FULL SOLAR SUPPLY OF INDUSTRIALIZED COUNTRIES - THE EXAMPLE JAPAN

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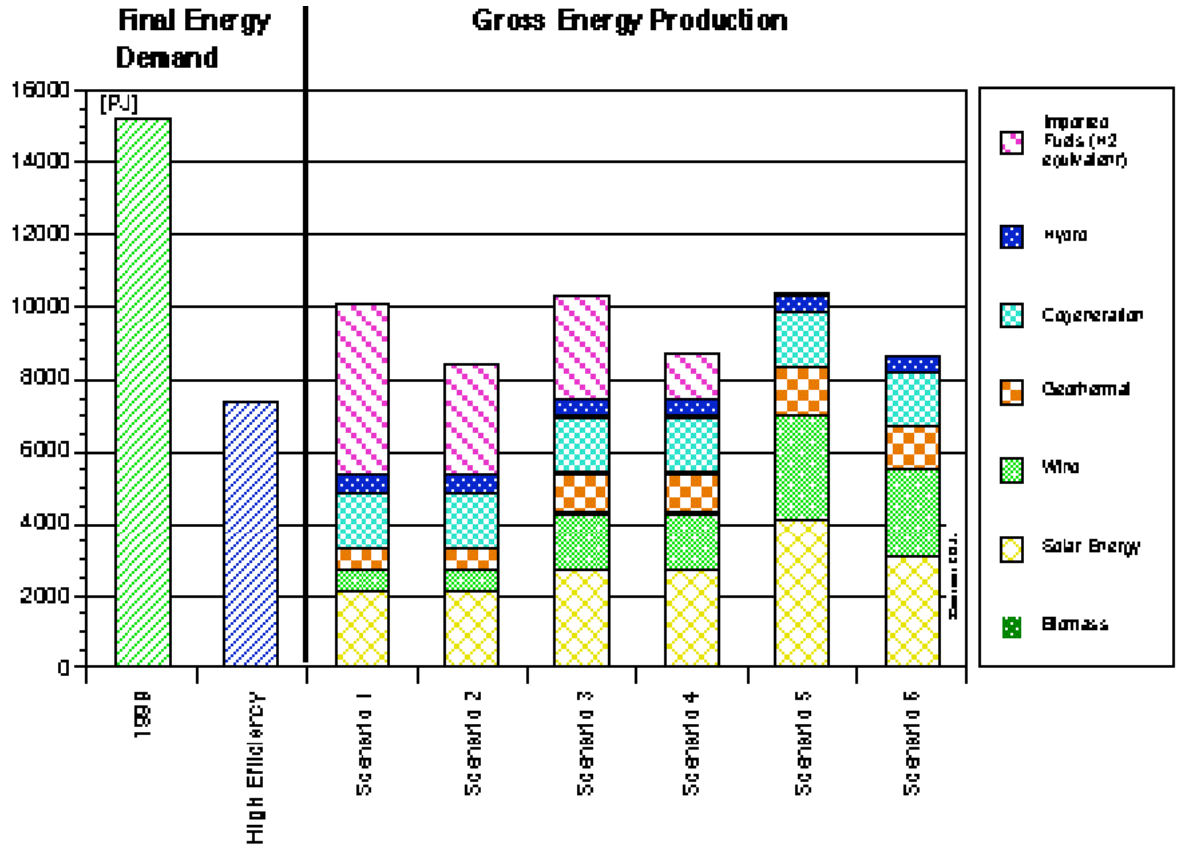
It has long been known that to protect people and the environment from both nuclear risks and dangerous levels of climate change, we must phase out the use of nuclear and fossil fuels, and switch to clean energy technology instead. Using Japan as a example, the „Energy Rich Japan“ Project illustrates that the vision of a clean, green, energy-rich future is not only possible, but globally feasible.



Pict. 1: Demand 1999 and the High Efficiency Model. Six Supply scenarios with different dependance from imports (Imported Fuels). Scenarios 2,4 and 6 assume a decreased population of Japan. Biomass is set to zero because of not having enough data about the sustainable potential in Japan. Knowing this potential it can substitute Hydrogen fuels.

