UNEP

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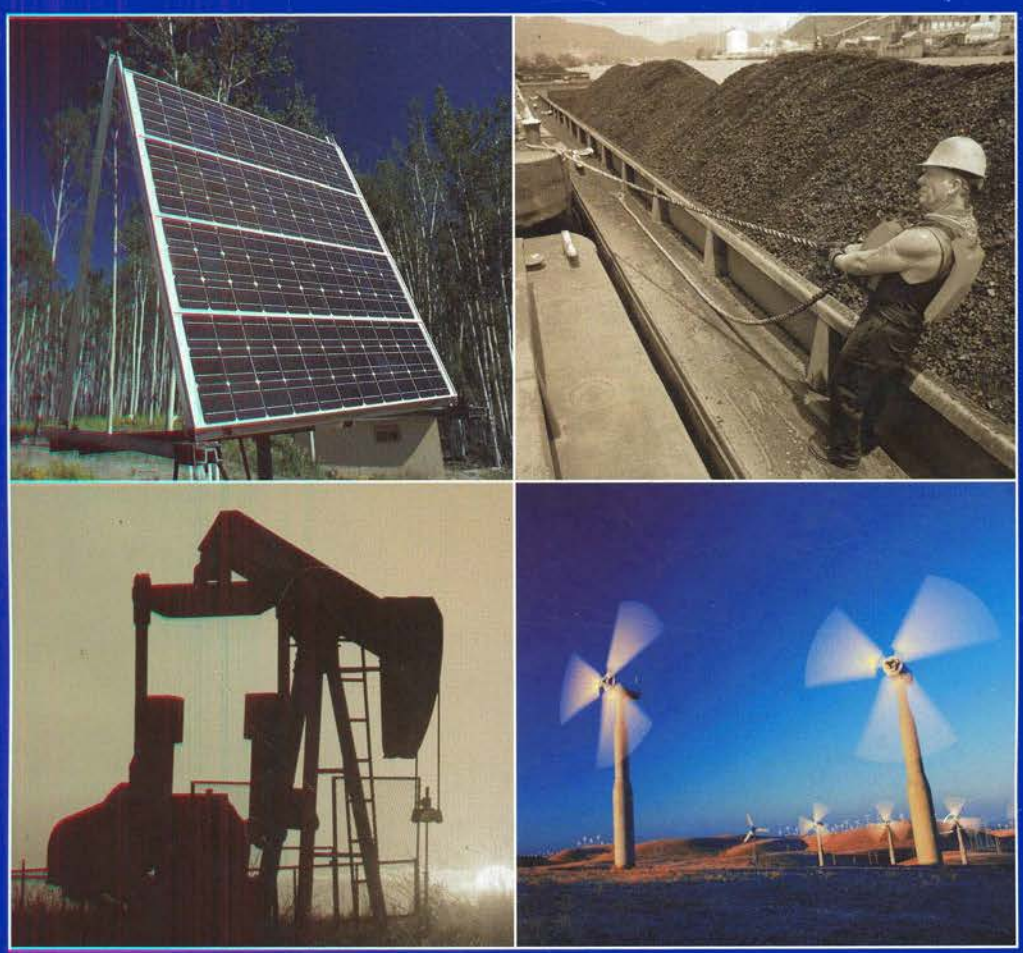
Reforming Energy Subsidies

An explanatory summary of the issues and challenges in removing or modifying subsidies on energy that undermine the pursuit of sustainable development



United Nations Environment Programme
Division of Technology, Industry and Economics

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Foreword

Subsidies on the supply and use of energy have emerged as a major theme in international discussions and negotiations aimed at promoting sustainable development. Energy subsidies matter, both because they are big and because they affect in wide-ranging and diverse ways the economy, social welfare and the environment – the three dimensions of sustainability. Reforming energy subsidies must, therefore, be a central plank of government efforts to promote energy systems that strike a better balance between these three dimensions.

Subsidies that encourage the production and use of fossil fuels are usually bad for the environment. They can also be costly and often bring few benefits to the people for whom they are intended. But subsidies may make sense in some cases, especially where they are aimed at encouraging more sustainable energy use. Examples include temporary support for new renewable and energy-efficient technologies to overcome market barriers, and measures to improve poor or rural households' access to modern, commercial forms of energy. The way in which specific programmes are designed is crucial to their effectiveness.

This booklet draws on recent work on energy-subsidy reform carried out by the United Nations Environment Programme (UNEP) and the International Energy Agency (IEA). It summarizes in non-technical language the central issues related to energy subsidies and key messages for policy makers looking to reform subsidy programmes. By raising awareness of these issues among a wider audience, we hope to contribute to a better understanding of the public policy challenges that lie ahead.

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Introduction

"Subsidies are typically introduced for social reasons, or to help an industry/technology develop, and to protect domestic industries against the loss of international competitiveness. Most of these subsidies are invested in conventional and nuclear energy. Removal of these subsidies would reduce electricity use, encourage equal treatment of renewables vis-à-vis conventional energies, and increase their deployment."

Sir Mark Moody-Stuart, Corrado Clini
Co-chairmen,
G8 Renewables Task Force

UNEP and the IEA conducted a series of regional workshops on energy-subsidy reform and sustainable development in late 2000 and early 2001. The workshops were financed by voluntary contributions from Austria, Canada, Denmark, Germany, The Netherlands, Sweden, Switzerland and the United Kingdom. The primary aims of the workshops, at which the findings of UNEP's and IEA's analyses of energy-subsidy issues were presented, were to:

- further the dialogue between developed and developing countries on the opportunities for, and challenges in, reforming subsidies;
- provide a platform for dialogue at the regional level for representatives of governments, non-governmental organizations and industry to exchange ideas and policy experiences on specific regional issues; and
- review and develop methodologies for identifying and assessing quantitatively the effects of energy subsidies and their reform.

The IEA and UNEP subsequently prepared a synthesis report, *Energy Subsidy Reform and Sustainable Development: Challenges for Policymakers*, setting out the key issues discussed during the workshops and the main findings and conclusions. That report was submitted to the ninth session of the United Nations Commission on Sustainable Development held in New York in April 2001.

This booklet presents in non-technical language the central messages and findings of the synthesis report and the background analytical studies. More detailed information can be found at www.uneptie.org and www.iea.org.

Energy and sustainable development

The term 'sustainable development' has become a guiding principle for public policy. But translating that principle into practical policies and measures can be difficult, not least because of the complex interrelationships that exist between the interests of present and future generations and between the three dimensions of sustainable development – the economy, social welfare and the environment. Energy is implicated deeply in all three dimensions. It is essential for economic and social development, but the current energy system harms the environment in many ways. The manner in which we produce, transport and consume energy is therefore crucial to the long-term sustainability of human development.

Defining sustainable development

What do we mean by sustainable development? There is no consensus on a strict definition. In its broadest sense, it concerns the long-term compatibility of the economic, social and environmental dimensions of human well-being. The 1987 Brundtland Report, which set in motion the process of incorporating sustainability into economic policy-making, defined sustainable development as *'...development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*. More simplistically, it may be seen as development that lasts.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Whatever the precise definition used, bringing about sustainable development must involve the balancing of the interests of current and future generations. The actions of the present generation inevitably affect the assets and resources of future generations. The reckless pursuit of economic growth today might leave our children with a larger inheritance of economic assets, but could seriously deplete environmental resources.

Meeting present needs also involves potential trade-offs in the short term between economic, social and environmental goals. Raising the living standards of the poor may carry significant near-term economic costs and the risk of increased pollution. The fundamental goal of sustainable development, therefore, is the quality of economic growth as well as its quantity.

Energy's role in sustainable development

The way we produce, transport and use energy has important consequences for sustainability. While certain forms of energy supply and consumption can degrade the environment, energy is crucial for economic development.

