, 2002

Over-consumption due to excessively low prices distorts supply and demand. Subsidies for energy consumption, which mask the true energy price, lead to higher use (and emissions) for every unit of output. By lowering the price to consumers, subsidies increase import requirements and decrease the availability of fuels for export.

There are a number of factors related to fuels, energy technology, and operating habits that collectively contribute to under-pricing of energy, or particular forms of energy supply. The common reference to such distortions is to "a playing field that is not level"[4]. Particularly when the full price of each fuel (incorporating all direct and indirect costs of use and production) is not reflected in its market price, such a distortion can lead to unwelcome outcomes, including reductions in economic efficiency and environmental damages.

Both direct, as well as implicit or hidden cross-subsidies tilt the playing field away from renewables and create significant barriers to the commercialization of renewable energy. Often, implicit or hidden subsidies manifest as system-wide biases toward large-scale, highly centralized energy systems – and disadvantage the smaller-scale, more modular distributed and decentralized energy systems typical of many renewable energy technologies.

The exact consequence of any subsidy is dependent on the specific national circumstances to which it is applied. As the policy context and the technical and institutional characteristics of the electricity system vary, so do the barriers and potential ways of overcoming these. Whether electricity markets are fully liberalized, unbundled and partially liberalized, or vertically integrated monopolies will influence the approach necessary to level the playing field at the national level.

A number of the key forms of market distortions and their consequences are evaluated by the IEA[5]:

- Subsidies that lower consumer prices lead to higher energy use and reduced incentives to conserve or use energy more efficiently. At the same time, they reduce incentives for producers to minimize costs, resulting in less efficient plant operation and investments;
- By reducing the price received by producers, subsidies can undermine energy producers return on investment and their ability and incentive to invest in new infrastructure;
- Direct subsidies in the form of grants or tax exemptions act as a drain on government finances;
- Price caps or ceilings below market-clearing levels may lead to physical shortages and a need for administratively costly rationing arrangements;
- By increasing energy use, consumption subsidies boost demand for imports or reduce the amount of energy available for export; and
- Subsidies to specific energy technologies can undermine the development and commercialization of other promising technologies.

2.2 Distributional impacts

The social impacts of energy subsidies vary according to the type of subsidy. Many subsidy programs intended to boost poor households' purchasing power or rural communities' access to modern energy can, paradoxically, leave the poor worse off.[6] This results as the benefits often go to energy company equipment suppliers and the better-off households (especially in the towns and cities) rather than to the rural poor. Studies, including those of the IEA and UNEP, have identified three main reasons why energy subsidies tend not to reach the poor:

- The poorest families may not be able to afford even subsidized energy as middle and higher income families tend to get the bulk of subsidized energy through favoritism and local political corruption;
- Even if the poor are able to benefit from a subsidy the financial value to them may be small because their consumption is so modest; and
- Consumption subsidies involving caps on prices below market levels may lead to a need for rationing.

2.3 Biases in favor of large scale

Energy subsidies often go to capital intensive projects such as large hydro dams or big oil refineries at the expense of smaller or distributed alternatives. As a secondary inequitable outcome, it is often low-income families living near dams, refineries, and gas processing plants who suffer disproportionately from the air pollution and other local damages of these facilities.

An example of the disproportionate attention to large scale infrastructure development is obtained from a consideration of recent World Bank energy loans: while the total loan portfolio devoted to renewable energy has risen from 4% in 1990 to 14% in 2003[7], the overwhelming preponderance of the total energy investment remains focused on large scale, conventional energy supplies and infrastructure, including loans to oil & gas, coal and transmission grids. However, the Bank policy *is* trending in the right direction; the issue is how to continue to increase the share to smaller and renewable energy projects. The Bank's bias is mirrored in the funding of private lending institutions. In a forthcoming study by WRI's Julia Philpott, $95 billion in capital flows for new power plants (from 1994-2001 in a selected group of developing countries) was heavily biased to coal and gas – with limited amounts for diesel (which tends to be small scale) or renewable energy (see Table 2 below). The bias was revealed not only in public financing, but also in private flows.

Table 2: Selected Capital Flows for New Power Plants in Developing Countries: 1994-2001, (US$ Billions)

	International Origin					Domestic Origin	
	Developed Country Sources			Developing Country Sources		Host Country Sources	
	Private Sector $	Export Credit Agencies $	Public Sector $	Private Sector $	Public Sector $	Private Sector $	Public Sector $
Coal	15,779	9,848	2,357	1,142	0	6,188	0
Natural Gas	25,228	9,582	2,546	1,349	0	8,508	0
Diesel	3,565	983	211	1,361	0	1,755	0
Renewable	656	228	206	93	283	294	0
Sub-Totals	$ 45,230	$ 20,643	$ 5,322	$ 3,945	$ 283	$ 15,166	$ 0
Regional Totals	$ 50,552 (72%)			$ 4,228 (6%)		$ 15,166 (22%)	
Grand Total	$ 90,587 billion						

Source: Philpott, 2004. Underlying data from *ProjectWare,*™ Dealogic Ltd., United Kingdom, Copyright 1994-01.

