



Energy Transition to Sustainable

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The Transition to Sustainable Energy

Current Global Energy Sources

The bulk of the global energy supply comes from fossil fuels. We will need to significantly reduce our dependence on these fossil fuel energy sources not only for the environments sake, but, to lengthen the timeframe before the near depletion of readily available fossil fuel occurs.

Perhaps part of the funding to speed up sustainable (environmentally friendly) energy development and implementation can be supplied by the ECO\$ funds. This can include the decommissioning of older energy technologies and the replacement by modern energy technologies.

Considerations in the Transition to Sustainable Energy Sources and Consumption:

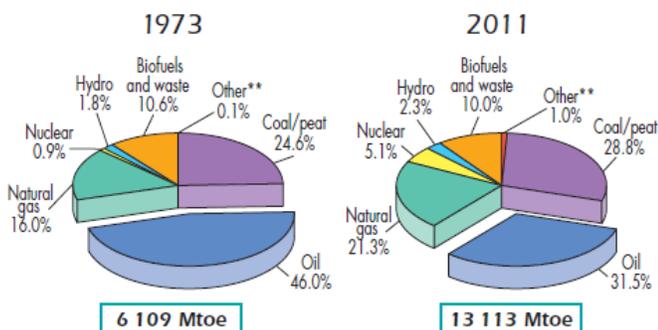
- I) Sustainable Urban Centers will most likely utilize more mass transit, more of a focus on taller buildings, and require more electrical energy.
- II) Nuclear energy sites are generally approaching their life expectancy for production. When these sites begin to be decommissioned what non fossil fuel energy source is to be utilized? Will we proceed with a modernized nuclear strategy?
- III) What other means are available for urban and industrial centers to decrease their energy requirements?
- IV) How do we transition our urban and industrial centers away from transportation consumption of oil based energy?
- V) There needs to be more information as to the capabilities, both positive and negative, in regard to each energy source and technology in order to make more informed planning decisions on the part of political leaders, corporate leaders, community groups, and the general public.

Energy Charts: Source, Generation, and Consumption

Total Primary Energy Supply, World

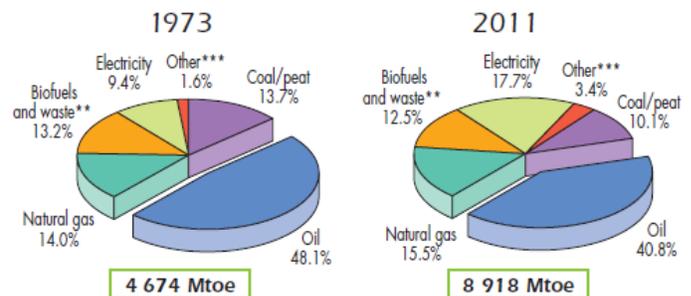
Total Final Consumption, World

1973 and 2011 fuel shares of TPES



*World includes international aviation and international marine bunkers.
**Other includes geothermal, solar, wind, heat, etc.

1973 and 2011 fuel shares of total final consumption



*World includes international aviation and international marine bunkers.
**Data prior to 1994 for biofuels and waste final consumption have been estimated.
***Other includes geothermal, solar, wind, heat, etc.

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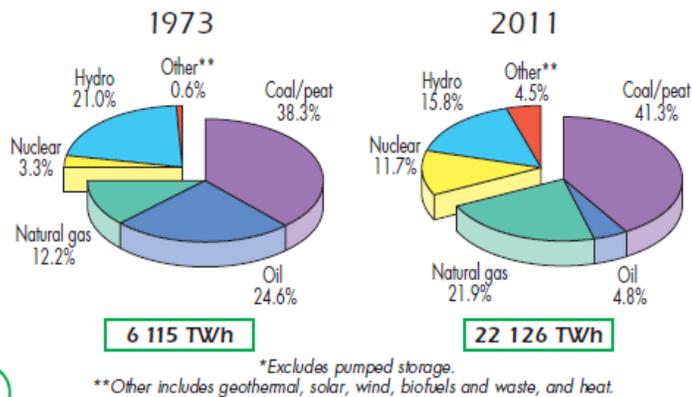
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Chart Courtesy of International Energy Agency
Key World Energy Statistics 2013 © OECD/IEA, 2013, p. 6

Chart Courtesy of International Energy Agency
Key World Energy Statistics 2013 © OECD/IEA, 2013, p. 28

Electricity Generation by Fuel (World)