[1] More Information about the „Energy Rich Japan“ Project (Reports, Simulation and Animation): www.energyrichjapan.info

Renewable energy technologies using regional or global sources, coupled with a reduction in energy use by adopting energy efficient technologies, offer the only safe and proven option open to us for future energy needs. The objective of this study is to show that a region such as Japan is able to supply all of its own energy needs with this option, and to use the report to influence the discussion over the change from fossil and nuclear energy sources to a sustainable energy system.

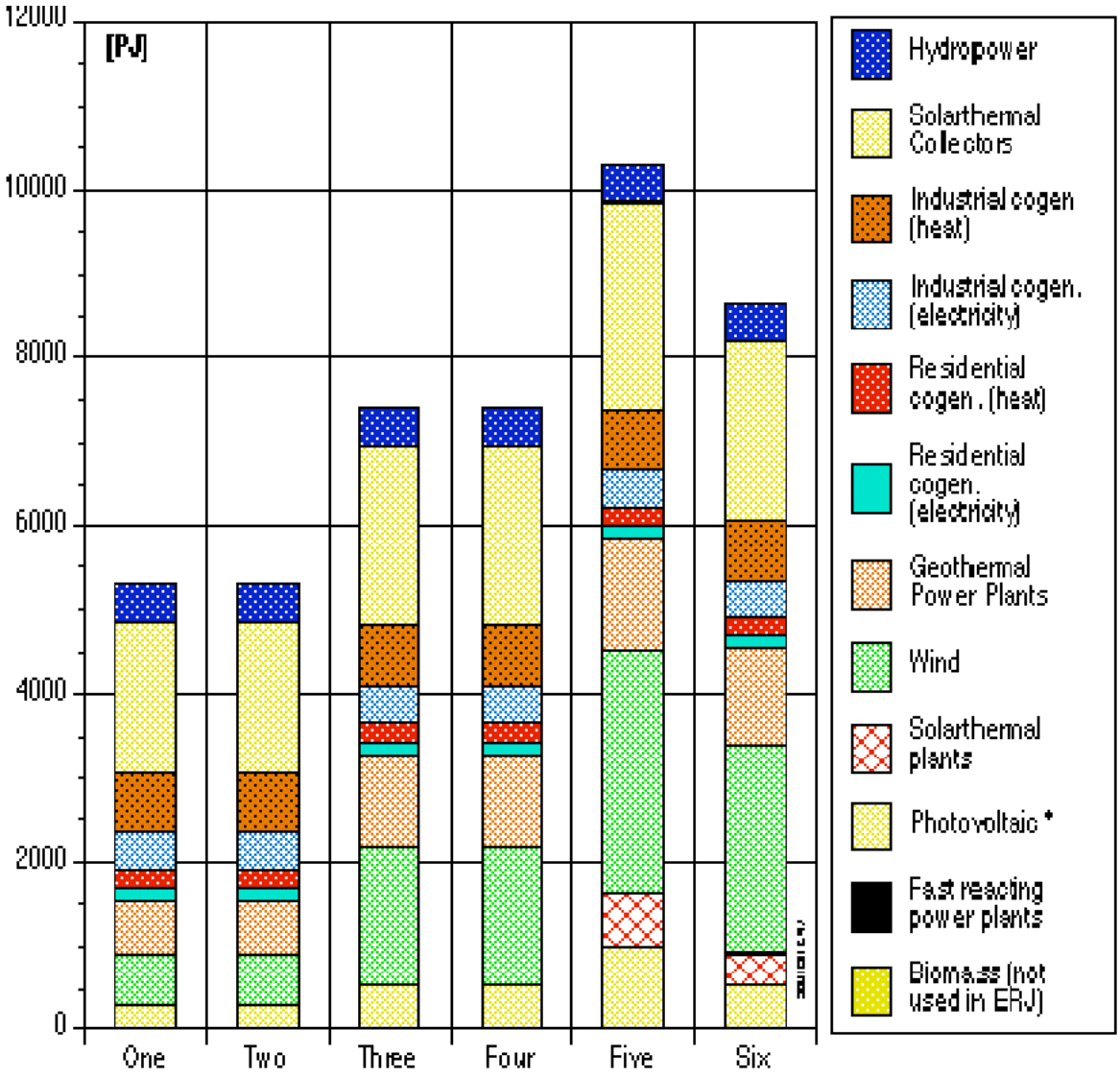
Japan is a heavily industrialised country, with a population of 127 million living in a small island nation, yet in 1999 it was the world's second most powerful economy, with an industrial base that was recognised as one of the most energy efficient globally.

