



Renewable Energy - Energy Markets in Europe

TJP Advisory & Management Services GmbH

Market Overview (1/4)

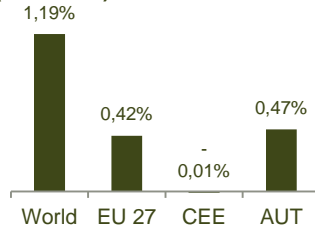
Population



- In July 2012 the world population was around 7.0 bn people. The CIA assumes a growth rate of 76 million people per year and expects increased urbanization.
- Population growth takes place predominately in the African developing and the middle east, i.e. Zimbabwe (2012: 4,36%) and Qatar (2012: 4,93%).
- The population keeps declining in some industrialized countries, having a dramatic impact on society.
- The US is an exception (2010: 309 million people) benefiting from immigration.

Need to meet increasing demand

Population growth p.a. (2003-2010)



Source: OECD (2012), Eurostat (2012)

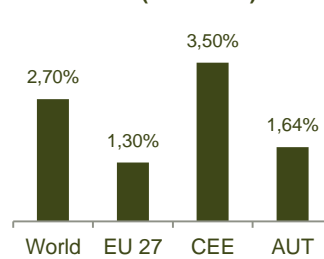
Gross Domestic Product



- The worldwide Gross Domestic Product and the multilaterale exchange of capital and goods increased strongly in the last years.
- Apart from the USA, Europe and Japan, the emerging markets are particularly affected by the negative shock.
- A decline in GDP has consequences on industry and consumer demand and therefore on the energy industry as well but the current economic recovery will drive output and energy demand.

Drive for increasing energy demand

GDP Growth (2003-2010)



Quelle: World Bank (2012)

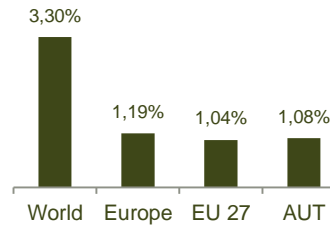
Electricity Generation



- The global volume of electricity generation rises steadily. Only in 2007 approx. 20.000 terawatt-hours of electricity were generated, nearly 5% more compared to the previous year.
- This growth trend will last in the long run and will only shortly be leveled off by the aftermath of the financial crisis.
- The increasing demand for electricity subsequently leads to a clear increase in demand for raw materials and power plant capacities.
- The possibilities for distributors and system manufacturers to participate in this development are very high.

Production efficiency gains and incentive schemes attract investments in RES

Total Electricity Net Generation Growth (CAGR, 2000-2010)



Source: EIA (2011)

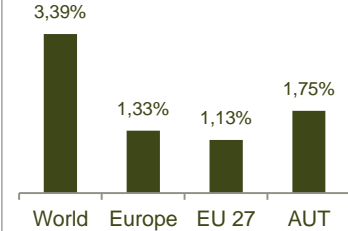
Electricity Consumption



- Energy consumption of the industrial states is already above average with roughly 4,000 kg OE per person. The US records the highest consumption with around 7,000 kg OE per person.
- Assuming that the political and economical development of the emerging markets continues, the consumption data will adjust to the western countries in the long-run.
- In order to meet future energy consumption, exploration of raw materials and power plant capacities must increase significantly.

RES will have to contribute to energy production to meet future energy demand

Total Electricity Net Consumption Growth (CAGR, 2000-2010)



Source: EIA (2011)

Market Overview (2/4)

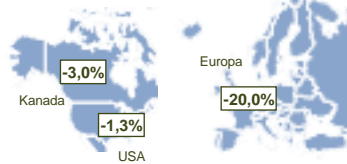
Energy Efficiency



- Energy and alternative energy sources will be future growth markets (growth in population, changes in lifestyle conditions, etc.)
- The EU community will significantly increase their measures to reduce greenhouse gas emissions and increase energy efficiency.
- EU 20/20/20 rule: 20% increase of energy efficiency, 20% decrease of greenhouse gas emissions, 20% increase of renewable energy sources (thereof 10% biofuels).

