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Geneva Declaration – Call for Action

Challenges

Meeting the world's growing demand in energy services and at the same time addressing serious concerns about greenhouse gas contributions to climate change are enormous challenges today. The growing world population – UN estimates are 9 billion people in 2050, growing economies in developing countries, particularly China and India, and improvements in the standard of living around the globe will lead to an increase in energy consumption by about 40% as expected by the IEA current policy scenario. With fossil fuels continuing to be the main energy source, without carbon capture and storage the Intergovernmental Panel on Climate Change (IPCC) suggested target to limit global warming to +2-degree C will be missed. Moreover, climate change has occurred and will continue to occur for decades, even if GHG emissions are reduced, and engineered facilities need to be functional and safe in the environments resulting from climate change.

There can be enough energy

The total energy from various sources around the globe might be sufficient to meet the needs of the population in the current century. Alternative renewable energy is abundant and by far exceeds the global energy consumption. However, alternative sources are either very low density requiring extensive collection systems or associated technologies that still require development to demonstrate feasibility. Today, oil, gas and coal provide 80% of our energy requirement, while most of the remainder is supplied by biomass, nuclear and hydro power. Renewable energy is still a minor contributor to the total energy mix.

Some of the technologies needed are not yet economically viable. In particular we have not yet learned to harness the abundant solar energy at a competitive cost, although costs are coming down fast. In addition, building the necessary infrastructure to bring large scale renewable electricity from places with high yields (areas with high insolation or strong winds) to the places with high consumption requires huge investments and long lead times, as well as development of mechanisms to encourage infrastructure investment.

In addition to an increased share of renewable energy in the world's energy mix, energy efficiency measures will help reduce the energy intensity of national economies and, therefore, slow down the increase of primary energy demand.

Available knowledge and technologies

The use of fossil energy accounts for most of the global CO_2 emissions. According to IEA's 450 ppm scenario, a mix of low-carbon options is available to limit greenhouse gas emissions from the energy sector. End-use efficiency, power-plant efficiency, biomass, biofuels, nuclear and carbon capture and storage need to contribute. While hydro and wind power are suited to be deployed for the long term, current nuclear technologies need to serve as a stopgap solution and, for large scale use in the future, they have to be made inherently safe.

Renewable technologies – hydro, wind, biomass, geothermal, solar thermal, solar photovoltaic and ambient heat - have experienced a tremendous technical and economical progress over the past decades. Energy storage technologies – e.g. pumped hydro and compressed air storage, batteries for transportation – are key to the management of intermittent renewable energy sources. The latter are either mature technologies or are making big strides, while geothermal power ("hot dry rock") still awaits the "proof of concept". Carbon capture and storage (CCS) is being developed and demonstrated at large scale. Today, wind and concentrated solar thermal power are close to being cost competitive in developed countries or in regions where other energy sources are in short supply.

For transportation, extensive effort is going into the development of biofuels and electrical vehicle drive chains and battery storage. The impacts of large scale usage of electric vehicles and the need for "charging stations" on electricity networks through "smart grid" developments is also being actively pursued. Huge efforts go into the development of biofuels for transportation and electrical vehicles. Thus, the technologies needed for a low-carbon economy are being made available, or expected to be competitive soon if external costs are to be taken into consideration.

Research is needed to define the extreme loadings for which engineered facilities should be designed, operated and maintained. Historical records, which have been the bases for engineering decisions, can no longer be considered to define the environments our facilities will face in the future.

Investing in our future

Investing in renewable technology means high “first costs” and low “fuel costs”. Thus, the transformation from today’s energy mix into a low-carbon energy system requires a substantial increase in investments into infrastructure such as power generation equipment, new grid capacity, new transportation infrastructure and new vehicles. The estimate by World Energy Outlook (IEA) is an additional investment of USD 9.3 trillion (9.3×10^{12}) for the 450ppm scenario as compared to the reference scenario.

According to the European Commission, approximately € 1 trillion (1×10^{12}) need to be invested starting soon in energy infrastructure until 2020 to secure the supply of oil, gas and electricity in Europe for achieving the 20-20-20 target by 2020, i.e. a renewable share of 20% in the energy mix, 20% energy reduction by efficiency measures and a 20% reduction of greenhouse gases compared to 1990. Further investments will be needed to meet the yearly per capita goal of 2 tons of CO_2 per person by 2050.

Besides financial resources, well trained, creative and highly motivated engineers are a pre-requisite for the successful development of the sustainable technologies needed and their implementation. The role of engineers in attaining energy security has to be emphasized.

We can do it – let’s do it!

To achieve the goals suggested by IPCC, the entire energy cycle – generation, transmission, distribution, and use – has to be considered, as well as the sustainable primary energy sources, renewable sources, efficiency in use and transmission, and environmental and economic consequences ought to be included. The solutions are necessarily customized for each region. Sustainable models for power interconnection of countries in a given region to complement their energy supplies will have to be pursued and implemented.

Sustainable primary energy is well distributed and available in sufficient quantities in many places. Hence, transforming the energy system at regional, national and international levels will require both autonomous and cooperative action with the aim to minimise impacts on natural competitive advantages.

Regions showing high per-capita CO_2 emissions are encouraged to start the transformation towards a more sustainable energy mix by identifying their specific way of achieving this transformation at lowest cost and impact to their economy and global competitiveness. Change and providing the incentives to invest and minimise the impacts on consumer budgets are manly a political decision.

Conclusions

1. To guarantee a good quality of life for everyone, all available energy sources must be considered. Greater energy efficiency will slow down growth in energy demand but will entail costs that are not necessarily negligible.
2. The use of any given technology requires a thorough analysis of the technological, economical, and environmental feasibility of implementing scientifically sound and efficiently engineered solutions.
3. The technologies we need to supply energy for substantially improving global quality of life are available or at an advanced stage of development or are currently being demonstrated. The goal is to secure a low-carbon energy supply. If the +2-degree C target is to be met, it is important that GHG emissions – and CO_2 emissions in particular – be drastically reduced during the production and consumption of different forms of energy.
4. Switching to a low-carbon economy will take substantial investment and time. In the transport sector, modifying unsustainable energy consumption patterns will necessitate difficult social adjustments.