

# Renewable energy and energy efficiency

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# Environmental (climate) dimension of EEP

- Climate change – EU aims to develop a low-carbon economy.
- Measures primarily to reduce GHG emissions
  - EU ETS
  - Individual targets of MS for the non-EU ETS sectors (housing, agriculture, transport, waste)
  - CCS.
- Measures to transform the energy sectors
  - RES
  - Energy Efficiency
  - Research and development, new technologies

# What is renewable energy?

- Renewable energy is energy derived from natural processes that is replenished at a higher rate than it is consumed.
- Solar, wind, geothermal, hydropower, bioenergy, ocean power.
- Variable/non-dispatchable (wind, solar) vs. dispatchable (hydro, biomass/biogas) RES.

# Drivers for deployment

- Energy security – RES are spread globally, in contrast to the fossil fuels that are more geographically concentrated. (Import savings of €16bn in 2015, expected to be €58bn in 2030).
- Environmental concerns - low environmental impact (vary according technology) – GHG emissions (expected savings of 600-900 million tons of CO<sub>2</sub>), local pollutants.
- Strategic economic development (rural development, agriculture sector, high-tech manufacturing – 30% of RES patents in the EU).
- Energy access through distributed or off-grid solutions → decentralized energy system.
- Diversification of energy sources.

# Development of the targets

- 1997: indicative target of 12% of energy consumption by 2010.
- 2001: indicative target of 21% for the electricity sector by 2010.
- 2020 aims (Energy and climate package, 2009) → RED I 2009/28/EC.
  - To increase the share of renewable energy (not only electricity!) from 5% in 2005 to at least 20% of final consumption in 2020 (17.5% in 2017).
  - Binding national targets.
  - With indicative targets for 2013 and 10% in transport sector goal (later limited on biofuels from energy crops grown on agricultural land limited to 7%).

# National targets

Member State	Share of renewables in 2005	Share required by 2020
Austria	23.3%	34%
Belgium	2.2%	13%
Bulgaria	9.4%	16%
Cyprus	2.9%	13%
Czech Republic	6.1%	13%
Denmark	17%	30%
Estonia	18%	25%
Finland	28.5%	38%
France	10.3%	23%
Germany	5.8%	18%
Greece	6.9%	18%
Hungary	4.3%	13%
Ireland	3.1%	16%
Italy	5.2%	17%
Latvia	32.6%	40%
Lithuania	15%	23%
Luxembourg	0.9%	11%
Malta	0%	10%
The Netherlands	2.4%	14%
Poland	7.2%	15%
Portugal	20.5%	31%
Romania	17.8%	24%
Slovak Republic	6.7%	14%
Slovenia	16%	25%
Spain	8.7%	20%
Sweden	39.8%	49%
United Kingdom	1.3%	15%

Source: thinkcarbon.wordpress.com

# Trade in renewables

- Cross-border trading → trading of RES certificates (Certificates of origin). Suggested in 2001, 2007 (and again in 2015 as a part of Energy Union plan).
  - For economy of scale.
  - For both technical and economical efficiency.
- Failed due to different support schemes with different level of support (esp. in FiT countries) in EU MS and political concerns of losing control.
  - Statistical swaps between MS allowed.
  - Two or more MS may combine targets, or support schemes (Sweden+Norway).

# Feed in Tariffs

- Majority of the EU states, provides a fixed rate of subsidy for fixed period.
- Cover all producer's costs and profit, essentially replacing the market.
- Instrument of choice for big RES players (Germany, Spain). Government sets the price, market (investor response) sets the quantity.
  - Very successful in triggering large deployment of RES, but at a high cost.
  - Greater security around income to investors, therefore reducing financial costs.



# Feed in Tarrifs

- FiT could be tailored to different technologies.

But:

- difficulty of setting the right price – too high and money is wasted, too low and no deployment. Once the price is set, it is hard to make radical changes without breaking contracts.
- they insulate the RES producer from the market (a limited compatibility with Internal energy market).
- Grid priority - the grid must take RES electricity first.

# Quota obligations

- Power plant operators receive certificates for their green energy to sell to the actors (suppliers, intensive industries, some others) obliged to fulfil the quota obligations.
- Selling the certificate provides an additional income on top of the market price of electricity.
- Quota obligations with tradeable certificates. Here government sets the quantity, the market the price.
- (Some) compatibility with market principles, competitive price determination.

# Quota obligations

- High risk premium – increases costs.
- Technology neutral way – only the most cost-effective technologies supported.

