Global Sustainable Energy Vision 2050

The Global Vision

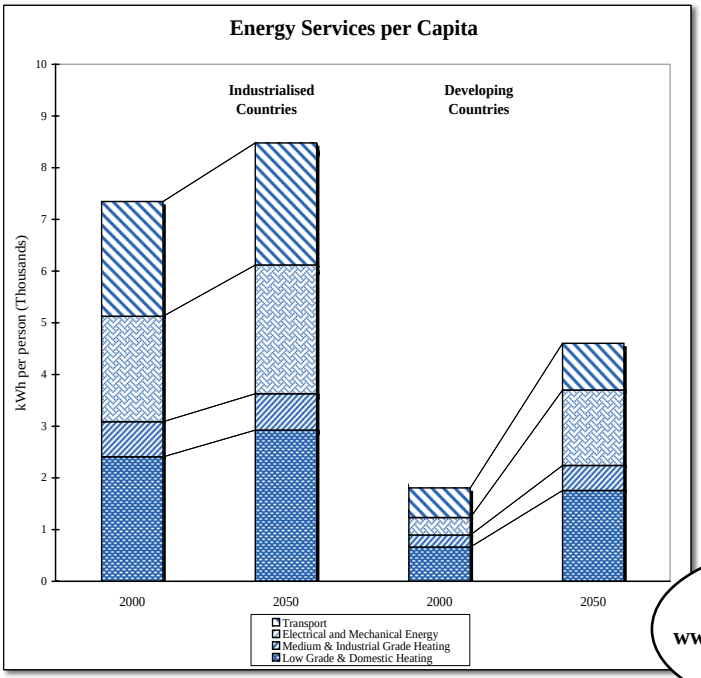
It is crucial that the world's energy systems be made environmentally benign and sufficient to meet everybody's energy needs within a few decades. This is the best answer to the need to reduce man-made climate change to acceptable levels and to solve the energy-supply crisis. We have better technologies than ever to realise such a vision by more energy efficiency and by sustainable use of renewable energy.

From independent researchers proposals exist for fast CO_2 reductions, based on use of existing technologies for energy efficiency and renewable energy. Based on such studies and proposals from the INFORSE network, INFORSE proposes a path to supply the world with 100% renewable energy by 2050, and accordingly, to 100% reduction of energy-related CO_2 emissions.

The massive introduction of new, efficient technologies will lead to huge reductions of costs for those new technologies as they become mass products. The investments necessary for the introduction of sustainable technologies will be paid back with the availability of a cheaper technologies in the future. Initially, there is an urgent need for large-scale shifts in energy investments towards production of renewable-energy and energy-efficiency equipment, including local production of simple renewable-energy equipment in developing countries.

A global shift towards a sustainable energy system is possible within a period of about 50 years. The changes will have a number of beneficial effects: e.g., they will yield a more stable energy supply and they are compatible with global equity. In addition, marginal costs to society will be small, and may even be negative, if the changes are well planned and phased in as part of the natural change of plants and equipment. These changes will require initial investments as well as long-term strategies. They will also require a major shift in energy supply systems along with optimisation of energy-consuming equipment. All of this requires political will.

INFORSE's vision 2050 is based on a global renewable-energy scenario that would satisfy the energy demands of more than 9 billion people with efficiently used renewable energy. For a number of European countries as well as for the EU, INFORSE and its members have developed visions with detailed descriptions of possible future energy balances decade by decade until 2050.