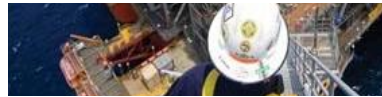
Renewables are a critical part of the EU energy efficiency directive

Preliminary targets for Copenhagen (2020 CO₂ reduction compared to 1990)



Source: EU-Commission, TJP Analyse (2011)

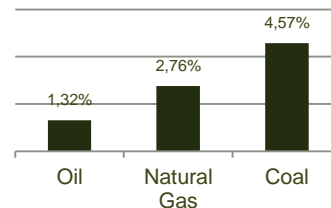
Raw Materials



- Demand for raw materials is growing steadily. This trend will continue in the medium- and long-run.
- The competition for energy resources is already observable throughout the world.
- Due to the high price level of raw materials during the last years, new capacities (e.g. oilsands, LNG) are continuously explored.
- Prognosis for the dates extinction of the global resources are revised positively at regular intervals.

Natural resources are limited and renewable sources will help close the gap.

Consumption of Raw Materials (CAGR; 2001-2011)



Source: BP Statistical Review (2012)

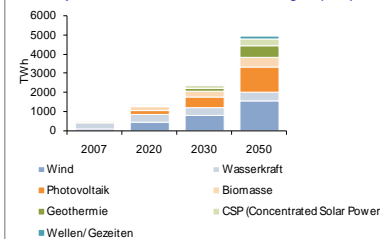
Renewable Energies



- The importance of renewable energies rises globally as a sustainable complement of the national energy mix.
- Political incentives and increasing awareness for environment and sustainability are drivers of growth.
- The adoption of renewable energy offers both ecologically and economically huge potential (e.g. avoidance of external costs, security of supply).
- High investment costs, a scarce infrastructure and a deficient technology transfer are an obstacle for global growth in this sector.

This trend opens the door for energy production from renewable resources

Consumption of Renewable Energy (TWh) in Europe



Source: EREC 2010

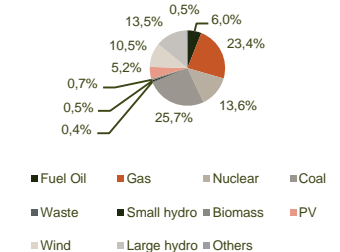
Climate Change



- Climate change is one of the most important issues of the 21st century. A low-CO₂ energy supply is the primary goal of many governments.
- In the last years global CO₂-emissions increased faster than energy consumption. It is not known when this trend will stop.
- In the long run CO₂-emissions will have a fair market price level, so that multilateral, ecologically compatible strategies will be necessary.
- Costs for CO₂-certificates become therefore increasingly important and therefore drive attractiveness of RES.

RES are a key element to decrease CO₂-emissions

EU Power Capacity Mix 2011



Source: EWEA (2012)

Market Overview (3/4)

Promotion of Renewable Energy in the EU	Greenhouse Gas Emission Reduction Measures	National Support Schemes	Additional Drivers (mainly in CEE)
			