= Quota systems with tradable certificates tend to be cheaper, but favour mature technologies like onshore wind and biomass.

# Feed-in Premium

- Plant operators have to sell the electricity at the market.
- To receive a fixed payment for each unit of electricity generated independent of the market price of electricity.
- More market oriented, higher risk for producer (compensated by the level of the premium).
- Used sporadically, as a second option to supplement FiTs.

# Subsidy schemes

- Feed-in tariff (FIT)
- Feed-in premium (FIP)
- Quota
- Tenders



Note: This map does not include secondary support instruments like tax incentives, investment grants, etc.

Source: Ecofys

# Costs of RES support

„A solar RES case“ – Spain, Italy, the Czech Republic...

- Generous FiT tariffs in place, volumes of deployment not controlled or capped and support mechanisms not sufficiently responsive to rapidly falling costs.
- PV developers earn high rates of return on their capital – overheated markets and rapid rises in support costs.
- Policy makers react by dramatically reducing tariffs and introducing retrospective measures to recouple some of the costs – detrimental impact on investor confidence in the government.
- Also impact on the other RES in given country.

# Czech Republic – Installed PV capacity

Source: ERÚ

Year	Installed capacity (in MWe)
2006	0,2
2007	3,4
2008	39,5
2009	464,6
2010	1959,1
2011	1971
2012	2086

Estimated costs in Czech Republic – 1,76 bn. euro in 2013

# Integration of RES to the system

- Electricity generation overcapacity in Europe, downward pressure on wholesale power prices.
- Capacity mechanisms for sources providing stability and reliability (back-up).
- Different support schemes distort the competition on the markets (subsidies national + related to production).
- Missing infrastructure – grids, back-up capacities.
- Priority dispatch.
- Increasing public costs.



# Integration of RES to the system

RES gradually considered 'mature technology' with significant level of penetration.

- 2014 - Guidelines on State aid for environmental protection and energy 2014-2020.
  - From 2016, in new RES schemes, FiT should be replaced by market premiums for the new projects.
  - From 2016, new RES need to be responsible for selling their electricity into the market (instead of TSO, DSO to do that). They should be responsible for balancing (to encourage them to predict their production).
  - From 2017 developers should compete for new subsidy money at auction.
- Winter package 2016 - Priority dispatch only for installations up to 500 kW (250 kW after 2026), existing generators, and innovative technologies. They are to be responsible for their imbalances.

# Tendering procedures for RES in Europe



# Integration of RES to the system

Example of Germany:

- PV from 9.2 to 5.7cts/kWh between 2015-2017. Bid bonds (deposit, €25-50/kW – 50 000 for 1 MW project); pre-qualification (local municipality's consent etc.); flexibility. → 100% of bids realized.
- 900 MW wind farm 'He Dreiht' in the Nord Sea without subsidies (EnBW).

## 2030 aims (after 2018 revision)

2014-2016 – A policy framework for climate and energy in the period from 2020 to 2030.

- At least 40% cuts in greenhouse gas emissions (from 1990 levels) – binding EU target.
  - EU ETS 43% compared to 2005, no external credits. Non-ETS 30% compared to 2005 (national targets).
- RED II (2018/2001/EU) - At least 32% (originally 27%) share for renewable energy – binding EU target, no national targets – countries to deliver 10-year National Energy and Climate Plans to outline their plans for RES.
- At least 32.5 (originally 27%) improvement in energy efficiency. Non-binding target, indicative national targets.
- + reform of EU ETS
- + interconnection of isolated energy markets of the Baltic states, Spain, Portugal.

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# Energy efficiency

- Energy efficiency.
- Energy savings.
  
- Why to invest in EE?
- How to measure the achievements? „Normal“ technological development, impact of other factors, modeling of the scenarios...?
  
- Vs. the goal of common market to deliver a cheap energy.
- Vs. the goal of energy security.

