

# **Logistic Management in Renewable Energy Sector**

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This textbook provides knowledge to understand the principles of operations and management of energy plants that use almost all known alternative energy sources except nuclear energy. The readers will become familiar with the logistic management of renewable energy sources harnessing, conversion, energy production and distribution and will be able to apply acquired knowledge in management practice.

Energy sources (often referred to as energy commodities) are divided into categories according to their origin and characteristics (direct or indirect use) as shown in Fig. 1. Many primary energy sources are converted from one energy form to another more useful form as is shown in Fig. 2. It is essential for good understanding a logistic management and processes as well as materials flows in the supply chains.

Today sustainable energy supply is based on eight basic technologies available in the market: biomass, geothermal energy, hydropower, photovoltaic systems, solar thermal collectors, and wind energy as well as some experimental technologies, mostly at the less advanced stage of development.

In most cases modern renewable energy systems rely on local renewable sources and intelligent interchange of energy between regions. It means that could be managed by the power grid and by transporting of biomass. National and also international networks can be used for supply system balancing (shifting surpluses to regions with deficits) [1]. The general structure of a renewable energy system is shown on Fig. 3.

Different technologies and diversification of regional production and demands should balance the fluctuations in energy supply between given regions. This approach is important in case of some technologies used, wind and solar photovoltaic, particularly. Power can be directly supplied from other regions to region with temporary energy deficit or by using other type of energy sources (when wind stop blowing shortage in energy supply could be supplemented from other even local source, biomass power plant for example). Such an en-

ergy supply structure requires much more intelligent management than current traditional energy distribution systems [1].

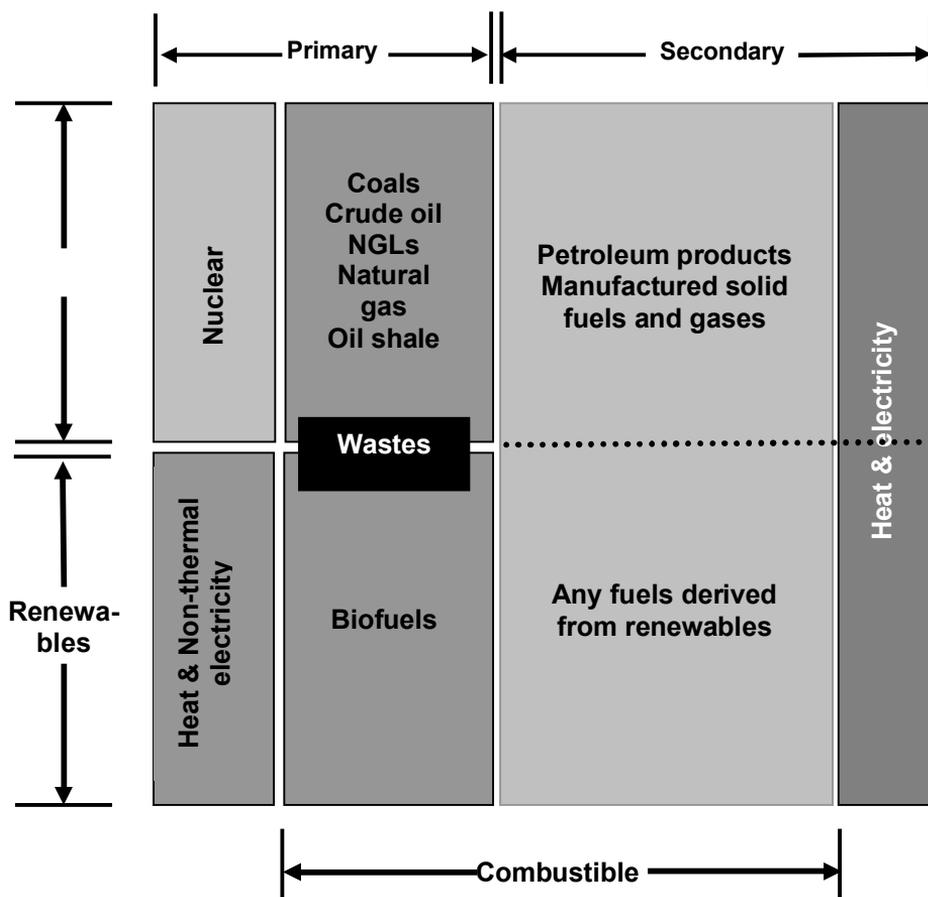


Fig. 1 General terminology of energy resources (Where NGLs means Natural Gas Liquids); *Applied from: IEA (2005) 'IEA Energy Statistics Manual', OECD/IEA Paris*

**Non-renewables** In such systems consumers (households, small and medium sized plants) can provide each other with heating and electricity and also deliver power to the national grid when national energy control authorities need to allocate a peak load or connect several smaller power plants together. Combination of various technologies and logistic management can assure stability of energy supply despite of seasonal changes in energy production (solar, for instance).