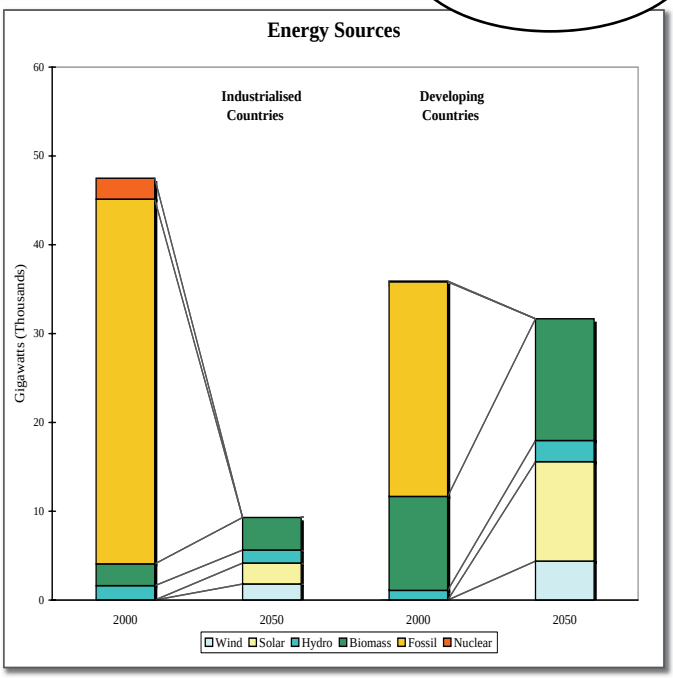


By Gunnar Boye Olesen, INFORSE/ OVE, Denmark

Readmore about the Vision at www.inforse.org/europe/Vision2050.htm

Graph (top): "Energy services", the benefits of energy use, will grow in both North and South according to the sustainable energy vision; but mostly in the South, where these services are expected to increase 2.5 times per capita as the number of people grows.

Graph (to the right): With the proposed strong increase in energy efficiency, primary energy consumption will decrease substantially, particularly in the North.



Phase out Nuclear Power

Nuclear power is marketed as clean, but it is not a sustainable form of energy. Pollution and contamination from uranium mining, along with safety problems, inherent problems of final waste transport and storage, and increased terrorism risks are just some of the problems that make nuclear power unsustainable. Further, the production of nuclear power does generate greenhouse-gas emissions. Properly managed mining and processing of fuel results in CO_2 emissions comparable to those of the best gas-fired power stations.

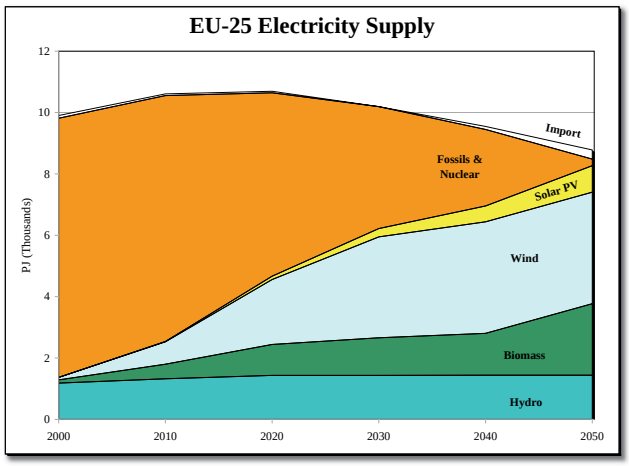
Nuclear fusion (hydrogen to helium) likewise is not sustainable It will not produce any practical amounts of energy before 2050, making it too late for the transition. The technology also has problems with radioactivity and waste.

The sustainable energy vision includes that nuclear power be phased out as soon as practical possible; that no new nuclear power plants be built; and that the existing ones have no lifetime extensions.