2.4 Rationales for subsidies

Notwithstanding these negative consequences to the implementation of subsidies, there are a number of reasons generally given for adopting energy subsidies, including:

- Protecting domestic industry and promoting jobs at home;
- Reducing imports and improving national security;
- Managing risk;
- Making energy more affordable for specific social groups; and
- Protecting the environment.

These reasons often apply particularly to the poor. According to a study released by the World Bank,[8] the poor often are unable to obtain services due to high access costs, non-availability, inadequate start-up capital for new supply, as well as import restrictions or tax policies.

Subsidies seek to remedy these effects. In short, those providing the subsidies argue that the benefits and welfare gained justify – and often are much higher than – the long-term costs in providing the subsidy. Thus, high up-front costs that may be recouped over time, but cannot be justified by low initial revenues (especially for firms with short-term profit goals), or the assistance to poor households in obtaining higher quality services, offer rationales to today's ongoing subsidies.

Some of the world's largest subsidies have been offered in support of energy security. Energy legislation debated in the US Congress in late 2003 (although not yet passed) provides an example of this. According to the U.S. Congressional Budget Office (CBO)[9], the draft 2003 energy bill would have increased direct spending by $3.7 billion over the 2004-2008 period and by $5.4 billion over the 2004-2013 period. Furthermore, the CBO estimated that the act would reduce revenues by $17.4 billion over the 2004-2008 period and by $25.7 billion over the 2004-2013 period. Revenues would be divided between electricity and gas distribution, coal, oil, natural gas production, as well as nuclear power. Only a very small share would go to renewable energy. The emphasis, according to the bill's drafters, was on reducing US reliance on imported supplies to power its economy.

A compelling case can be made for promoting renewable energy from an energy security point. The UK's Renewable Energy and Energy Efficiency Partnership (REEEP) and the UN Environment Programme (UNEP) are currently funding a project focusing on how renewable energy can provide energy security benefits[10]. The work explores the potential for a portfolio planning approach – which shows there may be less risk associated with renewable energy compared to gas.

Similarly, energy security is affected not only by disruptions in the source of supply, but also by failures in the grid and diminished operating reliability of the electricity system. The recent power system outages in North America provide evidence of how highly centralized energy systems can be vulnerable. Taking the massive impact of large-scale system failure increases the rationale for distributed and decentralized energy systems within the context of energy security.

Despite the economic, social, and environmental problems brought on by subsidy programs, it is difficult, politically, to discontinue them. This is so partly because of short term economic costs that subsidy removal would entail. Increases in energy prices have immediate impacts, especially among the poor and there can be major reactions if there are not adequate programs to at least partially compensate for subsidy losses. Indeed, there are often more efficient ways – such as social security programs – that can reduce the burdens faced by the energy-poor. While the political barriers to reducing subsidies do not justify the maintenance of these measures, they do, nevertheless, suggest that subsidy reforms may best be confronted gradually to improve their chances of success.

As the above discussion suggests, there may be some cases in which subsidies are appropriate policy tools. Those arguing for subsidies have suggested a framework for effective policy, and called for subsidies to be assessed according to the efficacy (the subsidy reaches those for whom it is intended), sector efficiency (the subsidy is structured to provide services at least cost), and cost-effectiveness (the subsidy achieves goals at lowest program cost while providing incentives to businesses that serve the poor)[11].

3. Quantification of Energy Subsidies and their Effects

A subsidy by its very nature involves a complex set of changes in economic resource allocation through its effects on costs and/or prices[12]. These shifts inevitably have economic, social, and environmental implications. Indeed the reason subsidies exist at all is to support some economic, social, or environmental goal. However, artificially low energy prices also contribute to poor economic performance on the part of many state-owned energy companies.[13] This poor performance reduces the ability of companies to invest to meet increasing demand. It also discourages private and foreign investment in the energy sectors of these countries.