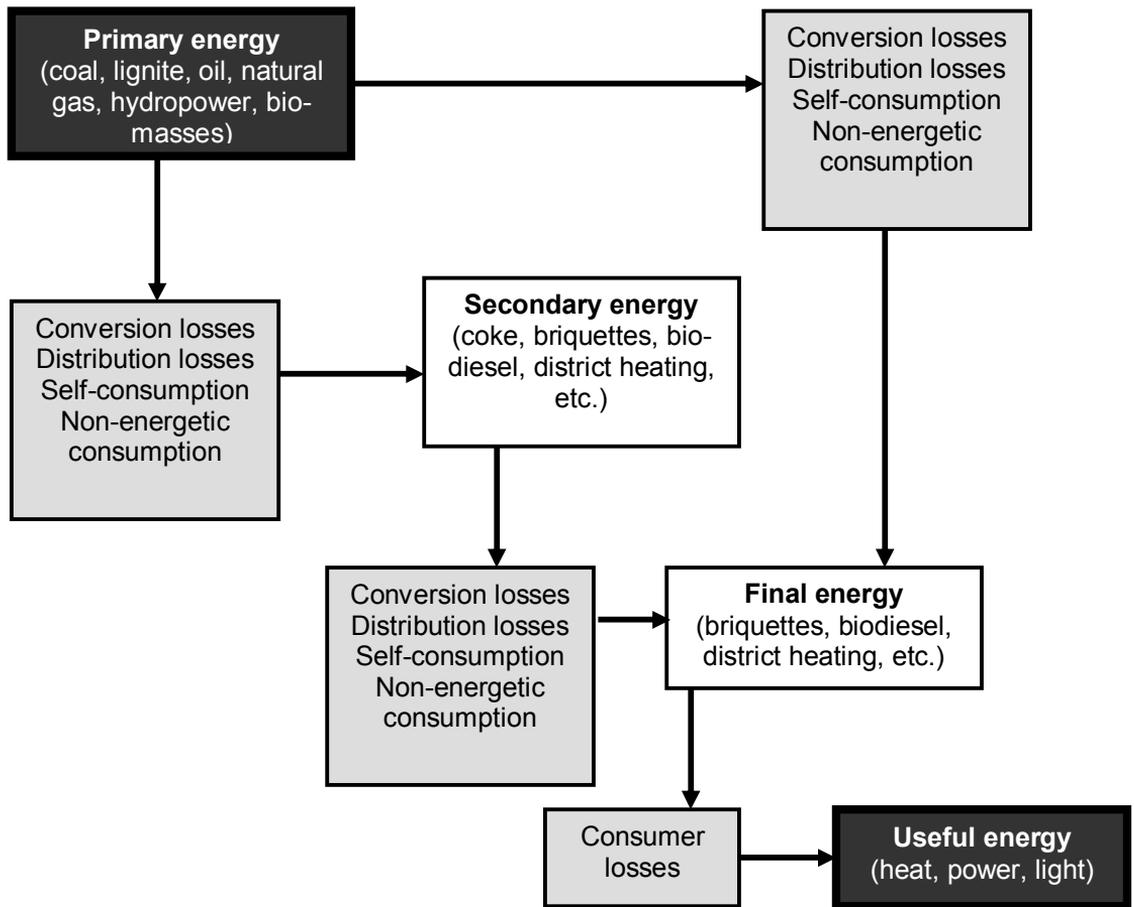


Fig. 2 Energy conversion diagram; *Applied from:* Kaltschmitt M., Streicher W., Wiese A. (2007) 'Renewable Energy, Technology, Economics and Environment', Springer-Verlag Berlin, DE

Mentioned above approach reflects assumptions that appeared at the end of XX Century when studies dealing with the future of energy supplies was started and have been published in recent decades. The 'Long Term Integration of Renewable Energies into the European Energy System' is one of them. The LTI project will work on 'extreme' scenarios with very different but ambitious economic, social and ecological goals over the next decades (LTI, 1998).