1973 and 2011 fuel shares of electricity generation*

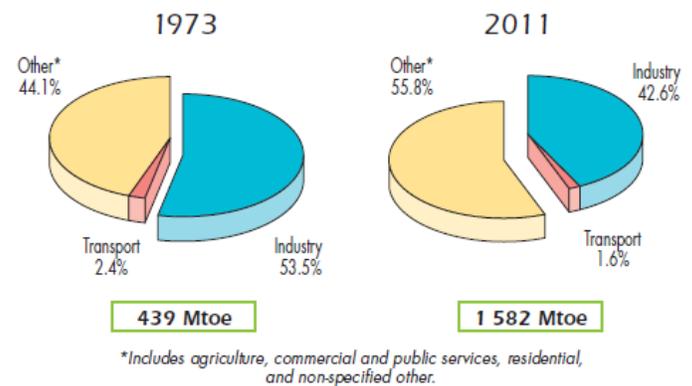


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Chart Courtesy of International Energy Agency
Key World Energy Statistics 2013 © OECD/IEA, 2013, p. 24

Total Final Consumption By Sector – Electricity

1973 and 2011 shares of world electricity consumption



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Chart Courtesy of International Energy Agency
Key World Energy Statistics 2013 © OECD/IEA, 2013, p. 35

Sources of Electrical Energy, a Review

Coal and Natural Gas

As indicated in the chart above on electricity generation by fuel the bulk of the source for electricity generation is coal and natural gas. While these fuels are relatively abundant when compared to oil, they are fossil fuels, and therefore still non renewable resources. Since electricity demand is likely to increase over time these fuels will probably still need to be part of the electricity generation sector going forward. The more modern coal plants are reputed to be far more efficient and produce far less waste than older technologies. However, coal and natural gas use and consumption will still need to be moderated perhaps by the following energy sources and technologies.

Nuclear Energy

Newer Nuclear Technologies in development: Generation III plus Nuclear Reactors, Thorium and Molten Salt Reactors (MSR), Small Modular Reactors (SMR) and future Generation IV Nuclear Reactors. It would appear nuclear energy generation may need to be part of the future sustainable strategy. There are indications that part of the future strategy, with the newer technologies, is the capability to use up nuclear waste as part of the process; which is of environmental benefit. There should be environmental groups' inputs into implementation of any nuclear sites & waste strategies, in addition to providing inputs to decommissioning old nuclear plants. The latest technology in nuclear energy may appear to offer significant capacity and efficiencies for electric power generation.

Solar and Wind

Solar, Wind, and other renewable energy generation methods may not provide as reliable and significant a supply of electricity. They do however mitigate the use of fossil fuels and offer electrical energy with much less apparent environmental impact. As with other sources of electrical generation we need to weigh up the benefits and drawbacks.

Alternatives to large scale Hydro Dams:

These technologies are relatively new and given sufficient support may eventually prove capable of providing significant capacity for hydro-electric generation to reduce the dependence on fossil fuels as well. While large scale hydro dams have proved of benefit in providing significant and reliable supply of electrical energy. There are also drawbacks due to their significant environmental impact and footprint.

Wave Farms (wave energy converters) Portugal has a wave farm off its coast (by Pelamis Wave Power) Ocean Power Technologies (OPT) PowerBuoy® turns wave power into reliable and clean electricity. At this time there is limited information on the success of this method.

Locally owned and operated small scale hydro generating stations (generally small municipal systems). The units are of benefit to local communities providing a direct and local electrical energy supply which is cost effective. See <http://www.alternative-energy-news.info/technology/hydro/>

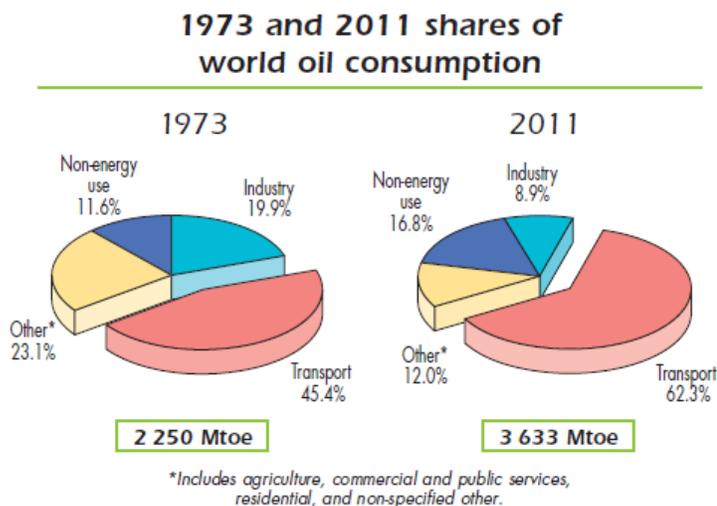
RER Hydro Inc Hydrokinetic Turbine Systems along rivers

“Unlike dams, the “hydrokinetic” turbines generate clean power, reportedly, without disrupting the river flow or the natural habitat of fish or other marine life, according to RER Hydro CEO Imad Hamad.”

<http://metronews.ca/news/canada/851232/rer-hydro-boeing-to-build-montreal-river-dam/>

In a pilot project, the Trek Turbine, was installed in August 2010 near Montreal, QC, Canada and has run successfully to date.