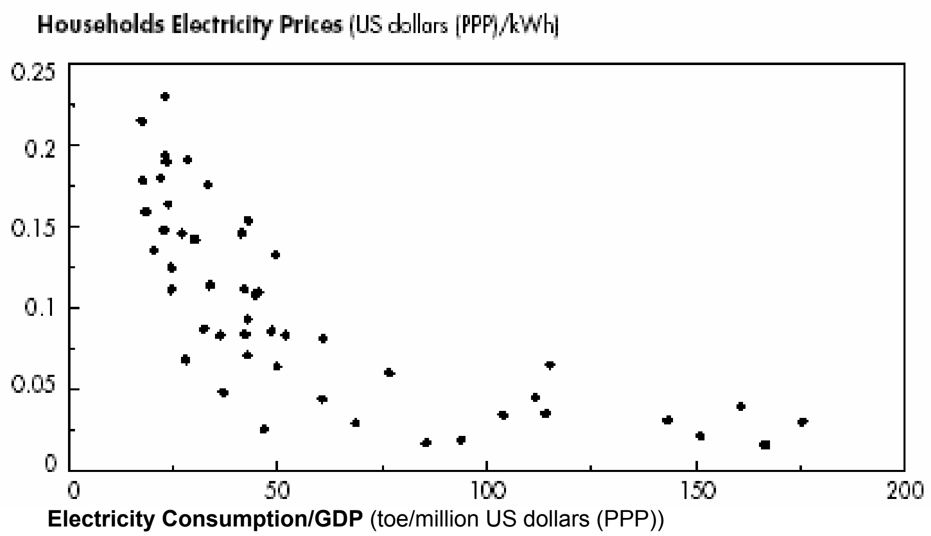
Quantifying these different effects, in terms of costs and benefits, is extremely difficult, and usually involves a subjective judgment on the part of the analyst. This is especially true when measuring the social and environmental benefits.

3.1 Economic costs

The change in the price of energy significantly affects energy consumption. As is made clear in the following figure (Figure 1), the higher the prices, the lower the consumption. Subsidies, which act to depress prices consumers see, thus, perversely, increase national demand – and reduce overall resource availability. Prices reflecting the real value of the resources employed in the generation of electricity ensure that consumers receive the correct signals to use electricity in the most efficient possible way.

Figure 1: Electricity Prices and Electricity Use per GDP, 1996

(27 OECD and 22 non-OECD countries)



Source: IEA, 1999

Energy subsidies are widespread though they vary greatly in importance and type according to the fuel and country.[14] Few studies have been carried out to quantify the energy subsidies for the world as a whole. A 1992 study by the World Bank, however, estimated global subsidies from under-pricing energy at around $230 billion per year (mostly related to below-market pricing in the former Soviet Union and developing countries). This can be compared with GDP in 1992 of about $27 trillion. This was confirmed in a 2001 paper by Andre de Moor of the Netherlands; the results of his study are reproduced in the table below:

Table 3: The cost of annual energy subsidies (1995-98, $US billion)

	OECD countries	Non-OECD countries	Total
Coal	30	23	53
Oil	19	33	52
Gas	8	38	46
All fossil fuels	57	94	151
Electricity	a)	48	48
Nuclear	16	nil	16
Renewable & end-use	9	nil	9
Non-payments and bail out[b]	0	20	20
Total	82	162	244
% global energy subsidies	34%	66%	100%
Per capita subsidies ($/cap)	88	35	44
Per capita GDP ($/cap, 2000)	23,132	3,903	7,316

Notes: a) Subsidies for electricity in OECD countries have been attributed to fossil fuels according the shares.

b) Subsidies from non-payments and bail out operations have not been attributed to energy sources.

Source: de Moor, 2001, and WRI, CAIT (for GDP numbers)

Other more recent studies confirm that energy subsidies are much larger in non-OECD countries. In 1997, the World Bank estimated annual fossil fuel subsidies at $48 billion in 20 of the largest countries outside the OECD and $10 billion within the OECD.[15]

While globally comprehensive studies are not generally available (nor are those that are available considered particularly accurate), a number of regional analyses have been made at a detailed level. In a World Bank paper[16] prepared in 1992 considering the FSU, China, Poland, India, South Africa, Czechoslovakia, Mexico, Brazil Argentina Venezuela, Indonesia, Saudi Arabia and Egypt, it was concluded that total economic efficiency losses produced by subsidies in these countries amounted to $33 billion annually. A 1999 IEA study[17] evaluating China, Russia, Indonesia, Iran, South Africa, Venezuela and Kazakhstan suggested economic efficiency losses of substantially less: about $17 billion (due to reduced subsidies in the intervening period, as well as to a different set of countries being evaluated). Table 4 below, prepared by Helen Mountford of the OECD, shows how extensive the subsidization is in a variety of OECD countries, drawing from a range of studies[18]:

Table 4: Results of OECD and other Studies on Energy Production Subsidy Removal

	Subsidy or Group of Subsidies Removed	Monetary Equivalent of Distortion	Other Economic Effects of Removing Subsidies
Study		**US$ million, various years, 1988-1995**	
DRI (1997)	Coal PSEs in Europe and Japan	5 800	Job loss in coal industry, increased coal trade.
Böhringer (1995)	Coal in Germany	6 700	Nearly 1% GDP increase. Job loss in coal industry, increased coal trade. Cost of using subsidies to maintain jobs is 94-145,000 DM per job per year. Reduces cost of meeting CO2 target.
Michaelis (1997)	Grants and price supports for coal and nuclear producers in the UK	2 500	
Shelby et al. (1996)	DFI (1993) analysis of US Federal subsidies	8 500*	
	DJA (1994) analysis of US Federal subsidies	15 400*	GNP increased 0.2% if revenue used to reduce capital taxes
Anderson & McKibbin (1997)	Coal subsidies and import restrictions in western Europe and Japan (to 2005)	NQ	Increased coal trade. GNP of transition and developing economies increased, while Australia's GNP is lowered.