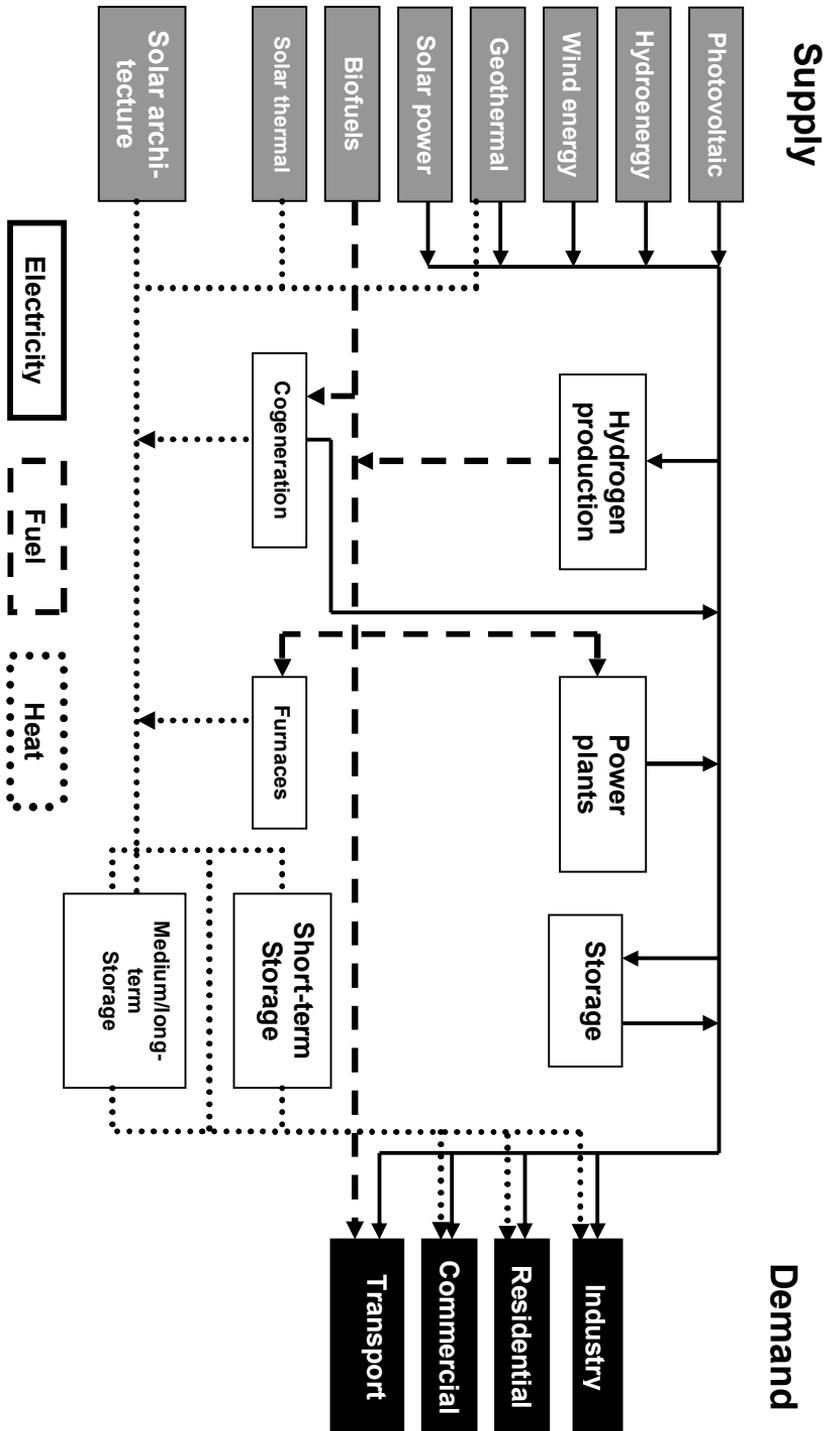


Fig. 3 The structure of energy system based on renewable sources;  
*Applied from:* Droege P. (2009) '100 per cent renewable : energy autonomy in action',  
 Earthscan, London UK

Three main scenarios were developed that result in an 80 per cent reduction of CO<sub>2</sub> by 2050. The LTI project shows that the European energy system can be changed until 2050 to use energy in a sustainable way [1]. However other scenarios for energy supply described in the '*Renewable Energies World Outlook 2030*' do not take into account 100% renewable supply.

Renewable energy market growth are calculated with regard to global renewable potentials and reduction of costs to extension of production capacity. Two scenarios, a 'low variant' and a 'high variant', assume different investment figures, defined as 'investment paths' with successive increasing annual investments towards 2030 [1]. Most important stimulus for development of renewable energy technologies is the amount of financial resources invested in such development. The another factor contributing to the development of renewable energy sector is willingness to pay for clean and secure energy.

Logistic management means management of all interconnected flows of materials from raw resources through energy production to distribution and it is the most important function of very diverse and complex of energy production business from renewable resources. Today logistic management skills and competencies are crucial for development of renewable energy sector and especially for cost-effective energy generation as well as power plant management. In the broader view it is important for development of smart energy supply networks.

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