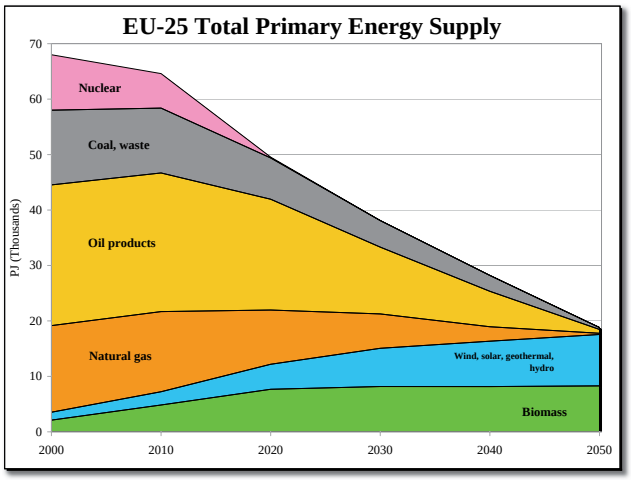
No Need for All Sources

The research that goes into INFORSE visions, along with a number of other strategies and studies, clearly shows that with sufficient use of energy efficiency, there will be no need to maintain unsustainable energy resources such as nuclear, coal or other fossil fuels. Similarly, there will be no need to develop polluting, unconventional fossil-fuel resources such as tar sands.

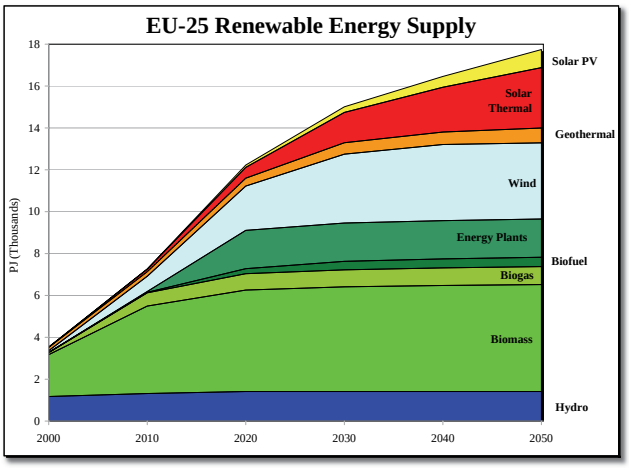
A Vision for EU - INFORSE's vision for the EU includes a transition of energy supply and demand for the 25 EU countries with phase-out of fossil and nuclear energy over a 50-year period. In line with the global vision, the European Vision is based on rapid growth of energy efficiency to reach an average level in 2050 similar to best available technologies today. Most energy-consuming equipment will be changed several times between now and 2050. If new generations of equipment are constructed for optimal energy performance, and if markets are compelled to promote the most efficient technology, it will not be a problem to reach the efficiency level of today's best available technology. Currently, that would yield efficiency gains of roughly 4 times, similar to an annual increase of efficiency of 3.3% per year in average from 2010. The "natural" technological development has managed efficiency increases of only about 1% per year. Realising this potentially very productive aspect of the vision will require more attention, political will, and concerted action from the stakeholders involved.



Graph: Development of EU-25 electricity production and sources, following Vision2050



Graph: EU-25 change of Energy Supply, following Vision2050



Graph: EU-25 Renewable Energy Growth, Following Vision2050

The Challenge of Reducing Heat Consumption

Most of the houses to be heated in 2050 are probably already built, and thus the increase in energy efficiency cannot be expected to be as fast as for equipment. For the 15 "old" EU countries, the target heat consumption is 60 kWh/m^2 in average. This will require about a 57% reduction compared with year 2000. This significant reduction is possible if energy-efficiency measures are included in adaptations and renovations, and if most new houses after 2015 are built as passive houses . The increase in efficiency is estimated to be 2%/year from 2010, but only 5% in total for 2000-2010. For the new EU countries, an increase in efficiency of 57% is also expected for space heating, though with a higher level of specific heat demand.

Efficient Transport

For transport, it is assumed that the conversion efficiency from fuel to transport-work is increased 2.5 times from the current 15- 20% in combustion-engine systems to 50% in fuel cell systems. Directly electrically driven vehicles have even higher efficiency. It is assumed as well that the vehicles will be equipped with recoverage of break-energy, reducing "end-use" of energy in transport to just the unavoidable friction losses in transport, except for aviation. Given these assumptions, total efficiency becomes about 4 times today's average. For rail and navigation, the vision assumes "only" efficiency gains of 40% and 25%, respectively.