A lack of access to reliable and affordable energy undermines economic and social development in many parts of the world today.

Energy services help to meet basic human needs such as the production of food, the provision of shelter and access to health services, while contributing to social development by enabling education. A lack of access to reliable and affordable energy undermines economic and social development in many parts of the world today. An estimated two billion people in the world have no access to commercial forms of energy including electricity. This holds back improvements in productivity, quality of life, health and education.

Meanwhile, the consequences of energy production and use around the world are threatening the stability of ecosystems and the health and well-being of current and future generations. Burning fossil fuels causes urban smog and acid rain, while producing them can pollute water supplies. In many towns and cities, local pollution caused by burning oil, gas and coal in houses, factories, cars and power stations is a major human health problem. Concentrations of the main local air pollutants – particulates, sulphur dioxide and nitrogen oxides – in the big cities of many developing countries are well above World Health Organization maximum guideline levels. Acidification of lakes and soils is also a big problem in many parts of the world.

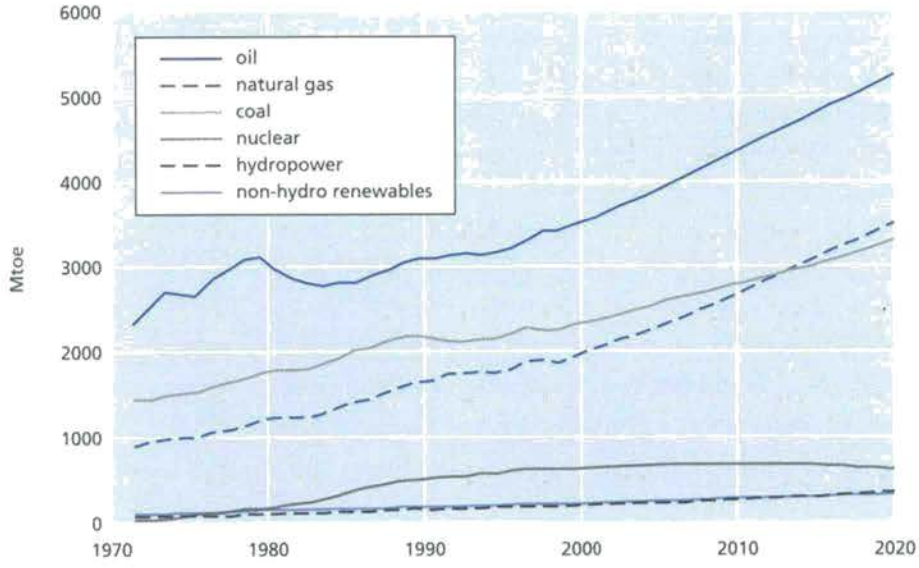
In addition to local and regional pollution, rising fossil-fuel use in all regions carries the long-term risk of disrupting climate as a result of emissions of greenhouse gases that trap heat in the Earth's atmosphere. The Intergovernmental Panel on Climate Change predicts that unless we lower our emissions of these gases, mostly carbon dioxide from energy use, the rise in concentrations will lead to an unprecedented increase in global temperatures of about 1.4–5.8°C by 2100. This is expected to lead to rising sea levels and profound changes in weather patterns.

Environmental problems are not limited to fossil fuels. Nuclear power production gives rise to radioactive waste and the risk of contamination. And the production of certain types of renewable energy can also have severe environmental consequences, such as the ecological effects of hydroelectric dams.

Public policies and the energy sector

Without proactive government policies and measures, the energy sector in most countries will continue to develop in ways that are incompatible with sustainable development. Primary energy use is expected to grow steadily over the next decade or two at least, unless decisive action is taken. The International Energy Agency, in its latest *World Energy Outlook*, projects global energy consumption to expand by more than half over the next twenty years, assuming no new government policies and measures are introduced. Around 90 per cent of the increase in energy needs over this period will be met by fossil fuels (see Figure 1). Most of the incremental demand will occur in developing countries, especially China and India.

Figure 1: World primary energy supply



Source: IEA, *World Energy Outlook 2000*

The 2000 *World Energy Assessment* also forecasts that primary energy use will continue to grow and that the world will rely primarily on fossil fuels for several decades to come.

These trends imply that the availability of energy services to households and productive activities in developing countries will expand, which should help to improve the employment opportunities, living conditions and comfort levels of poor people. But they also imply worsening pollution problems and a big increase in airborne emissions of carbon dioxide. The IEA projects an average annual increase of 2.1 per cent in carbon dioxide emissions through 2020.

Achieving energy sustainability, therefore, requires a radical change in present trends. This can only be achieved, in principle, in one or more of the following ways, where cost and practicality are at odds:

- Increasing the energy efficiency of output so that we produce the same amount of goods and services with less energy.
- Conserving energy. The cleanest way to use energy is not to use it at all.
- Switching from fossil fuels to others that emit little or no noxious and greenhouse gases, such as renewable energy.
- Increasing the capacity of the Earth's forests to absorb carbon.
- Capturing carbon and other substances at the point of combustion before they are emitted into the atmosphere.

Energy sustainability will not happen naturally. Governments, individually and collectively, will need to make it happen through appropriate policies and measures, including a range of regulatory and market-based interventions.

Getting market signals right so that prices better reflect the true costs of producing and consuming energy, taking account of the environmental and social consequences, should be a key guiding principle.

The right approach for each country must take account of local market conditions, the structure of the energy sector, patterns of energy use, institutional characteristics and changing circumstances. But there is a broad consensus on the need for an approach that promotes efficient, competitive energy markets as the foundation upon which government policies should be superimposed. Getting market signals right so that prices better reflect the true costs of producing and consuming energy, taking account of the environmental and social consequences, should be a key guiding principle in all cases. In this way, the economic costs of meeting sustainable development goals will be minimized.

The impact of energy subsidies on sustainability

Energy subsidies have important implications for sustainable development through their effect on the level of energy use and the types of fuels that are used. For example, a producer or consumer subsidy that ultimately lowers the price of a given fuel to end users raises the demand for that fuel and usually the overall use of energy. This can bring social benefits, where access to affordable energy or employment in an indigenous industry is an issue, but may involve economic and environmental costs. Subsidies that encourage the use of fossil fuels inevitably harm the environment through higher emissions of noxious and greenhouse gases, although they may in some cases ease deforestation pressures. Subsidies that promote the use of renewables and energy-efficient technologies may, on the other hand, help reduce emissions, though they may need to be large initially.

What is an energy subsidy?

There is enormous confusion about what is meant by an energy subsidy. The narrowest and perhaps most commonly used definition is a direct cash payment by a government to an energy producer or consumer. But this is just one way in which governments can stimulate the production or use of a particular fuel or form of energy. Broader definitions attempt to capture other types of government interventions that affect prices or costs, either directly or indirectly. For example, a recent OECD study defined a subsidy in general terms as *any measure that keeps prices for consumers below market levels, or for producers above market levels or that reduces costs for consumers and producers.* In a similar way, the IEA defines energy subsidies as *any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers.*

> *An energy subsidy is any government action that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers.*

There are many different types of energy subsidies (see Table 1). Some have a direct effect on price, like grants and tax exemptions, while others act indirectly, such as regulations that skew the market in favour of a particular fuel or government-sponsored technology research and development. How governments choose to go about subsidizing energy depends on a number of factors. These include the overall cost of the programme, the transaction and administration costs, and the impact—financial and otherwise—on different social groups. A simple per-unit cash payment to producers or consumers is the simplest and most transparent form of subsidy, but can involve considerable accounting and transaction costs. It also puts a direct financial burden on the national treasury. Governments like to keep subsidies 'off-budget' for political

reasons; on-budget subsidies are an easy target for pressure groups interested in reducing the overall tax burden. For this reason, subsidies often take the form of price controls that keep set prices below full cost, especially where the energy company is state-owned, or the form of requirements on energy buyers to take minimum volumes from a specific, usually indigenous, supply source. Subsidies may be aimed at producers, such as a grant paid for each unit of production, or to consumers, such as a rebate or exemption on the normal sales tax.

