

## OECD ROUND TABLE ON SUSTAINABLE DEVELOPMENT

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Agenda Item 3

### SUSTAINABLE DEVELOPMENT: AN ENERGY PERSPECTIVE

Background Paper

#### *Introduction and Overview*

*Energy is integral to sustainable development.*

1. Energy, including its availability, its cost and its environmental effects, is integral to any discussion of development – and in particular to any discussion of sustainable development.

*While historically the focus in energy policy has been on ensuring adequate supply...*

2. Both historically and in every simulation of the future, economic growth and improved human welfare are predicated on assumptions of adequate supplies of energy. Over the past several decades, issues related to secure, low cost availability of energy (predominantly oil) have dominated the international energy-related discussions in OECD countries. In responding to the oil shocks of the 1970's and 1980's, OECD countries have sought to diversify supply, have invested enormous resources in new energy technologies and efficiency improvements, and have created emergency stockpiles to ensure continuity of supply should international supplies again be disrupted.

*... it is now turning more to energy-related environmental damage.*

3. More recently, while securing a continuous supply of energy at reasonable cost remains a key goal, environmental issues associated with energy have become more central. While some of the energy related environmental impacts are immediate (e.g., local air quality), in other cases (e.g., global climate change), environmental damage is difficult to detect, and may not become apparent for decades – leading to inadequate investment incentives and rendering political decision-making extremely difficult.

*Near term fossil fuel supplies are not limited; such constraints will not drive OECD*

4. Resource limitations are not now thought likely to determine the medium-term pattern of energy use and environmental impact. Proven reserves of fossil fuels are adequate to provide low cost energy well into the 21<sup>st</sup> century. Changes in pursuit of sustainability in energy production and consumption will not arise spontaneously from such constraints, but depend rather on deliberate action to abate

*energy decisions.*

ancillary damage. Ultimately, though, the finite nature of fossil fuel reserves will affect the picture.

*In non-OECD countries, increasing basic energy services is still the highest priority.*

5. While the energy debate within OECD countries has begun to focus on environmental issues, developing countries, which account for a large and rapidly growing share of global energy demand, do not have the same priorities. For most of the world's people, acquiring basic energy services, such as refrigeration, heating and lighting, remains an urgent need. Furthermore, developing countries seldom have adequate financial resources to purchase the most up-to-date, environmentally sound and efficient energy technologies. The net result is both a steadily increasing gap between the "rich and "poor" of the world (both within and between countries), and a deterioration in the quality of the environment.

*Market forces and new technologies are necessary – but not sufficient – components of a solution.*

6. Some components of the solution to these conflicts may be emerging, in particular the advent of new technologies and greater reliance on market forces and new market related instruments as drivers of decision-making. Governments have to combine and supplement these components. Their role includes setting appropriate sustainable development goals, designing the necessary instruments for their realisation, removing distortionary effects (such as price subsidies), ensuring that adequate resources are committed to basic scientific research to underpin new technological developments, and providing information to consumers about the consequences of their decisions. But not all countries will be able to undertake such changes unaided; some, including the poorest, will continue to require financial and technical assistance if they are to make the transition. And even substantial financial aid (for example, towards the high costs of constructing new power generation facilities) will be insufficient to enable countries with economies so underdeveloped that they cannot support economic energy pricing to move toward a more productive and sustainable future.

*Sustainable development is about increasing services – including those provided by energy use – while protecting the environment.*

7. Like other components of economic activity, energy use is not an end in itself, but rather a means to an end. Increasing energy supplies and availability translate into improved welfare through the increased availability of transport, motive power, lighting, heating and cooling. The developed world may be reaching the point at which deterioration in the environment is so serious that increases in the use of energy (particularly fossil energy) are recognised to involve a net welfare loss. But the remaining basic needs of the greater part of mankind mean that we must find ways to continue to expand the provision of the services provided by energy use. This must be done at minimal environmental cost; but the scale of the task is such that sustainability, in the sense of no net worsening of environmental conditions, is not yet within reach.