Japan was forced to become relatively energy efficient because it has very little domestic supplies of what are known as conventional energy sources. This industrial powerhouse meets the bulk of its energy demand by importing nuclear and fossil fuels, supplemented by a small amount of domestic oil and gas production, as well as some hydro and geothermal power. Japan's total primary energy consumption in 1999 stood at just over 22,970 Petajoules, (A Petajoule is a 1000 million, million joules). Of this, 18,500 Petajoules (80%) was imported as nuclear and fossil fuels.

Yet Japan could be independently rich in energy. Using baseline data from 1999, the „Energy Rich Japan" report shows how a combination of the best energy efficiency technologies available today, and a massive investment in renewable energy, could ultimately provide Japan with 100% of its energy needs from renewables – including transportation fuels -without expensive and environmentally damaging imported fossil and nuclear fuels. Rather than seeking „energy security" through its hugely expensive and polluting nuclear program, for example, Japan could instead build its own renewable energy industry. As an energy-hungry and supposedly "resource- poor" country, Japan could make this transition to clean, renewable energy without any sacrifice in living standards or industrial capacity.

The report takes Japan's current energy use, based on 1999 levels, and shows that demand could be reduced by 50% with energy efficient technologies that are already available around the world today. The „ERJ High Efficiency Demand Model" showed that using highly energy efficient technologies could save nearly 40% of today's energy consumption in the industrial sector, more than 50% in the residential and commercial sectors and about 70% in the transport sector.

It then shows how renewable energy could be used to meet that new level of demand, reducing and ultimately eliminating the need for imports. Six scenarios of how this might happen are outlined in the report, all of which can provide 100% renewable energy for Japan. Starting from a basic model (Scenario One) providing more than 50% of total energy needs from domestic renewable sources, each subsequent scenario provides variations or expansions on Scenario One, gradually reducing the reliance on imported energy, factoring in different population projections and expected improvements in renewable generation capacity and energy efficiencies, until by Scenarios Five and Six, no energy imports are required.