TOTAL FINAL CONSUMPTION By Sector - Oil



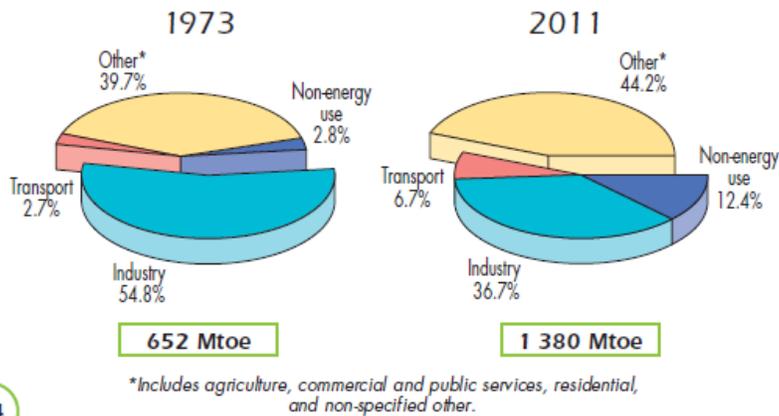
Since oil is the energy source that appears to have the shortest timeline before apparent depletion of reserves. This is the energy source that needs to be the prime focus for reduction in use. As most of the oil is consumed by transportation reductions can occur if we introduce and promote the following strategies:

Sustainable Strategies

- Increased promotion and support for mass transit for urban and sub-urban centers. This includes any further urban planning and development which should favor mass transit over individual transit.
- Support for alternate bio-fuels (renewables), such as bio-diesel, and increasing their availability and use.
- Support for further R&D on electric vehicles.
- Encourage the automotive industry in developing further efficiencies in performance and waste output.

TOTAL FINAL CONSUMPTION By Sector – Natural Gas

1973 and 2011 shares of world natural gas consumption



Natural gas is a major fuel for providing heating and hot water for industry, residential, commercial, and agriculture. The following strategies may help in reducing the use of natural gas as well as our dependence on natural gas. One caveat needs to be brought up. We may need to ask natural gas suppliers to collectively co-ordinate the reduction in production if and when the following initiatives are introduced to ensure we maintain a reasonably high price for natural gas to ensure long term availability.

Chart Courtesy of International Energy Agency
Key World Energy Statistics 2013 © OECD/IEA,
2013, p. 34

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Sustainable Building Strategies

Whether the building is existing or a new build, there should be support to be able to modify or rebuild with modern “sustainable” designs, materials, and technologies.

<http://www.usgbc.org/>

"The U.S. Green Building Council (USGBC) non-profit organization committed to a prosperous and sustainable future for our nation through cost-efficient and energy-saving green buildings."

"LEED, or Leadership in Energy & Environmental Design, is transforming the way we think about how our buildings and communities are designed, constructed, maintained and operated across the globe. Comprehensive and flexible, LEED is a green building tool that addresses the entire building lifecycle recognizing best-in-class building strategies."

<http://www.cagbc.org/> Canada Green Building Council (Canada version)

Alternate Sources of Heating and Cooling

One promising source for an alternative to heating and hot water generation by natural gas is the Ground Source Heat Pump technology. While initial costs of implementing may be high the benefits in the reduction in demand on natural gas reserves could prove significant. In addition there are many suppliers of solar energy solutions that also help in reducing fossil fuel demands.

Practical Applications Examples:

ClimateMaster Water-Source Heat Pump Systems

<http://www.climatemaster.com/commercial-geothermal>

"These "Boilerless/Towerless" Heat Pump systems use the natural thermal properties of the Earth to dissipate or capture heat for the water loop. Geothermal Heat Pumps operate in an identical fashion to Water-Source Heat Pump units. However, without the need for a boiler or cooling tower, they save substantial energy costs and space. The water loop system is underground and the units are inside the building. Thus, the environmentally friendly geothermal system preserves the architectural design of a building naturally."

Other applications can be found here.

<http://www.gshp.org.uk> Ground Source Heat Pump Association

GeoSmart Energy

http://geosmartenergy.com/pdf_files/MKG-CST-Challenger-0909.pdf

A commercial application

Challenger Motor Freight (CMF of Cambridge Ontario), a freight distribution company built a new Operations and Maintenance facility (60,000 sq feet). The company decided on a state of the art facility. The facility has a 30 ton hydronic heat pump hooked up to a horizontal closed loop that has a capacity for 150 tons. The particular equipment and set-up utilized provides in floor heating as well as hot water.

WSE Technologies - Winning with Solar Energy

<http://www.wsetech.com/>

Examples of Alternative Solar applications:

“Cogeneration systems generate both heat and power. Cogeneration achieves 40 percent energy savings vs. separate power and heat generation equipment”

Applications:

Solar Water Heating Solar Pool Heating Solar Air Conditioning Solar Domestic Water Heat
Solar Commercial Water Heating

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