Subsidies to indigenous energy production, usually aimed at protecting jobs, remain common throughout the world. They have, nonetheless, been declining in many countries over the past decade with a shift towards more market-oriented economic and energy policies and liberalization of international trade. Subsidies to coal producers, for example, have fallen sharply in recent years,

Table 1: Types of energy subsidy

Government intervention	Example	How the subsidy usually works		
		lowers cost of production	raises cost of production	lowers price to consumer
Direct financial transfer	Grants to producers	•		
	Grants to consumers			•
	Low-interest or preferential loans to producers	•		
Preferential tax treatment	Rebates or exemptions on royalties, duties, producer levies and tariffs	•		
	Tax credit	•		•
	Accelerated depreciation allowances on energy-supply equipment	•		
Trade restrictions	Quotas, technical restrictions and trade embargoes		•	
Energy-related services provided directly by government at less then full cost	Direct investment in energy infrastructure	•		
	Public research and development	•		
Regulation of the energy sector	Demand guarantees and mandated deployment rates	•	•	
	Price controls		•	•
	Market-access restrictions		•	

although they are still big in several countries, including a handful of OECD countries. On the other hand, subsidies designed to encourage the uptake of renewable energy technologies are growing, driven mainly by environmental and energy-security concerns and, in some cases, by regional employment objectives. For example, several OECD and non-OECD countries subsidize the production of fuels derived from agricultural products.

It is important to make a distinction been gross subsidies and subsidies net of taxes in measuring how big they are and how they affect energy supply and use. Taxes reduce the effect of subsidies on price. In some cases, energy subsidies are more than offset by special taxes and duties that raise the final end-use price to above free market levels. What matters in practice is the overall impact of all subsidies and taxes on the absolute level of prices and costs and the competitiveness of each fuel or technology.

The size of energy subsidies

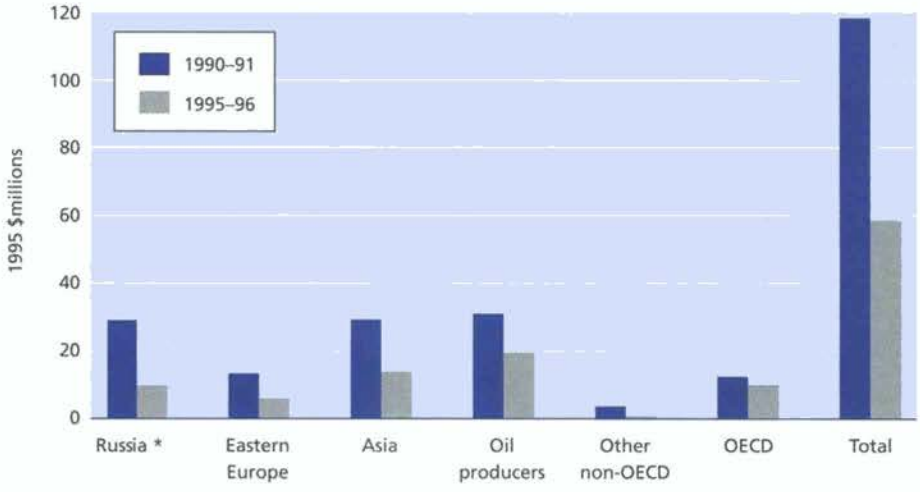
Energy subsidies are widespread, but they vary greatly in importance and type according to the fuel and country. Estimating their size depends heavily on definitions and methodologies. Differences in definitions make comparisons of individual studies of the impact of energy subsidies in specific countries or regions difficult and complicate discussions of issues relating to subsidies and their reform.

Few studies have attempted to quantify subsidies for the world as a whole, because of data deficiencies and the sheer scale of the exercise, and most comprehensive studies are now somewhat dated. The most prominent global study, carried out by the World Bank in 1992, put world fossil-fuel consumption subsidies from under-pricing alone at around $230 billion per year. The Former Soviet Union accounted for around two-thirds of this total and developing countries for most of the rest. An OECD study the same year estimated net global consumption subsidies at $235 billion per year, with $254 billion of net subsidies in non-OECD countries offsetting $19 billion in net energy taxes in the OECD. Other more recent studies confirm that energy subsidies are much bigger in non-OECD countries. In 1997, the World Bank estimated annual fossil-fuel subsidies at $48 billion in twenty of the largest countries outside the OECD and $10 billion in the OECD.

The overall size of energy subsidies has fallen sharply since the 1980s, mainly due to economic reform in the former communist bloc. Subsidies dropped by more than half in the five years to 1996 according to the World Bank (see Figure 2). A 1999 IEA study, which examined eight of the largest non-OECD countries covering almost 60 per cent of total non-OECD energy demand, put the total value of energy subsidies in those countries at around $95 billion in 1998. End-use prices were found to be about one-fifth below market levels in those countries.

The overall size of energy subsidies has fallen sharply since the 1980s mainly due to economic reform in the former communist bloc.

Figure 2: Fossil fuel subsidies in selected countries, 1990–91 and 1995–96



*Estimates for Russia are for 1990 and 1994 in purchasing power parities. Source: World Bank.

In most OECD countries gross energy subsidies are more than offset by taxes. In the four largest European states, for example, revenues from special duties and taxes on sales of oil products (not including value-added taxes) alone amount to almost $160 billion. This compares to perhaps $20–30 billion per year of energy subsidies for the OECD as a whole.

In all regions, the fossil-fuel and nuclear industries get the lion's share of subsidies.

Producer subsidies, usually in the form of direct payments or support for research and development, are most common in OECD countries. By contrast, most subsidies in developing countries and transition economies go to consumers—usually through price controls that hold end-user prices below the full cost of supply. In all regions, the fossil-fuel and nuclear industries get the lion's share of subsidies. In the United States, for example, renewables and energy conservation together receive only 5 per cent of total federal energy subsidies, according to studies carried out by the Government in 1999.

Economic, social and environmental effects

A subsidy by its very nature involves a complex set of changes in economic resource allocation through its effect on costs and/or prices. These shifts inevitably have economic, social and environmental implications. Indeed, the reason any subsidy exists at all is to support some economic, social or environmental goal.

Quantifying these different effects, in terms of costs and benefits, is extremely difficult and judgemental. This is especially true when measuring the social and environmental benefits. But there are many examples from different countries and regions of the high ***economic costs*** associated with energy subsidies. The IEA, for example, estimates the net present value of the loss of economic growth due to consumer energy subsidies in the eight largest non-OECD countries at $257 billion per year using a discount rate of 7 per cent. The overall

social and environmental benefits of those subsidies are unlikely to be higher and could, in any case, be achieved at lower cost in ways that do not involve subsidizing energy.