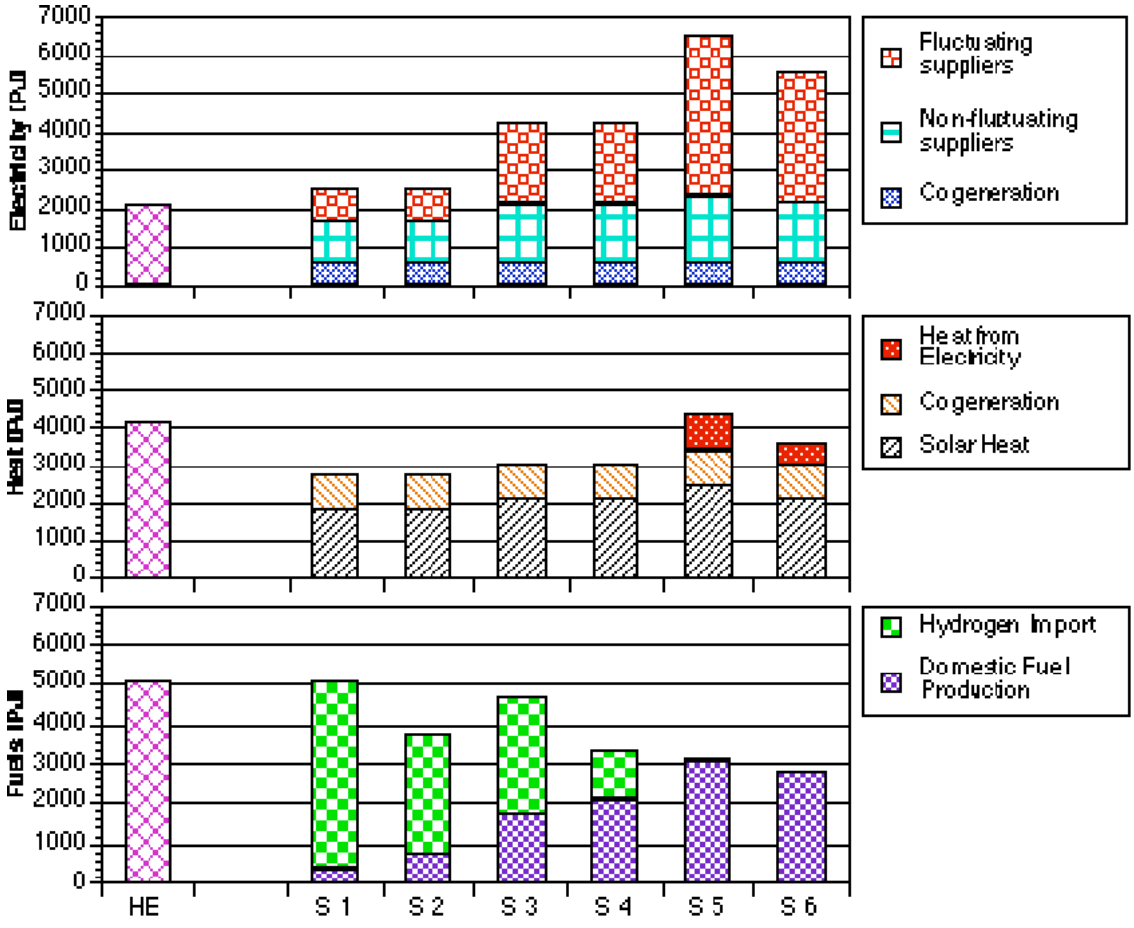


Pict. 2: Domestic gross energy production in petajoules using energy conversion technologies from renewable sources in Japan as used in the six scenarios. This is the production of electricity and heat in the installed power plants. Biomass, although listed is set to zero because of the unavailability of the potential of sustainable produced biomass.

As supply reliability is most acute in the electricity sector where supply and demand must be fully matched in time, a simulation of the Japanese electrical power system and part of the heating system with the computer programmSimREN was done.

This study does not attempt to answer two key questions: How quickly can such a system be implemented and how much will this system cost? To demonstrate the possibility of a solar energy supply for Japan, it is not necessary to specify the costs and the timeframe such a development will require.