### ***Future Energy Demand and Supply***

*World energy supply and demand continues to grow rapidly.*

8. According to the International Energy Agency's World Energy Outlook, the world's production and use of energy is continuing to grow at a rapid pace. Total primary energy supply climbed from approximately 2000 million tons of oil equivalent in 1970 to more than 8000 m.t. in 1995 – and is projected to reach over 13000 m.t. in 2020. The vast majority of the supply is composed of fossil fuels, including oil, coal and natural gas. Global energy use in all energy-related services

is increasing: power generation demand has increased five-fold, while demand in the transport sector has more than tripled. Even in the OECD countries, where policies have encouraged increased efficiency, demand in all services except stationary uses (e.g., mainly fossil fuels used for heating in buildings and industrial processes) has grown significantly, with a nearly linear correlation between economic growth and energy demand.

*The OECD share of global energy use remains more than half of global totals, but it is quickly falling.*

9. Countries outside the OECD are becoming increasingly important in the world energy balance. In 1973, OECD countries consumed 66% of the world's total commercial energy supply and 70% of its oil. Today, these shares have dropped to 55% and 56%. They are expected to fall to less than half by 2010. Per capita energy consumption in developing countries is still only one sixth of that in the OECD countries but is expected to rise quickly (although it will be some time before it comes close to OECD levels). As a result, according to the World Energy Outlook, two thirds of the projected increase of world energy demand between now and 2020 will occur in non-OECD countries.

*Many non-OECD countries have urgent needs for more energy.*

10. Nevertheless, differences in terms of energy structure between industrialised and developing countries are still extraordinary. Per capita commercial energy use for industrialised countries is about 10 times higher than in developing countries. 2 billion people still have no or very limited access to commercial energy. For some developing countries, firewood still represents 80% of total household energy consumption. Energy services too are unevenly distributed: per capita electricity consumption in industrialised countries is approximately 7,500 kWh; in developing countries it is closer to 800 kWh, and in least developed countries, it is as low as 80 kWh. Growing pressure on energy, both from the supply and the demand side, is inevitable.

### ***Resource Availability***

*Are there resource constraints?*

11. In light of the large projected increase in demand, the issue of resource availability becomes central to the debate over sustainability: if supplies of conventional fuels "run out" in the near term, no level of use can be considered to be sustainable. The scarcity issue has been at the core of an intense debate from the beginning of the 1970's.

*Not in the near-medium term for oil...*

12. Recent analysis sheds some new light on this question. According to the 1998 World Energy Outlook, conventional crude oil production is likely to peak between 2010 and 2020 (i.e. half the world's conventional crude oil reserves will by then have been consumed). However, with the majority of experts placing the world's ultimately recoverable conventional oil at between 2000 billion and 3000 billion barrels (of which 800 billion barrels have already been produced) production from conventional deposits will almost certainly continue well past 2050. Oil produced from unconventional sources – tar sands, or extra-heavy crude oil; oil synthesised from coal; liquid fuel produced from plant matter – will by then have become an important component of supply. Estimates of the amount of oil that can be ultimately recovered from non-renewable unconventional sources vary from 300 to 2 000 billion barrels.

*...or gas...*

13. Cumulative production of natural gas to date has exhausted less than one-sixth of the 11 500 trillion cubic feet (325 trillion cubic metres) that can be expected to be recovered ultimately from conventional deposits. Assuming consumption increases at an annualised rate of 2.6 per cent (the base case assumption in the 1998 World Energy Outlook), some 41 per cent of natural gas ultimately recoverable from conventional sources will have been produced by the year 2020, suggesting production of half the conventional resource by the year 2030. Substantial untapped reservoirs of unconventional gas are known to exist, but the economics of producing them are not currently favourable. However, as advances in technology push production costs downward, and output from conventional reservoirs peaks, it is likely that supplies from unconventional deposits will begin to displace them.