# Energy efficiency

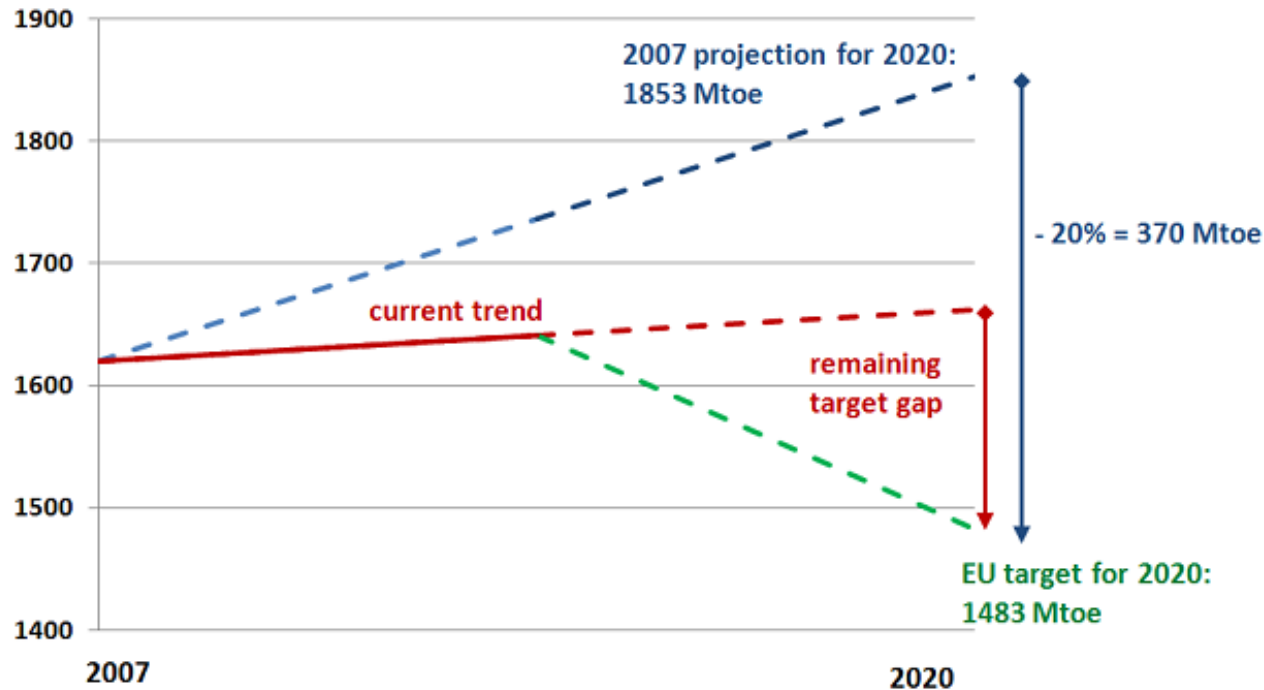
Energy and climate package 2009 (2020 targets): an energy consumption is to be cut by 20% by 2020 relative to the BAU scenario, (only) non-binding target (cap of 1483 Mtoe in 2020).

- Restriction on consumption of energy + increased energy efficiency.
- The only one that the EU is struggling to meet (18-19% by 2020).

# Energy efficiency

## EU 20% energy savings target: the target gap

EU 27 primary energy consumption (Mtoe)





# Energy efficiency instruments

- EU instruments:
  - Products (energy labeling, eco-design).
  - Transport (measures to cut vehicle and air transportation emissions).
  - Buildings (40% of all energy in the EU is consumed in building. Energy performance standards on new- esp. public - buildings).
  - Public procurement (energy efficiency a criteria when govts buy goods and services).
- National instruments:
  - National indicative energy efficiency targets.
  - National plans with national measures. (NEEAPs).

