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The system of renewable energy potentials

Perspectives of Renewable Energy in the Danube Region

Workshop Pécs, September 26, 2014



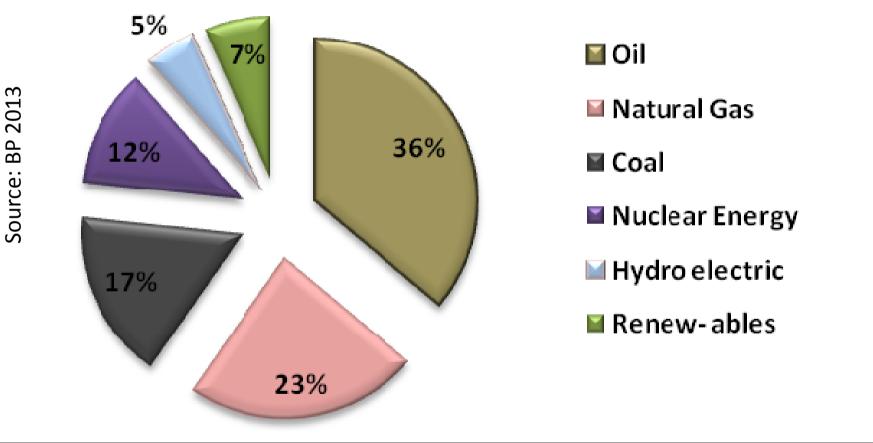




Energy Landscape of Europe

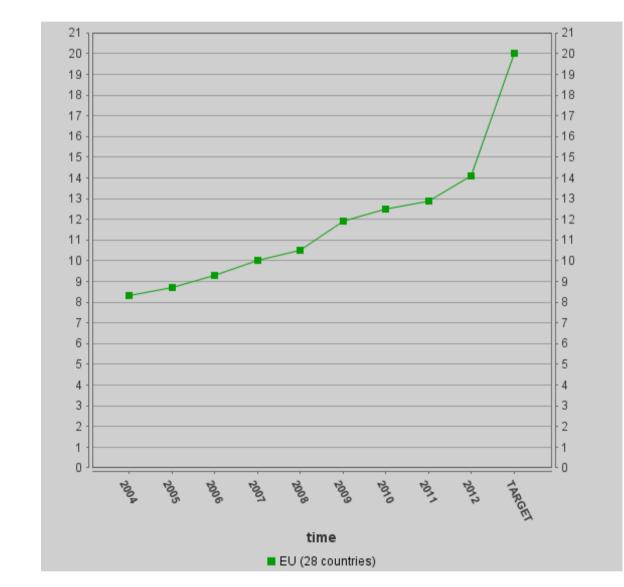


Primary Energy Consumption by Fuel in the EU, Million tonnes oil equivalent



Oil	Natural	Coal	Nuclear	Hydro	Renew-	Total
	Gas		Energy	electric	ables	
605,2	394,3	285,4	198,5	81,9	110,6	1675,9

Share of renewable energy in gross final energy consumption (EU28)