Depending on the type of subsidy, the loss of economic efficiency is manifested in one or more of the following ways:

- Subsidies to consumption and/or production, by lowering end-use prices, lead to higher energy use and reduced incentives to conserve or use energy more efficiently. An extreme example is the disregard for energy efficiency in housing blocks in Russia and other transition economies during the Soviet era, which resulted from a failure to price heating services properly—in some cases, not at all. The situation has improved in the past decade. In Hungary, for instance, spending on energy efficiency jumped from $5–10 million to $80 million per year after consumer price subsidies were removed in 1997. But subsidies and waste persist in most other transition economies.
- By reducing the price received by producers, a subsidy may undermine energy providers' return on investment and, consequently, their ability and incentive to invest in new infrastructure. As a result, the subsidy may encourage reliance on out-of-date and dirtier technologies. The dire financial straits of energy companies and the resulting under-investment in several developing countries, such as the state electricity boards in India, are largely due to under-pricing.
- Subsidies to producers, by cushioning them from competitive market pressures, tend to reduce incentives to minimize costs, resulting in less efficient plant operation and investments that may otherwise not be economic. Subsidies on coal production in several OECD countries have hampered efforts to improve productivity in past decades.
- Direct subsidies in the form of grants or tax exemptions act as a drain on government finances. For example, the IMF estimates that the Iranian Government's direct spending on energy subsidies amounted to $4 billion in 1997—8 per cent of its budget. Direct subsidies on oil products can lead to acute pressure on the government budget during periods of rising prices. In the long run, indirect subsidies that reduce economic growth also lead to lower tax revenues.
- Price caps or ceilings below market-clearing levels may lead to physical shortages and a need for administratively costly rationing arrangements. This is the case in India, where subsidized oil products are rationed.
- By increasing energy use, consumption subsidies boost demand for imports or reduce the amount of energy available for export. This harms the balance of payments and energy supply security by increasing the country's dependence on imports. The Indonesian Government, for example, estimates that energy subsidies will cost the country $16 billion in lost export earnings over the five years to 2005 if they are left as they are.

Subsidies act as a drain on government finances and reduce the incentive to use energy efficiently.

- Subsidies to specific energy technologies inevitably undermine the development and commercialization of other technologies that might ultimately become more economically and environmentally attractive. In this way, subsidies can 'lock in' technologies to the exclusion of other, more promising ones.

Some of these costs are ultimately borne, at least in part, by the intended beneficiaries of the subsidies as well as the rest of society. And not all of these costs disappear straight away with the removal of subsidies because it can take a long time to replace the stock of energy-supply and combustion equipment.

The ***social implications*** of energy subsidies vary according to the type of subsidy. Subsidies to modern cooking and heating fuels, such as kerosene, LPG and natural gas, as well as electricity are common in developing countries. They are aimed at improving poor households' living conditions by making those fuels more affordable and accessible. Where they result in switching from traditional fuels and improved access to electricity, those subsidies can bring considerable benefits to poor communities. These include less indoor pollution and a reduction in the time women and children spend gathering fuel and, therefore, more time they can spend on productive activities, like farming, and education.

Many energy subsidy programmes intended to boost poor households' purchasing power or rural communities' access to modern energy can, paradoxically, leave the poor worse off.

In reality, however, these subsidies often benefit mainly the energy companies, equipment suppliers and the better-off households, especially in the towns and cities, and, in some cases, may not even reach the poor at all. As a result, many energy-subsidy programmes intended to boost poor households' purchasing power or rural communities' access to modern energy through lower prices can, paradoxically, leave the poor worse off, since the costs are shared by the entire population including the poor. There are three main reasons for this:

- The poorest households may be unable to afford even subsidized energy or may have no physical access to it, for example when a rural community is not connected to the electricity grid.
- Even if the poor are able to benefit from an energy subsidy, the financial value to them may be small since their consumption is generally modest. Higher income households tend to benefit much more in nominal terms since they consume more of the subsidized fuel.
- Consumption subsidies that involve the imposition of caps on prices below market levels may lead to a need for rationing (see Box 1). Middle and higher income households tend to get hold of the bulk of subsidized energy in countries where it is rationed, through petty corruption and favouritism. Price caps, where they have led to big differences in prices with neighbouring countries, have also encouraged smuggling in some parts of Africa and Asia.

Box 1: Case study of LPG subsidies in India

India has subsidized LPG sold in small cylinders along with some other fuels for many years, mainly to make it affordable to low-income households. But those subsidies together with a complex system of price controls on oil products have resulted in large distortions in energy markets. The Government has been forced to ration the supply of subsidized LPG to limit the rising financial cost as demand has increased. At present, subsidized LPG is only available in towns with more than 20,000 inhabitants. Even there, supply falls short of demand. There are 12 million households on the official waiting list for subsidized LPG and a further 30 million households are unofficially waiting to be supplied. The cost of LPG subsidies has still grown from 9 billion rupees in 1991/2 to 26 billion Rupees ($600 million) in 2000/1.

LPG subsidies have benefited almost exclusively better-off households, who generally prefer LPG for cooking and water heating. In Hyderabad, for example, LPG accounts for about 40 per cent of energy use in the richest 10 per cent of households, but only 4 per cent in the poorest 10 per cent. This difference is due not just to the fact that LPG is more affordable for richer households; they also find it easier to obtain the cheaper, rationed fuel. These problems and the high cost of fuel subsidies have prompted the Government to reduce them and phase out the system of oil product price controls. However, the Government plans to maintain a subsidy of 15 per cent on the retail price of LPG, to be funded directly out of the national budget.

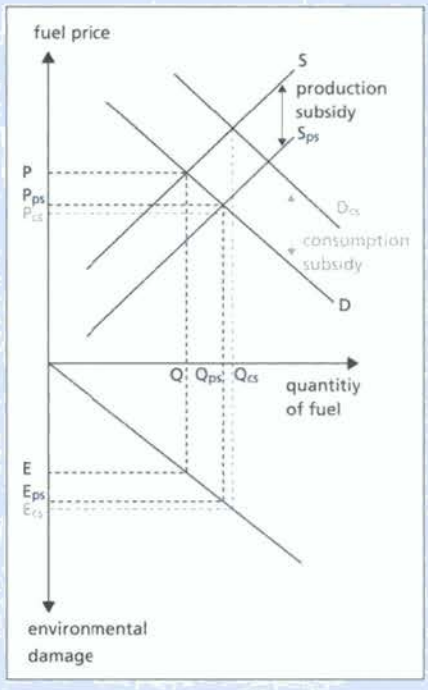
Sources: World Bank/World LP Gas Association; Tata Energy Research Institute

Subsidies can hurt the interests of poor people in other ways too. In practice, energy subsidies often go to large capital-intensive projects, such as hydroelectric dams, at the expense of local, small-scale labour-intensive alternatives, such as biomass burners. The construction of dams usually involves displacing communities, although the improved availability of electric power and water for irrigation can bring important social benefits as well. Subsidies to large-scale thermal power plants, oil refineries and gas-processing plants affect poor households close to those facilities most, since they are usually less able to move to avoid local pollution and safety risks.

The ***environmental effects*** of introducing and maintaining energy subsidies are complex. They can be positive and negative, depending on the precise nature of the subsidy and energy source. Subsidies that encourage the production and use of fossil fuels inevitably have some harmful consequences for the environment. Consumer subsidies that lower the price paid for those fuels or the cost of using them, mean more gets used, which can lead to higher airborne emissions of noxious and/or greenhouse gases (see Box 2). Higher fossil-fuel production can also damage the environment directly, by polluting water supplies and spoiling the landscape. For example, subsidies on biofuels, used by several OECD

Subsidies that encourage the production and use of fossil fuels inevitably have some harmful consequences for the environment.

Box 2: The environmental effects of subsidies



The graph on the left demonstrates how production and consumption subsidies on fuel production can be bad for the environment, assuming that the supply and/or use of the fuel results in some form of air pollution or climate-destabilizing emissions.

The introduction of a per-unit subsidy on fuel production shifts the supply curve down from S to S_{ps}, causing the price to drop to P_{ps} and the quantity of the fuel sold to rise to Q_{ps}. This equates to an increase in environmental damage from E to E_{ps}.

A per-unit consumption subsidy shifts the demand curve up from D to D_{cs}. This results in a drop in the net price paid by consumers to P_{cs}, an increase in the quantity consumed to Q_{cs} and an increase in environmental damage to E_{cs}.

The precise impact of any production or consumption subsidy depends on the shapes of the demand, supply and environmental damage curves. The less sensitive supply and demand are to price, the less impact subsidies have on the environment. Inter-fuel substitution will determine the overall environmental impact of a subsidy on a given fuel, since that subsidy will normally affect the use of other fuels.

countries, usually result in greater use of fertilizers and pesticides, which can damage local ecosystems and cause both soil and water pollution.