* The two studies analyze different sets of energy supports and use slightly different estimates for some of them.

NQ = not quantified

More specificity is available for some fuel subsidies, particularly for coal: The IEA provides a regular update of coal subsidies in those member countries subsidizing this fuel.

As can be seen from table 5 below, while these levels have been decreasing with time, they are still significant:

Table 5: Total Support to Coal Production in Selected IEA Countries (US$ million)[19]

	1991	1992	1993	1994	1995	1996	1997	1998 (p)
France	397	402	422	361	83 (1)	118	(2)	(2)
Germany	6919	7885	6873	7930	8502	7165	5880	4982
Japan	815	739	878	918	884	729	469	n.a.
Spain	709	735	595	959	1110	1043	956	929
Turkey	408	613	394	165	267	195	158	171
UK	1991	1898	292	318	204	179	293	0

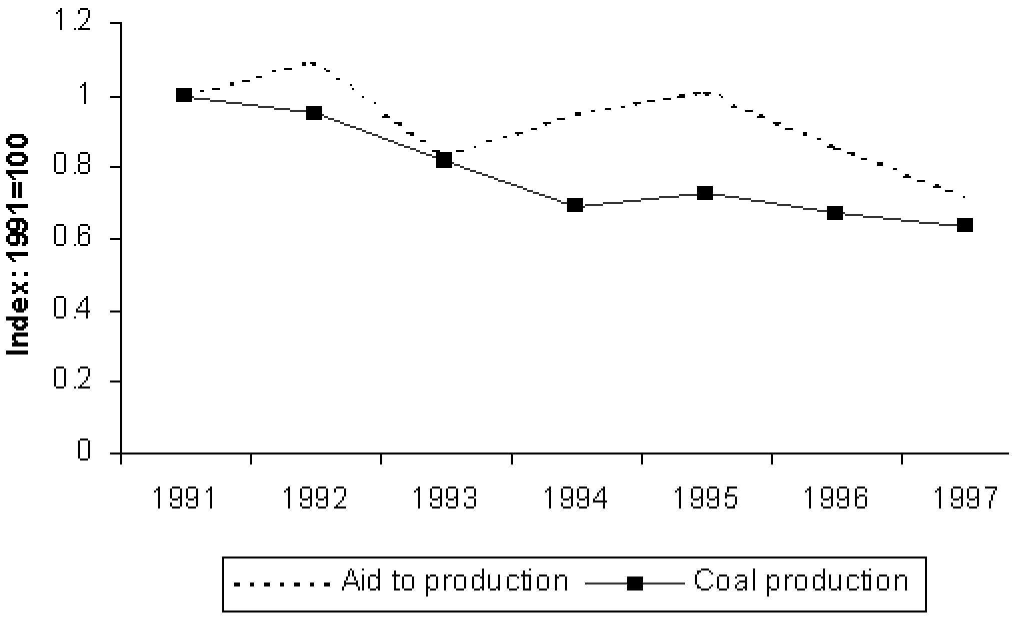
(p) Preliminary data, subject to revision.

(1) Note that loans taken out by Charbonnages de France have increased since 1994, as have production costs.

(2) Aid for the French coal industry has not been authorised by the European Commission for the years 1997 and 1998.

The results of such declining subsidies can be seen directly in the production numbers shown in figure 2 below. Inasmuch as coal has been replaced by other, cleaner fuels, there is a net environmental benefit to such subsidy reform. However, in many countries, the coal that had been produced domestically has been replaced with imported coal – providing little environmental benefit – and perhaps a loss in domestic energy security.

Figure 2: Coal Production and Aid to Production (Subsidies) in selected IEA Countries, 1991–1997 (Index: 1991=100)



Source: IEA

The results of subsidy reform can have significant effects on national – and global – economies as well as the environment. According to the 1999 IEA study, removing subsidies in the energy sector of eight key countries would:

- reduce primary energy consumption in these countries by 13%;
- increase the countries' GDP through higher economic efficiency by almost 1%;
- lower CO2 emissions by 16%; and
- yield domestic environmental benefits, including reduced local air pollution.

Positive effects on a global scale are to be expected. Subsidy removal in all eight countries would cut energy consumption by 3.5% at world level, thus improving world energy intensity significantly.

Notwithstanding these still-large subsidies, the trend is improving. The overall size of subsidies has fallen sharply since the 1980s, mainly due to economic reforms in the former communist bloc. According to the World Bank, subsidies dropped by more than half in the 5 years ending in 1996. Additionally, in most OECD countries, gross energy subsidies are more than offset by taxes. In the four largest European states, for example, revenue from special duties and taxes on sales of oil products alone amount to almost $160 billion. This compares to perhaps $20-30 billion per year of energy subsidies for the OECD as a whole.[20]

3.2 Environmental implications

While subsidies that encourage the production and use of fossil fuels often have detrimental environmental impacts, such generalizations are not always accurate. For example, subsidies that lead to switching from firewood and dung to oil products (such as propane) could greatly reduce indoor air pollution, a particularly acute problem in developing countries. Some countries also promote policies to encourage the use of renewables for environmental and security objectives; for example, Brazil, Denmark and the US all subsidize the production of fuels derived from agricultural feed stocks or biomass with these goals in mind. However, more frequently, consumer subsidies that lower the price of fuels or the cost of using them lead to environmental damages at the local level, including water and air pollution through additional use (and misuse) of energy, particularly fossil fuels.