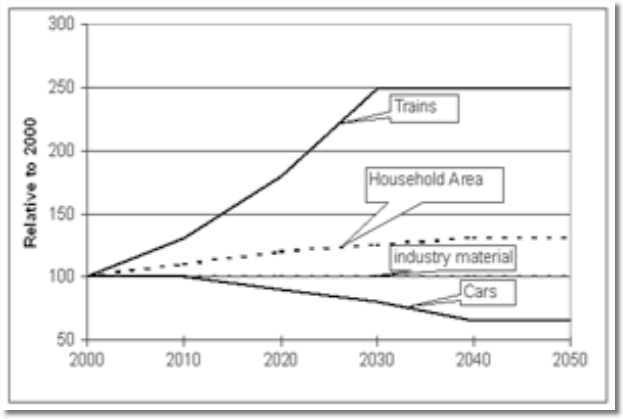
Decoupling Growth

The growth of energy services, i.e., of heated floor space, of transported goods and people, and of energy-consuming production, is expected to plateau during the 50-year period of the vision. This assumes that the average Western European has reached a sufficient level of material consumption to satisfy needs, and that material growth should ease out to leave environmental space for the poorer parts of the world. If such a change in consumer behaviour is to be realised, it will require that the growth of energy services be decoupled from economic growth. Economists typically use a normal economic growth rate of 2.5% for Western Europe. Given that assumption, the challenge for realisation of this vision is almost to triple the economic value expressed as GDP compared with energy services. It is important that economic growth be used to increase energy efficiency, to reduce structural transport, to increase local production, and to increase quality of products rather than quantity. For the transport sector, a modal shift from road to rail transport results in less road transport after 2030 than today in the "old" EU-15.

Renewable Energy

The vision supports the EU target of 12% renewable energy in 2010 as well as the target proposed by a large number of NGOs of 25% renewable energy in 2020. The vision projects shares of renewable energy in 2030 and 2050, respectively, of 40% and of more than 95%. The renewable energy proposal is divided into proposals that address individual renewable energy sources:

- *Windpower.* Strong development is projected, such that by 2020 the EU has 220,000 MW of windpower, compared with 40,000 MW at the beginning of 2006, and 340,000 MW projected for 2030.



Graph: Development of selected activities 2000 - 2050 for EU-15, Vision2050 Higher growth is expected of the 10 "new" EU countries than of the EU-15, mainly in the service sector and in road transport.

(Continued from page 5)

- *Solar energy:* Use is expected to grow to 1,6 m^2/person by 2020 and to 8 m2/person by 2050, with solar heating being the most important for the first decades and solar electricity, including PV, gradually taking over. This will require a strengthening of current development.
- *Solid biomass:* Use by the EU-15, apart from energy crops, is expected to grow to about 3,700 PJ by 2010. This represents 90% of the sustainable potential, a doubling from 2000. Current trends are well below that target; but are increasing. After 2010 it is expected than biomass use will grow to its sustainability limit, about 5,100 PJ for the entire EU.
- *Biogas:* The full potential, 850 PJ, should be reached by 2020.
- *Energy crops:* Energy forest is projected to expand to cover 7% of present agricultural land by 2020.
- *Other renewables*, such as small hydro-power, geothermal energy, and liquid biofuels also play increasing roles in the energy mix.

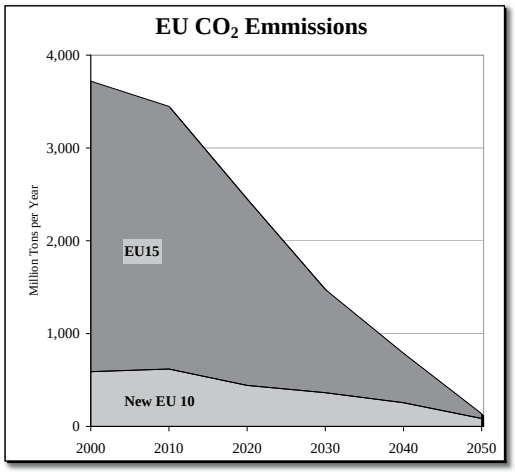
How Fast Can We Change?