*...or coal.*

14. The World Energy Outlook also forecasts no supply problems for coal during the first two decades of the next millennium. Beyond 2020 it is difficult to project coal production, as it will depend critically on demand conditions, which will be affected strongly by government policies and the prices of alternative energy sources. Given the abundant and widespread endowment of coal world-wide, lack of economically exploitable resources is not likely to be a constraint on production. Other concerns – notably, coal's high carbon content and CO<sub>2</sub> emissions from its use – may be more important in shaping its future production prospects.

*Fossil fuel constraints will ultimately apply.*

15. In short, for fossil fuels as a whole, the World Energy Outlook projects no fundamental supply problems in the near to medium term. Deliberate intervention in pursuit of sustainable development will be required before the necessary changes are driven by the prospect of resource exhaustion. In the longer term (more than 50 years), fossil fuel resource constraints can be expected to contribute to the drive for alternative energy technologies, such as nuclear power and renewable energy supplies – although action will be necessary much sooner if these are to developed to meet expected demand.

### ***Environmental Impacts***

*Environmental impacts from energy production and use are real.*

16. The environmental consequences of energy production and use already present a more immediate motivation for intervention in pursuit of sustainable development. Extraction technologies (open pit mines for coal, and ocean drilling for oil and gas) pose problems for local fauna and flora. Transport of fuels (from leaking oil tankers and gas pipelines and transport of fissionable uranium) presents environmental, health and security concerns. Combustion of fossil fuels leads to emissions of particulates, sulphur, nitrous oxides and greenhouse gases. Even the use of renewable energy sources is implicated in environmental damage (for example, in the toxics released in the manufacture of solar cells, the “visual pollution” of wind-farms, and the potential hazards to biodiversity of the use of bio-fuels).

*Historically, once countries exceed a certain level of per*

17. Generally speaking, the relation between per capita economic growth and environmental impact may be exemplified as a bell shape curve. As a country develops from a mainly agriculture economy to an industrialised economy its GDP

*capita GDP, improvements in the environment are seen, though energy demand may still rise.*

grows, while simultaneously the use of resources and pollution increases. Most industrialised countries followed the upward path of the bell shape until about 1970 – at which time, for most, the signals of environmental degradation had become highly visible. Meanwhile, the primary societal needs, such as water, food, infrastructure and housing had been met and human, financial and technical resources were available to redesign industrial processes and to clean up some of the most polluted industrial sites. The idea that the developed countries will continue to move downward along the right hand side of the bell shaped curve is based on the hypothesis that a services and information economy will use energy in a more efficient way (*i.e.*, the energy intensity will continue to decline), that a larger share of the economy will be based on services, and that a larger share of economic productivity will be spent on environmental protection. But absolute demand for energy, even in the most highly industrialised countries, continues at present to rise inexorably.

*Developing countries may "leap-frog" the established pattern of development.*

18. The bell shape curve implies that there are opportunities for learning– and suggests that developing countries may "leap-frog" current technology to a more sustainable and environmentally friendly future. History shows that most OECD countries reduced their environmental impacts through structural changes in the economy and through technological innovation. Countries which industrialised later generally reached a much lower peak -- and at a more rapid pace. While these results send a message that long-term sustainability is possible, it remains critical to ensure that newly industrialising and still developing countries do not repeat earlier patterns of energy intensive development.

#### **Potential Solutions**

*While solutions may exist, environmental pollution is likely to increase before declining.*

19. Is there any policy prescription that can be drawn from past experience? The answer is by no means straightforward. Past improvements in local pollution suggest that change is indeed possible. However, the economic levels at which attention began to be paid to making such improvements are still well beyond the reach of most developing countries. Furthermore, population pressures today are more significant, and even small marginal increases in per capita pollution will seriously affect both the local – and increasingly the global – environment. In the near term, environmental damage is likely to increase.