A number of studies have sought to quantify the effects of subsidies on the environment, including on emissions of conventional pollutants such as SO_2, NO_x, and particulates as well as carbon dioxide. The following table, from Helen Mountford, shows the results of several studies examining the effects of subsidy removal on CO_2:

Table 5: Energy Production Subsidy Removal - Effects on CO_2

	Subsidy or Group of Subsidies Removed	**Decrease in Annual Co2 Emissions Relative to Reference Scenario Resulting from Reforms by 2010**	
Study		**million tonnes**	**% in sector concerned**
DRI (1997)	Coal Producer Subsidy Equivalents (PSE) in Europe and Japan	10 (DRI estimate)>50 (OECD estimate)	1%
Michaelis (1997)	Grants and price supports for coal and nuclear producers in the UK	0 to 40	0-8%
Shelby et al. (1996)	DFI (1993) analysis of US Federal subsidies	40	0.7%
	DJA (1994) analysis of US Federal subsidies	235	4%
Anderson & McKibbin (1997)	Coal subsidies and import restrictions in western Europe and Japan (to 2005)	13 000 (worldwide)	8% (worldwide)

A number of studies have shown the harmful effects of various types of fossil fuel subsidies. For example, according to the OECD, global CO_2 emissions would be reduced by more than 6 percent and real income by 0.1 percent by 2010 if all subsidies on fossil fuels used in industry and the power sector were removed everywhere[21]. The IEA's 1999 study concluded that the removal of consumption subsidies in 8 of the largest non-OECD countries would reduce primary energy use by 13 percent, lower CO_2 emissions by 16 percent, and raise GDP by almost 1 per cent in those countries as a whole. These same subsidy reductions would have global impacts including a reduction in energy consumption by 3.5% and global emissions by 4.6%. Other benefits would accrue from subsidy reduction such as improved international security from reductions in oil imports from unstable parts of the world. The removal of coal subsidies generally yields the biggest environmental benefits.

4. Subsidy Reform and Renewable Energy: Leveling the Playing Field

While subsidies often have detrimental impacts, governments can have a clear and pressing policy goal for which subsidies are an appropriate instrument. The existence of market barriers to the introduction of climate friendly technologies provides an example where subsidies may be justified. Renewable energy sources, which often have high initial (capital) costs and concomitant risks, may be subsidized by governments wishing to encourage investments in new capacity or in research to meet environmental or social goals.

Lowering the unit costs of emerging renewable technologies like solar PV or wind requires experience – which comes from building and operating plants. The time needed to gain this experience may by too long for the market to bear without a degree of government support. The facts bear this out. Few energy technologies have reached maturity without substantial public sector investment.

Identifying a "good" subsidy is essential to the task of reform. Experience shows that good subsidies should be:

- Well targeted so that only a fairly narrow group of consumers or producers are recipients;
- Soundly based, so that incentives to provide the service efficiently are not undermined;
- Practical, so that the financial resources are adequate and the management of the program is feasible and affordable;
- Transparent, so that financial costs and the provisions of the program are clear;
- In effect only for a limited lifetime, (i.e. have a sunset provision) and be predictable so recipients can plan for future phase-down and phase-out;
- Close-to-market (technologies that are "deserving" of subsidies should not be over-subsidized lest the subsidy stifle commercial discipline and competition; the subsidy provided should be only equal to the magnitude of the externality); and
- Competitive, so that subsidies are provided through competitive mechanisms so as to ensure that excess "rents" are dissipated.

Adopting or removing subsidies must take these properties into account. In addition, phasing in reforms can be done over a period of time to reduce the resistance and pain. If new subsidies reduce the economic status of a specific group, compensating measures can be (and may need to be) introduced if such a goal is considered desirable. For example, if subsidies directly supporting energy prices are to be removed, they may be offset by loans for introducing new, energy efficient appliances. Thus, while energy costs rise (and demand falls), the final price to the consumer may stay level – or even decline. Such multi-goal strategies must be developed and implemented – which, in turn, requires that politicians communicate to the public the overall benefits of subsidy reform.