A number of studies have demonstrated the harmful effects of various types of fossil-fuel subsidies. A recent study by the OECD, for example, shows that global carbon dioxide emissions would be reduced by more than 6 per cent and real income increased by 0.1 per cent by 2010 if all subsidies on fossil fuels used in industry and the power sector were removed everywhere in the world. The IEA's 1999 study shows that the removal of consumption subsidies in eight of the largest non-OECD countries would reduce primary energy use by 13 per cent, lower carbon dioxide emissions by 16 per cent and raise GDP by almost 1 per cent in those countries as a whole (see Table 2). Because coal is the 'dirtiest fuel', the removal of coal subsidies generally yields the biggest environmental benefits.

Table 2: The impact of the removal of energy consumption subsidies in selected countries

Country	Average rate of subsidy (% of market price)	Annual economic efficiency gain (% of GDP)	Reduction in energy consumption (%)	Reduction in CO_2 emissions
China	10.9	0.4	9.4	13.4
Russia	32.5	1.5	18.0	17.1
India	14.2	0.3	7.2	14.1
Indonesia	27.5	0.2	7.1	11.0
Iran	80.4	2.2	47.5	49.4
South Africa	6.4	0.1	6.3	8.1
Venezuela	57.6	1.2	24.9	26.1
Kazakhstan	18.2	1.0	19.2	22.8
Total Sample	21.1	0.7	12.8	16.0
Total World	n.a.	n.a.	3.5	4.6

Source: International Energy Agency, *World Energy Outlook 2001 Insights*

But the overall impact of fossil-fuel and other energy subsidies on the environment is not always negative. For example, encouraging the use of oil products can reduce deforestation in developing countries as poor rural households switch from firewood. This is a major reason for maintaining subsidies to kerosene and LPG in many cases. Public funding of fossil-fuel research and development can also yield positive environmental effects if it results in the use of more efficient, cleaner-burning technologies in the long term.

And subsidies to indigenous fossil-fuel production do not systematically lead to higher consumption if they result in a switch from imported to indigenously produced fuel on a one-for-one basis. This has been a strong argument to defend coal-production subsidies in Germany and the United Kingdom, because they now cover the difference between actual production costs and import prices and do not involve lower prices and, therefore, higher consumption. Nonetheless, the financial and economic cost of keeping inefficient mines open is very high. Past agreements that mandated the burning of minimum amounts of coal in German power stations undoubtedly held back the use of cleaner fuels such as natural gas.

Subsidies on oil products and electricity in poor countries can also reduce indoor pollution, if they encourage switching away from traditional energy like wood, straw, crop residues and dung. Recent evidence from India suggests that indoor pollution caused by burning these fuels accounts for about half-a-million premature deaths a year in women and children under five years old. Given that India contains about one-quarter of the world's solid fuel cooking stoves, the global impact could be expected to be about four times larger, or about 2 million

Subsidies on oil products and electricity in poor countries can reduce indoor pollution, if they encourage switching away from traditional energy, like wood, straw, crop residues and dung.

premature deaths per year. The World Health Organization has come up with an estimate of 2.5 million by extrapolating industrialized country studies to developing countries.

Subsidies to support renewables and energy-efficient technologies may help to reduce harmful emissions depending on how they are structured and market conditions. If renewables replace fossil fuels and the amount of fossil-fuel-based energy consumed in building the plants and equipment is not too high, then the net effect on emissions will generally be positive—although other environmental or aesthetic effects may be significant. Denmark's long-standing commitment to subsidizing wind, as described in Box 3, is driven by the goal of reducing carbon dioxide emissions through switching from coal.

Most industrialized countries have introduced and increased subsidies to renewables or energy-efficient combustion technologies for environmental and energy-security reasons. These include grants for producing electricity or transport fuels based on renewables and for buying energy-efficient combustion plant and equipment, preferential power tariffs and spending on research and development projects. In some cases, these subsidies need to be big to make those technologies competitive with existing ones based on fossil fuels.

Box 3: Wind energy subsidies in Denmark

Denmark has actively encouraged the growth of electricity production from wind turbines for environmental reasons since the 1980s. Initially, this policy was motivated by local air quality, but reducing carbon dioxide emissions is now the overriding rationale. Capacity now stands at more than 2,300 GW. Production reached 4,442 GWh in 2000, accounting for almost 13 per cent of total power generation in Denmark. The Danish wind-turbine construction industry is the largest in the world, with turnover of more than $800 million. Around 13,000 people are thought to be employed domestically in construction and services related to wind power.

The Government promotes wind power through a combination of voluntary agreements with electricity utilities on building new capacity and subsidies to non-utility generators. The latter take the form of attractive buy-back rates, an obligation on the utilities to pay for the cost of upgrading the transmission network to accommodate wind-capacity additions and tax benefits. Direct grants to turbine owners for each kWh supplied to the grid were available until 1999.

Source: Danish Energy Agency

Designing and reforming energy subsidies

Access to modern forms of energy like electricity is one of several elements that underpin economic and social development and improved living conditions. But protecting the environment and global climate requires that the production, supply and use of energy be as clean and as efficient as possible. In many countries, the removal or reform of energy subsidies – especially those that encourage fossil-fuel consumption – in combination with more rational taxation structures and other policy initiatives could play a significant role in steering their development onto a more sustainable path. Energy-subsidy reform, once the pursuit of finance ministries and trade economists, has become a cause célèbre *of the green movement. However, the rigidity and inertia of many subsidy programmes in practice, along with institutional and political barriers, can make reform difficult.*

Grounds for subsidizing energy

Left to their own devices, free markets in energy services do not always work effectively. In particular, they do not take account of social and environmental benefits and costs that might be associated with certain types of energy activities. Governments intervene in energy markets to achieve social and environmental objectives and to fix any problems in the way those markets operate. In theory, any subsidy can be justified if the gain in social welfare or environmental improvement that it brings about exceeds the net economic cost.

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Energy markets can malfunction in various ways. A market is said to fail when it does not put a price on a public good, that is a good or service which is freely accessible by everyone but which carries no explicit charge. Air is a classic example of a public good, and one that directly concerns energy. Governments have a responsibility to intervene to protect air quality by regulating emissions from energy-related and other activities, since individual polluters would otherwise not pay for the environmental damage. Levying charges on polluting activities is one way of making the polluter pay for that damage – the 'polluter pays principle'. A carbon tax, which has been introduced in a number of industrialized countries, is an example of this approach. Subsidizing less or non-polluting activities can achieve similar end-results.

Social considerations such as concern for the poor, sick or otherwise disadvantaged may also, in principle, provide a reason for subsidizing energy. Society as whole benefits from everyone having access to modern energy, but the market does not reflect that 'social good'. If some people are too poor to afford to pay for that energy, then the market again is failing. Most governments

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consider that access to a reasonably priced minimum supply of modern energy services is socially desirable. Subsidies are often used to that end, although they are not always successful in practice.

The existence of barriers to market entry might also justify subsidizing energy. The high up-front cost of developing cleaner energy technologies and the acute technical and financial risks associated with those new technologies, which might deter investors, is an example. The government can help to compensate for this by subsidizing a particular energy source or technology so as to encourage investment either in new capacity or in research and commercial development. Lowering the unit costs of production of emerging renewable technologies like solar photovoltaics and wind requires experience, which comes from building and operating plants. The time needed to gain this experience may be 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.

So much for the theory. In practice, the reasons politicians give for justifying some kind of energy subsidy include:

- protecting a particular indigenous industry against international competition and promote jobs;
- stimulating regional or rural economic development in the interests of national and social cohesion;
- reducing dependence on imports for energy-security reasons;
- making modern energy services more affordable for specific social groups or rural communities as a way of raising incomes and living standards; and
- protecting the environment.