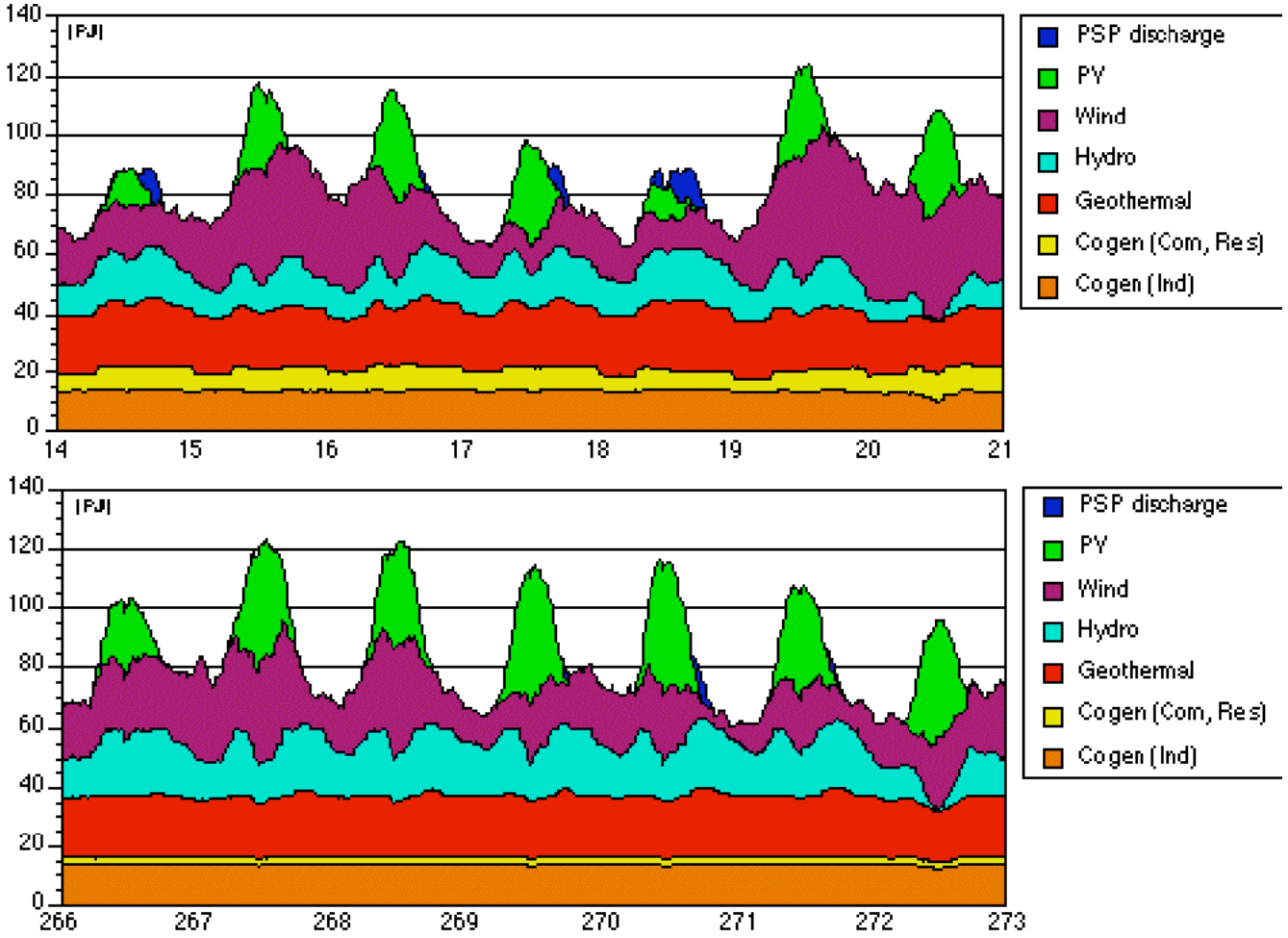
The systems described here provide a framework for a debate about the restructuring of the Japanese energy economy. However restructuring with renewable energy does not need to be limited to the ideas described in this report. Other systems that can supply Japan with renewable energy are also possible.



Pict. 3: Electricity, heat and fuel production in all six "Energy-Rich Japan" scenarios. Electricity surplus is used for heat and fuel production.Biomass, although listed is set to zero because of the unavailability of the potential of sustainable produced biomass.

All of the scenarios are able to be met in Japan, both in technical terms and in terms of natural resources, such as wind, solar radiation and geothermal capacity. The decisive factors will be public acceptance, priorities set by national policy in terms of energy security and international commitments and the future development of renewable energy technologies. „Energy Rich Japan" is an ambitious concept, yet conservative in its methodology. Admittedly its implementation would involve considerable investment in infrastructure and far reaching changes to the way Japan designs and builds its future industrial, residential, commercial and transport sectors. Compared to the environmental dangers faced globally by climate change and nuclear accidents, the costs of not developing sustainable energy systems, be they in Japan or anywhere around the world, are potentially far greater.

How to achieve to a sustainable energy system is the question we hope we have addressed with this study. What we need now is the desire and will to make it happen.



Pict. 4: The figures show the dynamics of electricity generation for 2 weeks of the year. The supply-system always produces enough electricity to cover the demand. If there is low electricity production of windenergy and photovoltaics at the same time, pumped storages get used to guarantee full supply (see days 14, 18, 19 and 271).