Source: EUROSTAT

Energy Security of EU

Gas

Reserve/Production

10,7 years

Reserve/Consumption

3,65 years

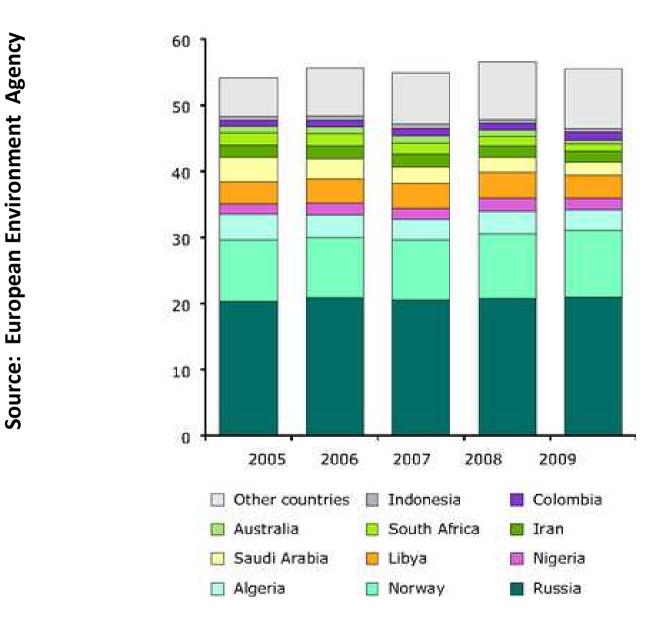
Oil: Reserve/Production

Reserve/Consumption

43 seconds

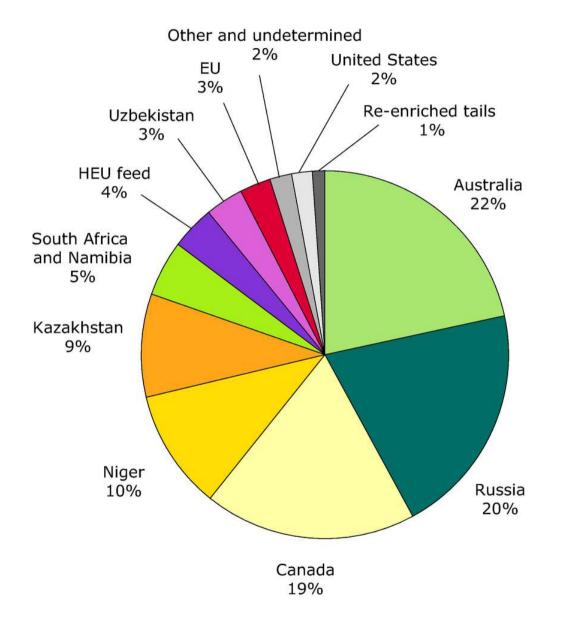
13 years

EU27 net imports of natural gas, oil, solid fuels and the sum of these, by country of origin, as a % of fuel-specific gross inland energy consumption



Source:

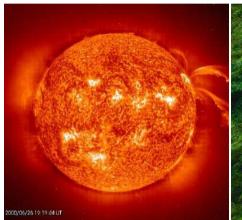
Sources of uranium delivered to EU-27 utilities in 2009





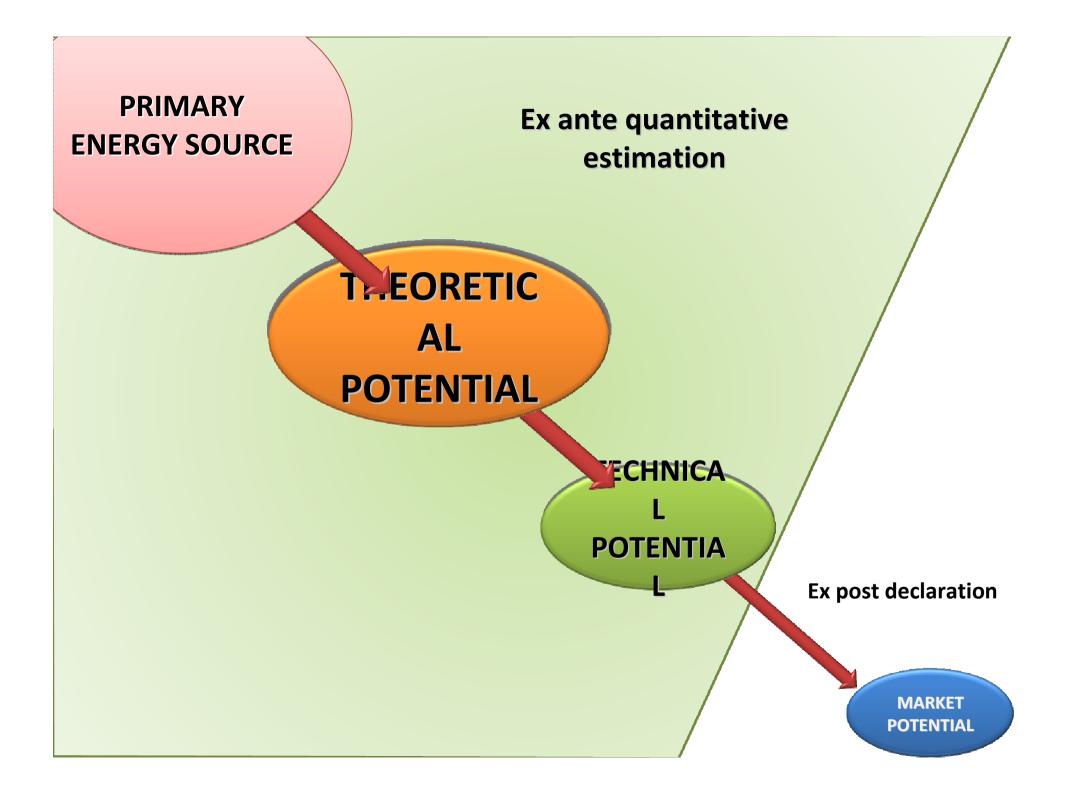
Classification of RE energy according to the possibility of renewal