Subsidy programmes are often meant to support several of these objectives simultaneously. Subsides designed to protect jobs and support regional development, to reduce energy-import dependence and, in some case, to contribute to environmental protection usually involve protection of indigenous energy industries. A good example is the production of biofuels—liquid fuels derived from agricultural and forest products, such as ethanol, methanol, ethyl tertiary butyl ether and rapeseed oil methyl ester. The United States and several countries in Europe provide generous subsidies for biofuel production, primarily to support farmers. Subsidies to nuclear power in several countries in the early days of the industry were largely justified by the need to reduce their dependence on imported energy. But the knock-on benefits for local employment and the environment—as well as for the development of nuclear weapons—also played a part.

In practice, there is a good case for retaining an element of subsidy to improve access to modern energy sources for the poor—especially where the social welfare infrastructure for distributing income support to the poor does not exist.

This argument is particularly strong for electricity, because of the key role it plays in economic and social development, in alleviating poverty and reducing indoor pollution. So subsidies are likely to remain a key part of energy policies that help the poor in developing countries for some time. They should not, however, lead to excessive levels of energy consumption and environmental damage. The other main justification for keeping or introducing certain types of subsidies is to promote the development and use of less environmentally harmful technologies and fuels, like renewables.

Reforming bad energy subsidies

Governments are questioning more and more the validity of certain types of energy subsidies as concerns grow about the environmental consequences of encouraging excessive energy use and the economic cost of subsidy programmes. The overriding objective of subsidy reform, therefore, should normally be to reduce the overall size of subsidies or remove them completely, especially where they are harmful to the environment or impede trade. Subsidy removal, in this case, would be a win-win policy reform. Many fossil-fuel subsidies fall into this category. But, in most instances, governments are faced with awkward trade-offs between the economic, social and environmental effects of reforming those subsidies. Scrapping or modifying a subsidy is clearly justified where the net effect is positive, but assessing the implications of that reform is highly judgemental and political.

How governments go about subsidizing energy is all-important regardless of their objectives. A 'good subsidy' is one that enhances access to modern energy or has a positive impact on the environment, while sustaining incentives for efficient delivery and consumption. There is no single right approach or model. Every country needs to take account of national and local circumstances, including its own set of policy objectives and priorities, its stage of economic development, market and economic conditions, the state of public finances and the institutional framework. But there are a number of basic principles that countries need to apply in designing subsidies and implementing reforms to existing programmes.

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Experience shows that subsidy programmes should be:

- **well-targeted**—subsidies should go only to those who are meant and deserve to receive them;
- **efficient**—subsidies should not undermine incentives for suppliers or consumers to provide or use a service efficiently;
- **soundly based**—subsidy programmes should be justified by a thorough analysis of the associated costs and benefits;
- **practical**—the overall amount of the subsidy should be affordable and the administration of the subsidy programme should be at a reasonable cost;
- **transparent**—information on the amount of government money spent on the subsidy and on subsidy recipients should be disclosed; and

- **limited in time**—sunset clauses should be included in the design of subsidy programmes to avoid consumers and producers becoming overly dependent on this support and costs spiralling out of control.

Targeting subsidies effectively so that their benefits are limited to a clearly defined targeted group should be the first consideration in designing or reforming a subsidy programme.

Targeting subsidies effectively so that their benefits are limited to a clearly defined targeted group should be the first consideration in designing or reforming a subsidy programme. The targeted group would normally be a certain type of producer or category of consumer, for example, the operator of a wind turbine or poor households. In practice, though, subsidies often end up helping other categories of producers or consumers too, resulting in significant economic distortions and costs. For example, higher income households may get to profit from special low rates for electricity supply—lifeline rates—even though the intention may be to relieve the financial burden on poor households. In Chad, for example, this rate was set at 200 kWh per month, which included more than 90 per cent of the population. Better targeting would have directed the subsidy to households with only low consumption or reduced the electricity cost for only the first, small tranche of consumption.

Energy-subsidy programmes should always be designed in a way that does not undermine incentives for producers and suppliers to provide a service efficiently, nor for consumers to use energy efficiently. A key issue for producer subsidies is whether to subsidize capacity or output. The answer depends to some extent on the type of fuel or technology. For example, subsidies to solar photovoltaics and wind power have been effective in boosting capacity in several countries, including Austria, Denmark, Germany, Japan and Sweden. But these subsidies do not always ensure that these systems, once installed, are run optimally. In general, producer subsidies should be based on per unit of output. Fixed, subsidized tariffs for renewables-based power producers may be the best way to encourage both investment and efficient operation. Consumer subsidies, on the other hand, should be large enough to encourage investment in supply infrastructure but not so large that they encourage waste.

Given the very real drawbacks with subsidies, it is essential that a decision to introduce or retain a subsidy be soundly based. In other words, the authorities should present a convincing case for the subsidy based on a thorough and coherent analysis of the associated economic, social and environmental costs and benefits. This has to be an ongoing exercise; a subsidy may make sense today but changing circumstances may mean that it no longer makes sense a year or two later. Carrying out this type of analysis is easier said than done. In reality, it requires reliable data and effective analytical capacity—conditions that are lacking in many instances. Where this is the case, the public authorities and energy-service providers need to carry out detailed market assessments and customer surveys.

Practical considerations may mean that a subsidy that looks good on paper is, in fact, a bad idea. There are two aspects to this. One, the country may simply not be able to afford the subsidy if it involves large financial transfers from the national treasury. Two, it may not be feasible to administer the subsidy in a way that does not involve large administration costs including the resources required to monitor, prevent and deal with abuse. Subsidy programmes involving cash payments to producers or consumers are notoriously expensive to administer, since the authorities need to verify that each recipient is entitled to the money. Cheating can be commonplace. For example, subsidized kerosene and LPG have been diverted to transport uses in several countries, including Ecuador and India, depriving the poor of the fuel and causing safety problems.

Transparency is essential. The financial costs and the channels through which financial transfers are made must be fully transparent, to prevent abuse and enable the authorities and the public to monitor whether the programme should be continued or not. On-budget costs should be properly accounted for and the results made available to the public.

When introducing a subsidy, it often makes sense to establish time limits or 'sunset clauses' right from the outset, especially where the aim is to address a specific market-entry barrier. This ensures that producers and consumers do not get permanently 'hooked' on it and can prevent the financial cost of the programme spiralling out of control. Once a technology or a distribution network is established and economic, the subsidy would normally no longer be needed and ought to be removed. The reintroduction of subsidies on coal in the United Kingdom in 2000, designed to give the mining industry a chance to further improve competitiveness, was accompanied by a commitment to remove them in 2002.

It often makes sense to establish time limits or 'sunset clauses' right from the outset. Once a technology or network is established and economic, the subsidy would normally no longer be required.

The removal or reduction of energy subsidies in the context of a move to more sustainable development policies does not mean the abandonment of social policy goals. In general, they can be achieved more effectively through alternative mechanisms involving direct welfare payments or investment in social services, since the economic efficiency losses and environmental effects are less marked. It is usually better for a government to contribute directly to the cost of building or running a school or hospital than to subsidize the electricity or heating fuels needed to run them.

Dealing with barriers to reform

Even when there is general agreement that the cost of a particular subsidy outweighs its benefits, it can be very difficult to reform the subsidy in the face of hostility from those who benefit from it. By its very nature, the costs of an energy subsidy are usually spread throughout the economy, while its benefits are usually enjoyed by only a small segment of the population—not necessarily the targeted group. Those beneficiaries will always have an interest in defending

that subsidy when their gains exceed their share of the economic or environmental costs. The resistance to cutting subsidies can be strong: plans to raise electricity prices in India in 2000, for instance, led to mass demonstrations and rioting.