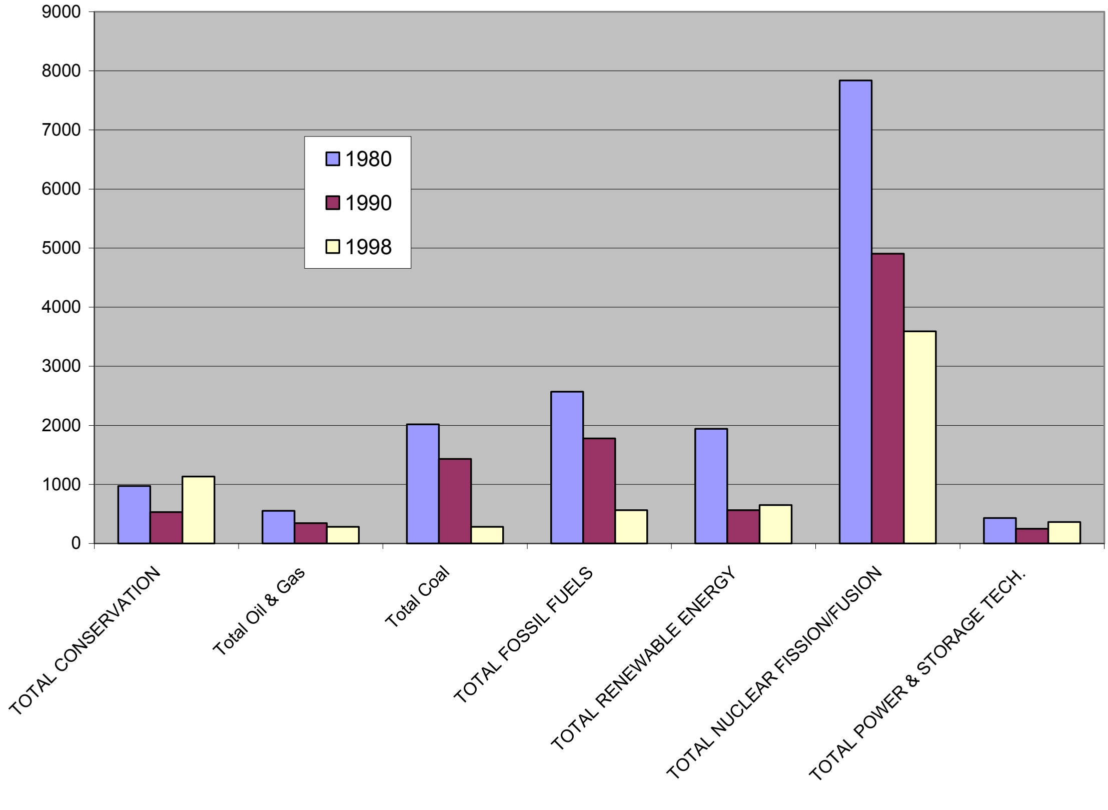
Subsidies for renewable energy may be usefully focused in three areas: (1) reducing technical barriers, (2) overcoming market impediments (including through internalizing externalities); and (3) addressing administrative barriers and social and environmental constraints.

4.1 Actions aimed at technical barriers

The barriers to renewables vary as new technologies move into the market place. In the initial stages of development, technical impediments usually predominate.[22] They can best be addressed through improved, strengthened, and extended international collaboration in R&D in the renewables area.

There is some indication that an increasing emphasis has been placed on R&D in the renewables area. According to the IEA, while the overall levels of energy related R&D have been steadily declining over the past decades (over 50% below 1980 levels in 2000) the support globally for renewable energy has increased slightly over the past decade – which means it has been absorbing an increasing share of the total R&D [23]. However, even with this support, the reduced overall levels of spending have been inadequate to address the serious technical hurdles that remain to competitive pricing in the renewable sector. Figure 4 shows the declining levels of support – as well as the dominant share of the total devoted to nuclear power.

Figure 4: R&D Investment by IEA Member countries, 1980, 1990 and 1998 (Million US$, 2002 prices and exchange rates)



Source: IEA, http://www.iea.org/dbtw-wpd/textbase/stats/rd.asp

4.2 Actions aimed at market impediments: internalizing externalities

The broadest and most economically sound approach to reform markets lies in the "internalizing" of externalities. In short, this means that price signals are provided to value any damages – or conversely, to recognize specific benefits. Such price signals can be explicit (in the form of new taxes, user fees or surcharges), or implicit (e.g. in the form of caps on use). If designed in a sufficiently flexible manner, these tools can allow the market to implement the desired outcomes at the lowest cost.

Perhaps the most promising of these are options that use trading systems, allowing the market to efficiently allocate the costs among energy producers and consumers. Two examples offer insight into this policy choice: the market for renewable energy certificates, and the market for greenhouse gas emissions.

According to the IEA[24], 9 IEA member countries (as well as several US states) have established renewable portfolio standards – which allow for trading of renewable energy certificates (RECs). The initial commitments to renewable energy were established to promote their use in order to decrease dependency on foreign imports, to promote long-term R&D, to reduce greenhouse gas emissions from fossil fuels, and to provide incentives for the development of new, indigenous industry. While the details vary, each of these systems requires a minimum share of electricity to be generated by renewable energy. This obligation, in turn, allows the market to establish a price at which renewable energy would trade – and prompts energy producers to invest accordingly. At present, REC permits trade at different prices in different markets: 500 kWh can be purchased in the US market for $7.50[25] or a much higher range of £45 - £48 per MWh in the UK[26].