<p>Reasons for promoting renewable energy in the EU</p> <ul style="list-style-type: none"> Reducing Carbon Dioxide (CO₂) emissions Enhancing sustainability Improving the security of energy supply Renewable energy can become economically competitive in the long run <p>Relevant EU regulations</p> <ul style="list-style-type: none"> COM(97) 599 White Paper Directive 2001/77/EC The 2008/0016 Proposal for Directive <p>Objectives and achievements</p> <p>Implementation of the 20/20/20 rule until 2020 and harmonization of provisions, controls and handling mechanisms in the member-states.</p>	<p>The Kyoto Protocol</p> <ul style="list-style-type: none"> Principal for update of the US Convention on Climate Change (UNFCCC) that sets mandatory emission limits for greenhouse gases (1997). Target: 5% global emission reduction by 2012 against baseline of 1990 (8% within EU-15) Follow-up regulation is not clear yet. (Copenhagen) <p>The EU ECTS</p> <ul style="list-style-type: none"> Market mechanism for buying and selling CO₂ emission credit. Affected installations are required to surrender a number of allowances corresponding to their actual CO₂ emissions. Penalties are given if they fail to do so. <p>Kyoto Mechanisms (CDM and JII)</p> <ul style="list-style-type: none"> Projects based mechanism for generators who cannot comply with emissions limits. Company receives Certified Emission Reduction (CER) or Emission Reduction unit certificates which can be surrendered as a substitute. 	<p>Types of Renewable Energy Support</p> <p>2 types of support schemes</p> <ul style="list-style-type: none"> Investment subsidies (non refundable governmental equity or tax exemption) Operating subsidies: <ul style="list-style-type: none"> Feed-in tariff: guaranteed off-take price paired with purchase obligation Premiums: Fixed premium for electricity sold on the competitive market Quota obligation based on TGC (Tradeable Green Certificate) System <p>Support mechanisms in EU member countries</p> <ul style="list-style-type: none"> Various different national support schemes of combining investment and operating subsidies Harmonization by EC is planned <p>Support mechanisms in Non-EU member countries</p> <ul style="list-style-type: none"> Among Non-EU CEE countries, Croatia, Macedonia, Serbia, Albania, and Bosnia and Herzegovina have support mechanisms in place. 	<ul style="list-style-type: none"> Several renewable generation oriented projects for transnational cooperation between EU and non EU-members in CEE. All countries in the Balkans have ratified the UNFCCC and the Kyoto Protocol, but only Croatia has a specified emission target. <p>Treaty Establishing the Energy Community</p> <ul style="list-style-type: none"> All Balkan countries have signed the Treaty. Milestone in the creation of the Common European Energy Market. The main goals are: <ul style="list-style-type: none"> Creation of a common market. Standardization of environmental and competition policies. Implementation of the <i>acquis communautaire</i>.

Source: COM 248, Renewable Energy Road Map, Euractiv, EEA – GHG Emission Trends and Projections in Europe (2009)

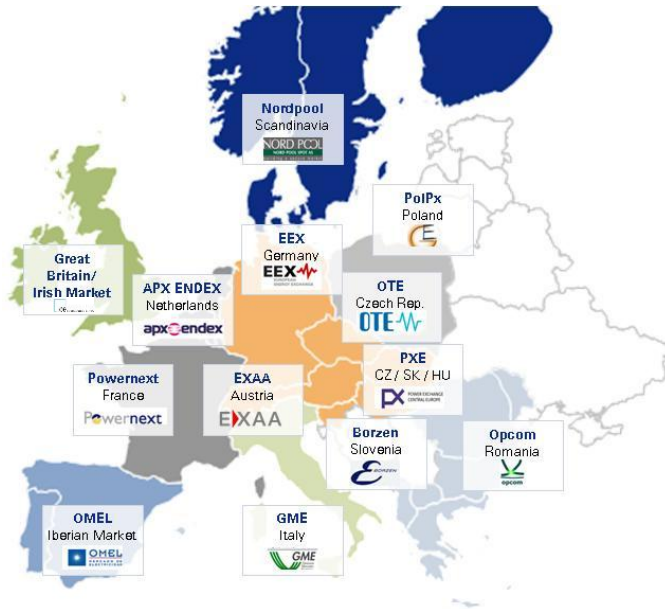
Source: EEA – GHG; The Carbon Trust (2009)

Source: OPTRES; Commission Staff Working Document, EWEA (2009)

Source: TJP analyses (2009)

Market Overview (4/4)