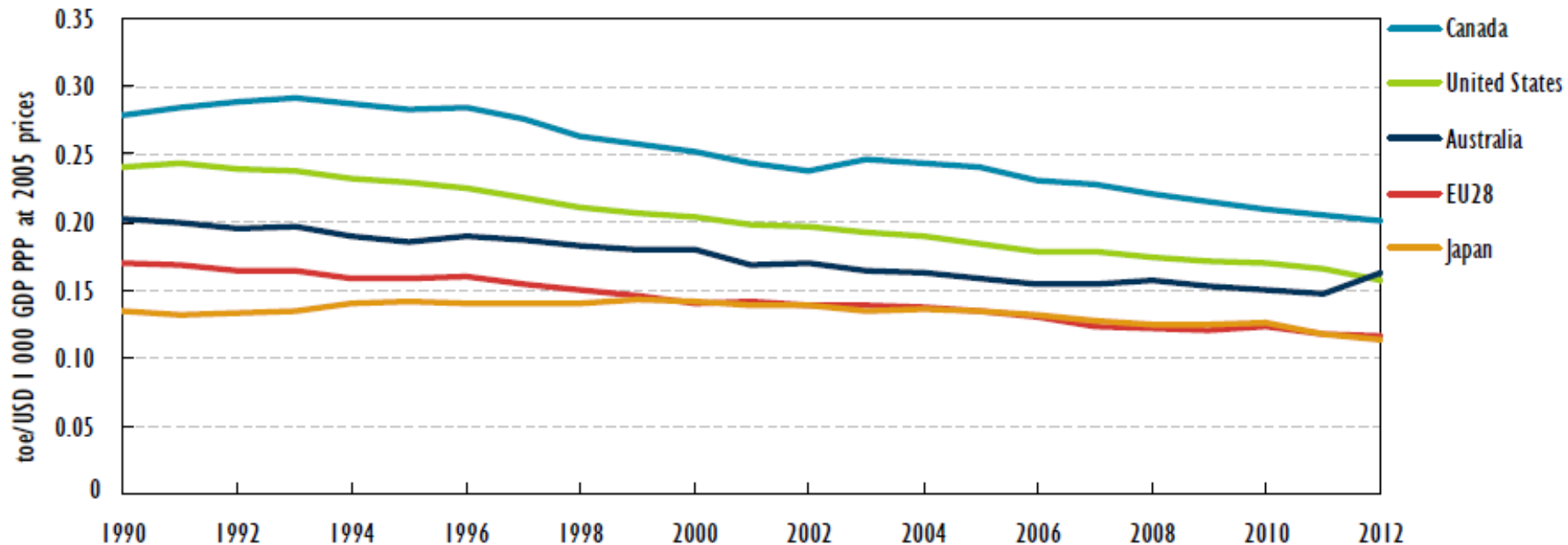
# Energy Efficiency Directive 2012/27/EC

- Developed to reach 20% target savings.
- Binding measures, not binding targets.
- MS are required to:
  - Set national targets in line with the overall EU target of 20%.
  - Evaluate the situation in national heating and cooling systems, suggest some cost-effective measures to improve them (every 5 years).
  - The same for gas and electricity infrastructure.
  - Oblige energy providers to achieve cumulative end-use energy savings by 2020 equivalent to 1,5% of annual energy sales over the period of 2014-2020, against scenario.

# Energy Efficiency Directive 2012/27/EC

- Introduce the metering and billing of actual energy consumption in all sectors – to provide consumers with data.
- Prepare public procurement rules ensuring that central governments purchase only high-efficiency products.
- Large industry enterprises to carry out an energy audits at least every four years. Audits for SME must be promoted by governments.
- Increasing attention given to appliances.
- Buildings – new buildings and buildings under renovation to be „nearly zero energy“ by the end of 2020. To improve the energy performance of 3% of the total floor area of heated and/or cooled buildings owned and occupied by the central government every year.

# Energy intensity in the EU and in selected IEA MS



Sources: IEA (2014a), *Energy Balances of OECD Countries*, OECD/IEA, Paris; IEA (2014b), *Energy Statistics of Non-OECD Countries*, OECD/IEA, Paris.

# 2018 revision of EED

- 2018 – revision of Energy Efficiency Directive – collective EU binding target of 32.5% by 2030 (possible revision in 2023). (Part of the Clean energy for all Europeans package).
- Each MS obliged to prepare a 10-year integrated National energy and climate plan (NECP) for 2021 – 2030.
  - Emphasis on metering and billing to give consumers signals to save
  - Transparent rules on the allocation of the costs of heating, cooling and hot water in multiapartment buildings.
  - Increased efficiency of electricity production.
  - And others, in line with previous versions.

# EU achievements

- EU GHG emissions reduced by 23% between 1990 and 2018, while the economy grew by 61% over the same period.
- From 2017 to 2018, emissions declined by 2%, mainly in the EU ETS sectors, mainly in power plants. Emissions from stationary installations covered by the EU ETS decreased by 4.1% compared to 2017. Emissions not covered by the EU ETS (transport, buildings, agriculture, waste...), decreased by 0.9%. This reduction comes after three years of slightly increasing emissions from these sectors.

# EU achievements

- Emissions from international aviation continued to increase in 2018, and are up 19% over the last five years.
- Malta, Germany, Ireland, and Austria may not fit into their effort sharing (non-EU ETS) limits over the period 2013 – 2020. EU as a whole is expected to overachieve the targets.
- Commitments of Kyoto first period (2008-2012) to be met. EU on track to meet targets under the second commitment period (2013-2020).

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