A similar system of caps (and subsequent trading) allows for the externality cost of climate to be added into energy prices. With fossil fuels emitting considerable carbon dioxide during the combustion stage, any pricing of carbon raises the price of those fuels relative to non-carbon alternatives. Currently a number of countries, responding to their commitments under the UN Climate Convention's Kyoto Protocol, have developed pilot programs to cap GHG emissions – and the markets have responded with trading and prices for emissions offsets. In 2003, according to information from Natsource, CO2e.com and PointCarbon (three international brokerage firms), the volume of tons trading exceeds 200 million, and the price ranges widely (between $1 and $17). The existence of such prices gives a general sense of the cost to the market of complying with the caps on emissions that have been set to date.

Clearly, while markets are being established in renewable energy, full values of market externalities are not yet assigned. If a technology is to become cost effective, market impediments such as hostile pricing structures often need to be overcome. This can be achieved through the removal of subsidies to competing non-renewable sources and through measurers to ensure full cost pricing among all forms of energy. This will ensure that energy prices reflect their social and environmental costs as well as their short term production costs. Full cost pricing is difficult to achieve because of uncertainties in the magnitude of external costs and the resulting political problems.

In order to take into account the full social, environmental, and economic benefits, the full value price for renewable electricity should be estimated and used. Such estimates can be made only with coordinated research on the full valuation of renewable electricity and through the dissemination of experience with approaches such as net metering and exploring voluntary agreements between regulators and utilities. Opportunities in niche markets world-wide should be published to enhance awareness of them and their attractiveness to investors and consumers. Commercial finance should be harnessed to develop technical standards to increase the confidence of investors and developers. At the same time certified methodologies for assessing resources should be standardized. Provisions should be adopted to support insurance instruments, thereby bringing the renewable industry and the financial community together to develop suitable financing packages.

4.3 Actions aimed at administrative barriers and social and environmental impediments

In addition to economic and technical barriers, reforming the energy sector will require removing system-wide institutional barriers. Renewable energy will only become competitive with larger-scale more traditional energy technologies if:

- Cost-reflective pricing and least-cost planning values and rewards small-scale and modular generation embedded within the distribution system.
- There is a longer-term move toward performance-based regulation – whereby energy suppliers or utilities are (financially or managerially) rewarded for quality of service provided as opposed to quantity of electricity sold, and
- Changes in the analysis of investment risk – whereby reduced fuel risk and lower capital investment risk are considered and incorporated into financial packages for new energy systems.

Development of guidelines on marketing and public education and certification schemes to build credibility will also aid in reducing administrative barriers. Transactions costs may be minimized by establishing regional energy centers allowing for some market aggregation. They may also be reduced through the establishment of effective financial and market intermediaries (such as funds, banks, dealer networks and concessions) that promote capital investment and liquidity. The development of international consensus on the desirability of removing impediments to new entrants to the energy market would provide a further impetus to new investment as well.

Other measures to help renewables include the creation of internationally recognized academic and vocational qualifications in renewable energy technology design, installation, and maintenance. Also desirable would be provision of specialized courses on renewables and a consensus with academic institutions to include a stronger coverage of renewable energy technologies in traditional academic courses.

There is a need to reduce the environmental impacts of renewables. For example, some communities have begun to resist new wind-turbine siting, while others have expressed concern at the potential land use requirements for large scale solar arrays. However, a combination of coordinated research, development and dissemination of results can lead to improvements in public awareness, and planning guidelines can be developed to outline frameworks to take into account the benefits and costs of renewables. In this context there is a need to organize training courses for local authorities to help them identify opportunities for renewables, and to establish technical advisory centers. Incorporating renewables early in the planning processes would also facilitate its use and widespread dissemination: This might be done through the voluntary adoption of planning guidelines calling for assessments of the potential for the use of renewables for every new development. Renewable technologies could be further enhanced if methodologies for cost-benefit analysis were developed and implemented by the power sector, by governments, by funding agencies and by the wider planning community. If such programs and policies are implemented, the learning curves that apply to new technologies suggest that renewable energy could be competitive with existing fossil alternatives within the next 20 to 30 years. However, if such policies are not adopted, the business-as-usual energy scenario, in which fossil fuels continue to supply the vast majority of the world's energy needs and emit concomitant quantities of toxic waste and greenhouse gases – remains the scenario for the future.

5. Recommendations

The following recommendations emerge from this study – as well as from a host of previous analyses and workshops on energy sector reforms (see, for example, IEA/UNEP 2001 or ECE 2001).