*New technologies and more open markets can be part of the solution if properly developed.*

20. Investments in technology, setting clear goals and promoting open and transparent markets can facilitate the development of solutions. But political and institutional barriers often limit new policies, while the long-term benefits for the environment are often not matched by near-term financial incentives for commercial investment. Common sense suggests that if the costs of achieving "sustainability" are too expensive, such approaches may not be adopted until too late. This is clear in the energy sector where new coal fired power plants (with fifty or more years of expected operating life) continue to be built – in spite of the projected long-term damage from their CO<sub>2</sub> emissions.

*Discount rates militate against*

21. Unfortunately, markets based on commercial considerations and conventional discount rates do not place much value on long-term effects (even if

*action with long-term consequences...*

these may lead to possibly irreversible environmental damage.) There is little, if any, present value to an investment which does not mature for 50 or 100 years. Power plant construction, like other large scale infrastructure changes which have huge energy implications, is subject to such long-term planning and investment horizon constraints.

*...as does political prioritisation.*

22. Not only discount rates set priorities. Benefits which are very difficult to assess (such as many of those related to sustainable development) are unlikely to command political priority. To a certain extent, this explains why local environmental issues are more readily addressed than global ones: local damage can be readily assessed, and remedial action can be measured in terms of a few years rather than decades.

*Impetus for local action may drive global benefits.*

23. There may be some hope for solving global problems by linking them to more local and near-term issues. For example, taking steps to reduce the environmental impact of transport will benefit the world through reduced greenhouse gas emissions – but will also lead to improvements in local air quality, reduced congestion, and reduced urban noise. Such investments can also bring new jobs, and increase overall welfare – criteria for sustainable development.

*As the private sector is likely to remain the most efficient provider of new technology, governments should promote better private sector incentives.*

24. To date, much government policy has relied on regulatory action, picking technology winners, and providing financial assistance to least developed countries to facilitate growth. However, there is an increasing recognition that to generate least-cost, efficient solutions, government's role should be more directed at setting performance goals (as a proxy for establishing environmental "values") and translating them into policy tools compatible with free and open markets. This will encourage the private sector to make the appropriate technology choices and devise specific solutions. New instruments are also likely to play a pivotal role. Governments have begun successfully to establish guidelines to allow for tradable emissions permits, to leverage or buy down investment risk. Governments have also had a longer-term history of success in promoting basic non-commercial research that underpins long-term technology development – although in this area, there has been a steadily declining commitment of resources.

*While financial aid will still play a role, new market instruments could provide substantial increases in financial and technical flows.*

25. While many countries will continue to require direct financial assistance to manage the transition to a sustainable and competitive economy, the existence of new market mechanisms offers considerable scope for increased levels of private capital flow. For example, a fully established tradable permit regime for greenhouse gases among developed and transition countries could stimulate resource transfers of more than \$40 billion. In a global GHG trading system, transfers of more than \$10 billion would be expected to go to developing countries – providing capital and technologies to build more advanced, efficient – and environmentally benign infrastructure, including in the energy sector.

*Questions for Discussion*

26. Against this background, questions for discussion include:
- Are there credible scenarios of the future that do not require continued increases in energy use to propel continued improvements in welfare – and how do we get to such a sustainable path? Is the realistic goal limitation of further environmental degradation or achieving a complete halt?
  - In the absence of an energy-related resource constraint to drive policy making, how will decisions be made to switch from low-cost fossil fuels to higher cost alternatives?
  - Do past experiences with environmental protection in OECD countries offer ideas to promote a more globally sustainable energy future – while keeping current energy supply and cost constraints under control? Do these experiences suggest a way to “tunnel” through the bell curves?
  - What role will the private sector play – and how can governments facilitate more active participation? For private sector action in developing countries, does the magnitude of the required investment create additional burdens, or is it only the risk associated with inadequate market frameworks?

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