Renewable and inexhaustible



Renewable and generally inexhaustible but locally exhaustible

Renewable but exhaustible



PRIMARY ENERGY SOURCE

Energy content of PES **Theoretical physical calculations**

Physical constraints as weather, precipitation, temperature, etc.

Dynamic factors: influence of climate change (via changing weather patterns)





Topographic/geological constraints of land use **System performance** of energy conversion technology (system efficiency)

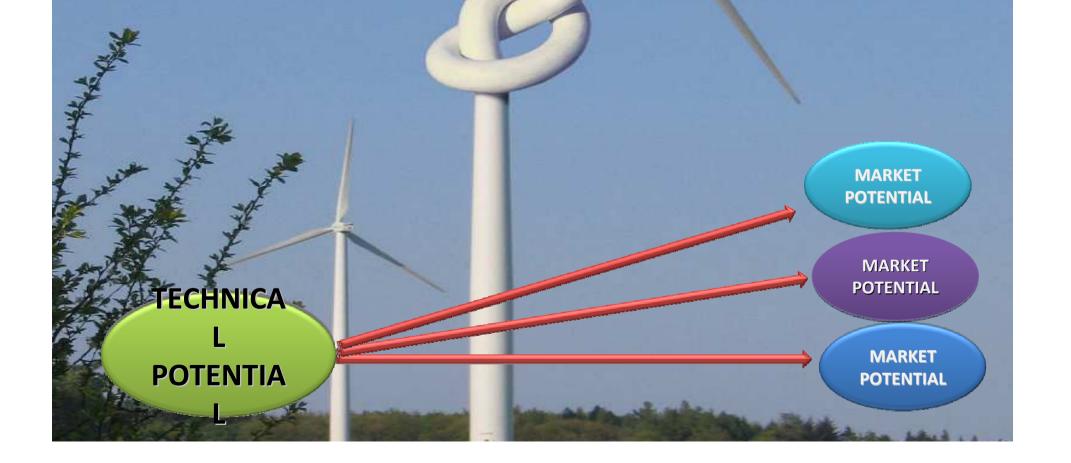
Resource constraints: limited raw material availability;

Other technical constraints (e.g. manufacturing; drilling technology, harvesting losses, etc)

Dynamic factors: R&D of new technology; increased system efficiency during continuous adjustment of existing technology



Scenarios





- **Energy system constraints:** barriers of integrating the RE
- technology into the existing energy system;
- Land use constraints: free land availability, ecological constraints, priorities of land use;
- **Societal constraints:** energy policy, juridical constraints; market regulation, attitude of society and/or local communities, public opinion;
- **Economic constraints:** market structure, market prices, marginal costs of competing technologies, investors expectations, subsidies,
- **Dynamic factors**: New system design philosophy (distributed systems); learning curve; economics of scale; changing society, new energy policy goals, liberalization of energy markets, changing business environment;

POTENTIAL

Primary Energy Source (PES)

Energy content of PES

Theoretical physical calculations

Physical constraints as weather, precipitation, temperature, etc.

Dynamic factors: influence of climate change (via changing weather patterns)

Theoretical Potential

Topographic/geological constraints of land use

System performance of energy conversion technology (system efficiency) **Resource constraints**: limited raw material availability;

Other technical constraints (e.g. manufacturing; drilling technology, harvesting losses, etc)

Dynamic factors: R&D of new technology; increased system efficiency during continuous adjustment of existing technology

Technical Potential

Energy system constraints: barriers of integrating the RE technology into the existing energy system;

Land use constraints: free land availability, ecological constraints, priorities of land use;

Societal constraints: energy policy, juridical constraints; market regulation, attitude of society and/or local communities, public opinion;

Economic constraints: market structure, market prices, marginal costs of competing technologies, investors expectations, subsidies,

Dynamic factors: New system design philosophy (distributed systems); learning curve; economics of scale; changing society, new energy policy goals, liberalization of energy markets, changing business environment;

Market Potential