The majority of the population, who bear the net cost of the subsidy, are typically less inclined to support political action to remove the subsidy because the cost is likely to be much smaller in per capita terms than the benefit to the recipients. Furthermore, it can be difficult to demonstrate the economic cost of subsidy in terms that the public can understand. Those that want to keep a subsidy often find it much easier to provide concrete examples of their social benefits, for example in terms of jobs supported or financial savings to poor people. The problem is even bigger when the environmental costs of a subsidy are global, as with greenhouse-gas emissions.

Reforming subsidies must take account of these barriers, which help to explain why it is so hard to remove subsidies once they have been introduced and why new subsidies should be considered very cautiously. And that is why, as a rule, a new subsidy should only be approved if the immediate net benefits are demonstratively large and likely to persist for a reasonable length of time after its introduction.

Reforming energy subsidies in practice requires strong political will to take tough decisions that benefit society as a whole.

Reforming energy subsidies in practice requires strong political will to take tough decisions that benefit society as a whole. The following approaches can also help policy makers to overcome resistance:

- Reforms may need to be implemented in a gradual, programmed fashion to alleviate the financial pain of those who stand to lose out. Financial support for coal mining in France, for example, has been gradually reduced under a 20-year programme agreed in 1986.
- If reforming an energy subsidy reduces the purchasing power of a specific social group, the authorities can introduce compensating measures that support their real incomes in more direct and effective ways—if that goal is considered socially desirable. This requires the existence of systems and structures for distributing welfare payments to the needy.
- Politicians need to communicate clearly to the public the overall benefits of subsidy reform to the economy and to society to counter political inertia and opposition. In many countries, the public is becoming familiar with the environmental advantages of renewables and natural gas over coal, making it harder for politicians to maintain support to ailing coal industries.

Lending institutions, aid providers and international organizations have an important role to play in assisting developing countries and transition economies in designing and implementing subsidy reforms through the transfer

of competence and technology and by imposing well-reasoned conditions for lending and development aid. These organizations should, nonetheless, take account of social considerations in formulating their strategies for developing countries and transition economies even if the primary aim should be to eliminate costly and ineffective subsidies. For example, the G-8 Task Force on Renewable Energy, at a Ministerial Meeting in July 2001, committed to help developing countries strengthen institutional capacity and national strategies aimed at removing subsidies on conventional energy and attracting private investment in renewable energy and other clean technologies.

Reforming energy subsidies needs to be part of a broader process of economic and social reform. Economic reform, aimed at restructuring the energy sector and the economy as a whole, should involve placing more emphasis on the market, encouraging private and foreign investment and reorganizing state enterprises. In the long run, competition can help to reduce energy-supply costs and, therefore, prices, which would ultimately help to reduce the need for subsidy. Education and training, health and welfare policies rather than subsidies should be the primary vehicles for addressing social issues.

Reforming energy subsidies needs to be part of a broader process of economic and social reform.

Subsidizing electrification cost-effectively

Despite the considerable progress that has been made over the past few decades in extending power networks, an estimated two billion people in the developing world still do not have access to electricity. This may be an underestimate since 'access' often means simply that electricity is available in a village, not that all households within it are actually connected to the grid. Most people who do not have electricity are located in rural areas and continue to use mainly traditional fuels for their basic energy needs.

Access to electricity services is essential to alleviate dire poverty and improve living standards. Certain energy services can only be provided effectively by electricity. It is the only practical means of running basic domestic appliances, such as telephones, refrigerators and small water pumps. And it provides the best quality and cheapest form of lighting. An electric light bulb gives of much more light and a more regular beam than a kerosene or LPG lamp. Good lighting enables people to extend the day so they can read or study longer, raising educational levels. Access to electricity also boosts economic productivity, by reducing manual labour. It leads to better health, by replacing polluting indoor fuels, by improving hygiene with the use of refrigerators and by making it possible to provide modern health services. It enables doctors and clinics to keep vaccines and medicines refrigerated, so that routine and emergency treatment can be offered locally.

The energy poor certainly want access to electricity services. And, in many cases, the benefits may well exceed the long-term costs involved in providing those services. But the energy poor are often unable to pay for the high up-front costs of connection, which are usually prohibitive when compared to their low initial

consumption levels, or the services are simply not made available to them because of their remoteness from the grid. If the initial investment cost is spread over a longer period, the resulting electricity tariffs may be too high for poor rural households to afford. Usage levels and revenue streams would, therefore, be too low to make that investment profitable for electricity-service providers. In this case, a degree of government subsidy could in principle be justified.

Badly designed programmes can lead to waste and inefficiencies, which can actually impair the ability of electricity companies to extend service.

The case for subsidizing electrification, especially in developing countries, is widely accepted. That is why electricity subsidies make up such a large share of all the energy subsidies still in place today. But the way the public authorities go about subsidizing electrification is crucial in determining how successful these policies are. Badly designed programmes can lead to waste and inefficiencies, which can actually impair the ability of electricity companies to extend service. Where this happens, the poor who are supposed to benefit from the subsidies can actually end up worse off.

The challenge is to ensure that electricity subsidies achieve the objective of promoting access to electricity for the poor in a cost-effective manner while ensuring the financial viability of the electricity-supply industry. In formulating or reforming an electrification-subsidy programme, the key questions that need to be addressed are:

- *Who?* Normally, subsidies ought to be limited to households and farmers that are not already connected to the distribution network. Subsidies to the poorest existing customers may also be justified if their consumption is very small because of high prices and low incomes.
- *What?* For customers without service, it may be reasonable to subsidize the initial cost of access to the service. For example, grants could be made available to cover part or all of the capital cost of connection, paid for out of the central or local government budget. The electricity supplier could also roll part of the cost of connection into monthly charges. This is how Chile has successfully encouraged rural electrification (see Box 4). For both new and existing customers, it may be necessary to subsidize the actual supply of electricity through lifeline rates for poor households.
- *How?* Demand-side subsidies such as those aimed at reducing connection costs often work better than producer subsidies in ensuring that subsidies go to targeted customer groups and in providing incentives for efficient service delivery. However, the management of demand-side subsidy programmes such as the distribution of connection grants can be expensive. In some cases, it may be more practical to provide direct incentives to electricity companies to expand their services to targeted customer groups. Generally, subsidies on providing the service on an ongoing basis should be kept to a minimum to deter consumers from wasting electricity or using it inefficiently.
- *How much?* In principle, subsidies should be large enough to provide an incentive to distributors to extend services to poor households that would

otherwise not receive it without creating unnecessary market distortions. This will depend on local market conditions. Lifeline-rates, if used, should be limited to modest levels of consumption—less than 50 kWh per month in most cases—so that poor households get most or all of the benefit. This way, larger consumers would be obliged to pay the full cost-tariff for the whole of their electricity consumption, denying them any access to subsidized electricity (unless they cheat by signing up for more than one subscription at the same address). If the rate is applied to the first tranche of consumption regardless of capacity with full cost-based rates applied to higher levels of consumption, richer households benefit to the same extent in absolute terms as poor households.

India provides an illustration of how badly designed subsidies can undermine rural electrification. Current electricity tariffs recover less than three-quarters of the full costs of supplying customers on average throughout the country. Above-cost prices for industrial and commercial customers are insufficient to offset

Box 4: Case study of subsidization of rural electrification in Chile

Chile has been highly successful in expanding electricity supplies to remote rural areas through a combination of market liberalization and well-targeted subsidies. In the early 1990s, more than 1 million people—almost half the rural population—still had no access to any source of electricity. A rural electrification programme launched in 1994 managed to increase rural electricity coverage to more than three-quarters of the population by the end of 1999, ahead of target and at a lower cost than originally estimated.