Energy Exchanges



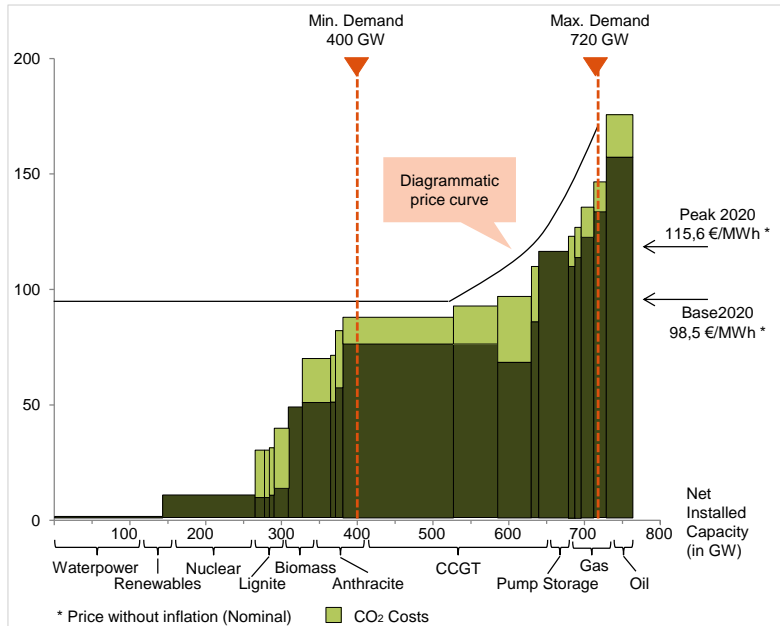
	Name	Country
	APX ENDEX	Netherlands
	Borzen	Slovenia
	EEX	Germany
	EXAA	Austria
	GME	Italy
	ICE / ECX	GB / IR
	OMEL	Iberian Market
	Opcom	Romania
	OTE	Czech Rep.
	Nordpool	Scandinavia
	PolPx	Poland
	Powernext	France
	PXE	CZ / SK / HU

- Since the opening of the energy markets, within the EU 15 area national markets have turned into regional markets.
- In the past few years an increasing correlation between the single markets can be observed.
- The missing transnational transmission networks prevent from arbitrage opportunities for traders as well as a further integration of the energy markets.
- Established market places all over Europe will help increase traded volumes and liquidity on the regional markets, which can potentially result in a stronger consolidation of hubs.

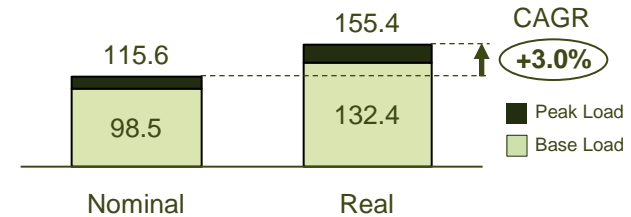
Sources: EEX, APX, Powernext, OMEL, IPEX, IKPX, EXAA, Nordpool, Borzen, Opcom, OTE, PXE

Merit Order based European power wholesale price 2020 shows long-term price advantages

Merit Order EU-27 2020: Conservative assumption



Indicative market tariff structure 2020



- The potential trend development of the Merit Order by 2020 is for a base price of 98,5 and a peak price of 115.6 EUR/MWh.
- The prices are not inflation indexed in the current study. The current study forecasts a conservative price. Modelling of high priced scenarios shows a non-inflationary trend of base and peak load with a 20% increase.
- The inflationary pricing factor of 3.0% p.a. would lead to an increase in the base load price to 132.4 EUR/MWh as the market price for base load energy. It has to be noted that indices for energy price inflation have been about 4-5% p.a. in the last years.
- In the current Merit Order, the closure of the German nuclear plants is not included (which have very low marginal costs), which – based on the assumption that demand remains unchanged – implies an additional increase of up to 15 EUR/MWh.

- The large share of renewable energy pushes the Merit Order Curve to the right. The main production type in price formation is CCGT.
- Further growth in electricity consumption is anticipated.
- High CO₂ and fossil fuel energy costs are expected.
- It follows that the spread (difference between base and peak pricing) will increase, whereby high price volatility is likely.

The Merit-Order-Curve orders power station groups in the order of their marginal costs of production (material costs plus other variable costs such as CO₂-certificate). Actual usage to cover demand follows this order. A position on the left of the curve indicates usage for base load.

