

How to Resolve Market Failures – A Sustainable Energy Mix Needs to be Clean,

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Today's society faces, as no generation before it, two main energy related threats: first, to guarantee secure and affordable energy supply and second, to reduce and abolish environmental and climate harms caused by energy consumption. Over 80 per cent of today's primary energy consumption is coming from non-renewable fossil fuels, as coal, oil and gas. If we do not change our behaviour, our future share of fossil fuel resources will remain as high as it is today.

When major oil and gas reserves are located in only a few areas of the world, importing countries become vulnerable to supply disruptions and energy price shocks. Increasing energy prices especially for oil and gas and recent geopolitical events remind us of the essential role affordable energy plays in economic growth and human development, and of the vulnerability of the global energy system to supply disruptions.

Today, the major share of primary energy demand comes from fossil fuels; oil, gas and coal. The main suppliers of oil are the OPEC region, Russia and the USA. If the oil demand continues to grow as fast as in the last decades, the demand for oil will

The current pattern of energy supply carries the threat of severe and irreversible environmental damage – including changes in the global climate.

be higher than the supply 15 years from now (depletion point). The oil price would also rise with increasing demand, and other oil reserves as oil shale or tar sands would be financially attractive to exploit further. Yet, oil

still remains the most scarce fossil resource on earth, followed by gas. The world's largest gas reserves are in Russia, followed by Qatar and Iran. The supply of coal is more widely spread in many countries of the world, the coal reserves will last over 200 years.

Energy forecasts demonstrate that the share of fossil fuel supply will remain high if no policy to

reach a sustainable energy future is formulated. The enormous economic and fuel consumption growth in developing countries, especially China followed by India, is leading to higher energy supply scarcity and energy prices, but also to higher CO₂ emissions. If no sustainable policy is adopted, global energy-related carbon-dioxide (CO₂) emissions will increase by 55% between 2004 and 2030, with developing countries accounting for over three-quarters of the increase in global CO₂ emissions.

Inherent Threat of Irreversible Damage

Reconciling the goals of energy security and environmental protection requires strong and coordinated government action and public support. As a consequence, the decoupling of energy use and economic growth, a diversification of energy supply and the mitigation of climate change causing emissions is more urgent than ever. A future energy system cannot rely on one energy source only, but must be as broad as possible. Energy security means also that energy imports are reduced and diversified from many different supply countries, and that domestic energy sources should be making a major contribution. A sustainable energy future must be CO₂ free, environmental friendly and secure – technology is the key to solve market failures.

A Sustainable Energy Future

Many domestic energy sources are not sustainable as coal emits climate harming carbon-dioxide emissions, and nuclear energy cause high environmental risks. Conventional nuclear energy can therefore only be a technology that bridges the gap between fossil fuel and carbon free technology. Three main pillars contribute to a sustainable energy future:


1. Energy efficiency. Economic growth and energy consumption growth needs to be decoupled. Many developed nations as Europe and Japan have been



Clever and Competitive



- quite successful in this, others can improve (for example, USA) or need to start soon (for example, China and India). Global energy consumption and emissions can be reduced by 24 per cent by 2050 primarily by energy efficiency measures.
2. Increasing the share of renewable energy for electricity production, as alternative fuel and for heating. For electricity production, renewable energy can increase from five to 16 per cent globally; the share of biofuels can also be increased drastically: up to ten per cent globally (IEA (2006)).
 3. Carbon Capture and Sequestration: coal power plants can be made more environmental friendly (“CO₂ low power plant”) by capturing and storing the CO₂ emissions. However, both environmental and financial risks are not sufficiently explored yet. If the technology becomes available in the future, production costs may double (IPCC (2005), IEA (2005)).

The main aim is to make future energy systems sustainable by, on the one hand, increasing energy efficiency and, on the other hand, establishing innovative, carbon free and environmental friendly technologies. In 100 years, the share of renewable energy can increase up to 80 per cent. In the meantime, carbon capture and storage technology can play a dominant role. 

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