Introduction of renewable energy can be very fast, as examples from a number of European countries show. In Denmark windpower covered less than 4% of electricity supply in 1996; but this rapidly changed in the next four years to cover more than 12% by 2000. In Germany, a country 16 times as large as Denmark, windpower increased its share of electricity supply from 1% in 1999 to about 4.5% in 2005. There are a number of other examples of fast increases in renewable-energy use, such as Swedish biomass electricity production, which grew from 1.5% to almost 4% of electricity production between 1995 and 2003; and the growth of geothermal electricity production in Iceland from 6% to 17% of electricity production during the period from 1990 to 1995. With successes like these replicated in other countries and in other sectors, the renewables part of the vision can be realised.

Increases in energy efficiency can be fast as well, although they tend to be less visible than renewable-energy successes. During the 1990's, white goods in Danish households increased efficiency by 3%/year. Improvements like this will realise the vision's "factor four" increase in energy efficiency by 2050.

In short, there is good empirical evidence that the increases in energy efficiency and renewable energy needed for the visions are possible, having been achieved already in some sectors of some countries.

More information on the visions can be found at http://www.inforse.org/europe/Vision2050.htm, where visitors can also download or order the series of posters about them.



Graph: EU-25 phase out of CO_2 emissions
The reduction of CO_2 from energy use is expected to follow the 8% reduction target for 2010, followed by a 35% reduction by 2020, 50% reduction by 2030, and more than 95% by 2050.

Nuclear and Fossil Energy

Nuclear energy is expected to be phased out as the current nuclear reactors are stopped because of age, safety problems, etc. This is expected to be complete by 2020. For fossil fuels, expectations are a gradual phase-out of coal use, a slow but increasing phase-out of oil use until 2050, and growing gas consumption until 2010, followed by phase-out until 2050.

Nuclear or Sustainable Energy – Outlooks for Lithuania

While the Lithuanian power company promotes new nuclear power, INFORSE-Europe is developing a vision for a fossil- and nuclear free Lithuania. Lithuania relies on gas imports, and the closure of the Ignalina nuclear power plant will increase this dependency. Lithuania has increased its energy independence somewhat, however, with a transition to biomass heating, in particular in district heating. The new vision proposes that this development continue, with biomass-based combined heat and power plants (CHP) for larger towns in Lithuania. To provide enough biomass, it is proposed that 7% of agricultural land be dedicated to energy plantations. The vision also includes leveling off of the current very strong increase in road transport and concurrent strong growth in rail transport. Even with this reduced growth, however, in 2030, road- and freight car transport will be 3.1 times and twice, respectively, of the year-2000 levels. Other trends in the vision for Lithuania follow the vision for the EU, including strong development of windpower 2010 - 2020.

The Lithuanian vision results in a gradual reduction of fossil-fuel imports starting in 2010. Thus, 2020 imports are reduced to 60% of the 2000 level, while the CO_2 emissions are gradually reduced to zero by 2050.

Fast Transition Proposed for Denmark

Danish INFORSE members favour a fast transition to sustainable energy, resulting in an almost full transition to renewable energy within 25 years, i.e., by 2030. Thus, INFORSE-Europe has developed a vision for a transition to sustainable energy by 2030. The energy-efficiency scenario includes the vision made by the Danish construction sector of a 20-year 50% reduction in building-energy use. The component addressing renewable energy combines strong development of windpower with the trends from INFORSE-Europe's vision for EU, and with a small share of electricity covered by wave-power in 2030. The vision also includes a transition to sustainable transport and development of a flexible energy system with storage capabilities for heat and electricity from 2020 onward.