- While considerable analysis has been undertaken to date, further work is required to accurately identify, particularly at a local and national level, the environmental externalities related to energy production and use, and to the environmental damage caused; identification of the specific forms for each country will be required to evaluate their importance and to determine whether (and if so how) they might be removed. It is clear that fossil fuels have historically benefited from such subsidies, leading to a distortion in the market.
- Any negative social impact of a given subsidy or tax reform should be identified and measures to alleviate such an impact considered. The most distortional (from the market point of view) and environmentally damaging subsidies and tax provisions should be identified so that they can be abolished first. From an environmental perspective, subsidies to fossil fuels can and should be removed expeditiously;
- To provide for appropriate full life cycle costs, environment-related taxes or charges should be introduced and environmentally harmful energy subsidies removed. Renewable energy subsidies, which meet public goods goals for environment and security, should be adopted;
- Timing matters for subsidy reform; sudden shocks can destabilize economies. Thus, energy price reform should be announced in advance to allow producers and consumers to adapt their behavior accordingly and to create a reliable investment climate, and the relevant legislative and regulatory instruments and institutions should be phased in;
- Transparency of a process improves the final product, and creates political buy-in. Thus public and private stakeholders should be involved and a broad consensus on energy price reform sought;
- Internationally coordinated action can facilitate the process of removing environmentally damaging subsidies. However, unilateral actions may still be appropriate in the absence of international agreements.

While there is generally broad agreement on these principles, it is equally clear that although such policy recommendations have been consistently made for decades, they have yet to be undertaken by the majority of countries.

There are, however, lessons from some successful subsidy reform efforts. In these examples, reforms seem to be linked to other cost-reducing activities. Successes tend to be introduced gradually – allowing changes to take place over a period that does not cause economic dislocation. Often, the decision process has been taken up-front and day-to-day operational decisions are removed from the purview of political winds. Policies that lead to negative impacts are offset with "safety nets" for those affected and there is a conscientious effort made both to assess (in advance) the nature of these impacts, and to inform affected populations of programs to ameliorate their costs. In short, the success stories are available – and indicate that with clear, careful and rational planning reforms are possible.

Thus, perhaps the key issues for consideration at the conference are two-fold: (1) "WHY" such strongly endorsed and broadly agreed changes have not been undertaken, and (2) HOW to improve the likelihood that such measures will be taken in the future. It is clear that success in the area of subsidy reform will generate twin benefits of economic growth and environmental protection described in this short note. If this session of the International Conference for Renewable Energies is able to make progress in understanding barriers and improving commitments to subsidy reform, it will indeed be a success.

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Endnotes:

[1] "Economic costs" here refer only to those used in standard accounting. Thus, in suggesting renewable energy is more expensive, no value is assigned for environmental damages or for fuel security values – both of which might make renewable energy more competitive. In fact, as discussed later in this paper, such economic accounting itself provides a form of "subsidy" to the existing energy regime.

[2] See http://www.wto.org/english/thewto_e/whatis_e/eol/e/wto04/wto4_24.htm#note3

[3] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002

[4] The underlying image is a football or soccer field that is tilted toward one end giving one of the teams an unfair advantage over its opponents. In a similar manner, energy subsidies promote one fuel at the expense of others; in this case, fossil fuels and nuclear power at the expense of renewable energy.

[5] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002, p. 13

[6] Ibid, p. 14

[7] Jamal Saghir, Director Energy and Water, The World Bank, October 2003, The Role of the World Bank Group in Renewable Energy and Energy Efficiency.
See http://www.worldbank.org/energy/pdfs/mso337.pdf

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[10] Catherine Mitchell, see http://www.reeep.org/index.cfm?articleid=35&iid=884

[11] Douglas F. Barnes and Jonathan Halpern, The role of Energy Subsidies, The World Bank, 2000

[12] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002, p.12

[13] Op cit. p.8

[14] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002

[15] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002, p. 11.

[16] B. Larsen and A. Shah, *World Energy Subsidies and Global Carbon Emissions* (World Bank, World Development Report 1992, Background Paper No. 25, Washington, D.C., 1992)

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[19] IEA (1999), *The Role of IEA Governments in Energy: 1999 Review*, OECD/IEA, Paris

[20] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002, p. 12.

[21] "Reforming Energy Subsidies," OECD/IEA, UNEP, 2002, p.16

[22] The following discussion is taken from "Penetration of renewable energy in the electricity sector," OECD, 1998

[23] It might be noted that the share of R&D devoted to nuclear power (both fission and fusion) has absorbed a much larger share of the total R&D budget than any other element of the R&D budget. According to the IEA (http://www.iea.org/dbtw-wpd/textbase/stats/rd.asp), nuclear energy (including both fission and fusion) were given approximately 51% of the more than $90.5 billion devoted to R&D between 1988 and 1998, while fossil fuels were given 13% and renewables only 7%.

[24] See http://www.iea.org/dbtw-wpd/textbase/pamsdb/re_webquery.htm

[25] See http://www.eadenvironmental.com/buy_credits_now/

[26] See http://www.natsource.com/markets/index.asp?s=103

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