The approach adopted by the government was to turn rural electrification into an attractive business opportunity. Subsidies and the cost of running the programme are delivered through a special central government fund. One-time subsidies are allocated to private electricity companies in a competitive bidding process to cover part of their investment costs in new electrification projects. Bidding rounds are conducted annually. The companies present their projects to the regional governments, which allocate funds to those projects that score best on various objective criteria, including cost-benefit analysis, the share of the investment to be taken by the company and the social impact. Only projects that show a positive social rate of return but a negative private financial return are eligible for subsidies. The programme allows a 10 per cent real rate of return on investment with subsidy. The central government allocates the subsidies to the regions according to the rate of progress in the previous year and the number of households that still lack electricity. Government funding amounted to $112 million from 1995 to 1999, with private investors contributing a further $60 million.

Source: World Bank

subsidies of almost 50 per cent for household around 90 per cent for farmers. In addition, many farmers do not pay at all while continuing to receive service thanks to lobbying of local politicians. Inadequate metering and billing systems and outright theft add to these problems. As a result, the state electricity boards face enormous financial difficulties, which impair their ability to meet government targets for connecting new villages and rural households. The under-recovery of costs reached a massive 272 billion rupees ($6.4 billion) in 1999/2000. Removing cross-subsidies and introducing a lifeline rate for households at about the same level as the average charge at present on just the first 50 kWh of consumption would reduce the overall financial cost of subsidies to 47 billion Rupees ($1.1 billion), according to IEA analysis.

Local circumstances will determine whether it is more economical to extend the existing grid or to develop decentralized production and distribution networks, based on photovoltaic systems or on renewable fuels found locally like wood, wind and hydropower. In Ghana, for example, photovoltaic systems were found to be a cheaper option for providing subsidized electricity services in remote communities with small energy needs. The impact of these programmes on incomes, education and health has been extremely positive (see Box 5).

Box 5: The impact of subsidized rural PV electrification in Ghana

The Ministry of Mines and Energy in Ghana, with financial assistance from the Spanish Government, has embarked on a programme to introduce solar photovoltaic electricity to remote rural communities, which cannot be economically supplied by the national grid. By 2001, more than 2000 systems had been installed providing modest amounts of power on a subsidized fee-for-service basis. The power is used mainly for lighting, television and radios in households, lighting and vaccine refrigeration in health centres, street lighting, charging batteries and powering water pumps.

The programme has had a tremendous impact on the productivity, health and comfort of people in these communities. Incomes have risen by as much as 150 per cent, which has in turn helped people pay for the electricity they use. Educational attainment has improved because teaching and studying are now possible after the sun has gone down. And emergency medical treatment and vaccinations can now be provided locally. The Government is considering ways of extending the programme to more communities.

Source: Ministry of Mines and Energy, Ghana.

Key messages

The UNEP/IEA workshops, on which this publication is based, demonstrated that energy subsidies come in different forms and guises, and that their effects on the economy, society and the environment are wide-ranging and complex. This makes the business of getting rid of subsidies or changing them complicated and politically sensitive. But it is becoming increasingly apparent that many types of energy subsidies today run counter to the goal of sustainable development:

- Subsidies often lead to higher consumption and waste, exacerbating the harmful effects of energy use on the environment.
- They can place a heavy burden on government finances and weaken the potential for economies to grow.
- They can undermine private and public investment in the energy sector, which can impede the expansion of distribution networks and the development of more environmentally benign energy technologies.
- They do not always end up helping the people that need them most.

Once in place, energy subsidies are notoriously difficult to remove. Strong political will in the face of lobbying by special interests is essential. Politicians have to tackle subsidies as part of a package of economic and social reforms aimed at improving the overall performance of the economy and addressing social issues such as health, education and welfare. Reform must be carried out in a gradual, programmed fashion to soften the financial pain of those who stand to lose, give them time to adjust and allow time for alternative policy mechanisms to take effect. Raising public awareness of the benefits of subsidy reform through information campaigns is a vital element of reform programmes. Where subsidies are retained, the authorities must take action to prevent or limit abuse and ensure that subsidies are restricted to targeted categories.

Many countries have already taken great strides in abolishing the most ineffective and costly subsidies or adapting them to changing market conditions and policy goals. Much more needs to be done, especially in developing countries where subsidies are still pervasive. In particular, more effort needs to be made in collecting data and analysing the environmental and social costs and benefits of subsidies, and in devising more effective mechanisms for subsidizing energy where it is justified.

About the UNEP Division of Technology, Industry and Economics

The mission of the UNEP Division of Technology, Industry and Economics is to help decision-makers in government, local authorities, and industry develop and adopt policies and practices that:

- are cleaner and safer;
- make efficient use of natural resources;
- ensure adequate management of chemicals;
- incorporate environmental costs; and
- reduce pollution and risks for humans and the environment.

The UNEP Division of Technology, Industry and Economics (UNEP DTIE), with the Division Office in Paris, is composed of one centre and five branches:

- **The International Environmental Technology Centre (Osaka)**, which promotes the adoption and use of environmentally sound technologies with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.
- **Production and Consumption (Paris)**, which fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.
- **Chemicals (Geneva)**, which promotes sustainable development by catalysing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety worldwide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).
- **Energy and OzonAction (Paris)**, which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/RISØ Collaborating Centre on Energy and Environment supports the work of the Unit.
- **Economics and Trade (Geneva)**, which promotes the use and application of assessment and incentive tools for environmental policy and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.
- **Coordination of Regional Activities Branch**, which coordinates regional delivery of UNEP DTIE's activities and ensures coordination of DTIE's activities funded by the Global Environment Facility (GEF).

UNEP DTIE activities focus on raising awareness, improving the transfer of information, building capacity, fostering technology cooperation, partnerships and transfer, improving understanding of environmental impacts of trade issues, promoting integration of environmental considerations into economic policies, and catalysing global chemical safety.

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About the International Energy Agency

The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the OECD to implement an international energy programme. It carries out a comprehensive programme of energy cooperation among twenty-six of the OECD's thirty Member countries. The existing Member countries of the OECD are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission also takes part in the work of the IEA.

The basic aims of the IEA are to:

- maintain and improve systems for coping with oil supply disruptions;
- promote rational energy policies in a global context through cooperative relations with non-member countries, industry and international organizations;
- operate a permanent information system on the international oil market;
- improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use; and
- assist in the integration of environmental and energy policies.

The Agency celebrated its first quarter century in 1999. Its core missions remain unchanged, but it has extended its activities in many directions. Today the IEA Secretariat:

- has become the authoritative source for energy statistics worldwide;
- publishes the indispensable monthly *Oil Market Report* and the influential biannual *World Energy Outlook;*
- reports regularly on the energy policies of its Member states and those of selected non-Members;
- provides Member countries and the public with a steady stream of information and analysis on the rapidly changing world of energy;
- actively reaches out to non-Member countries whose role in the world economy and world energy markets is rapidly growing;
- plays a leading role in the international effort to combat climate destabilization; and
- stimulates the development and deployment of new energy technologies through a vast network of Implementing Agreements.

The IEA has been mandated by its Member countries to provide analytical work on the energy dimension of climate change and the implications of the United Nations Framework Convention on Climate Change and its Kyoto Protocol on the energy sector. Beyond national policies and measures that help promote lower greenhouse gas emissions from energy and develop climate-friendly technology, the IEA is also working on international cooperation (including the Clean Development Mechanism and Emissions Trading) to help achieve greenhouse gas objectives at lowest possible cost.

The IEA, through its Committee on Non-Member Countries (CNMC), carries out significant work and organizes workshops covering countries outside the OECD. OECD countries rely increasingly on energy supplies from non-OECD sources. It is therefore important for the IEA to maintain close relationships with non-IEA countries to enhance security of supply, advise on energy policy and regulatory reform, and promote energy efficiency and technology.

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