RES in the EEP

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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 – covers 40% of EU emissions.
  - individual targets of MS for the non-EU ETS sectors (housing, agriculture, transport, waste) – cover 60% of EU emissions.
  - CCS.

- Measures to transform the energy sectors
  - RES
  - Energy Efficiency
  - Research and development, new technologies

What are RES?

- 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.

Deployment of RES

- Why should RES be part of any energy mix?
- Why should RES be supported (subsidized)?

Drivers for deployment

- Energy security – RES are spread globally, in contrast to the conventional (fossil) fuels that are more geographically concentrated. (Import savings €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 CO2), 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 sollutions → de-centralized 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)
  - To reduce greenhouse gases by at least 20%.
  - To increase the share of renewable energy (!) in the EU's energy mix from 5% in 2005 to at least 20% of consumption in 2020. (Broken down to 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%). = RED 2009/28/EC.
  - To improve energy efficiency by at least 20%.

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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.wordpres.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 (distributors) 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.
- Compatibility with market principles, competitive price determination.

Quota obligations

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

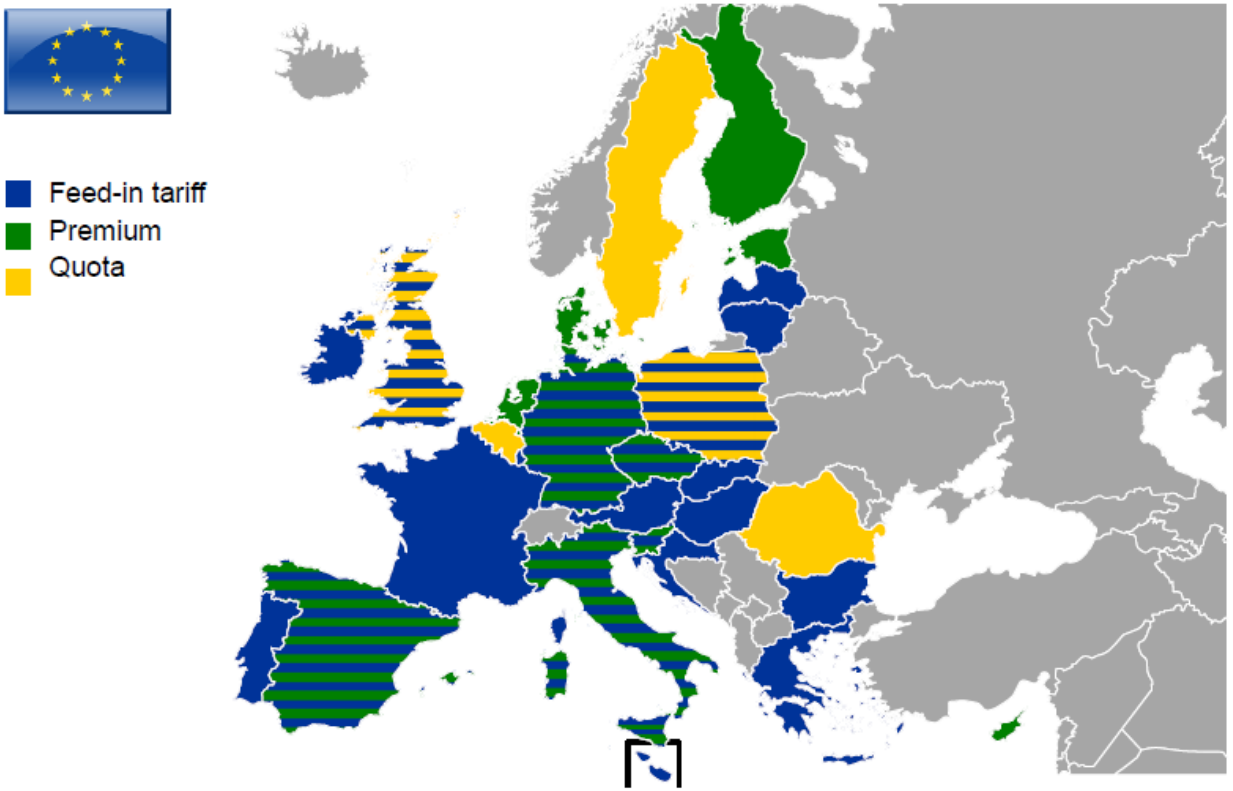
= Quota systems with tradable certificates tend to be cheaper, but favour mature technologies like onshore wind and biomass.

Feed-in Premium

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

Subsidy schemes

Renewable support schemes in the European Union, 2013



Source: EU submission, 2013.

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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

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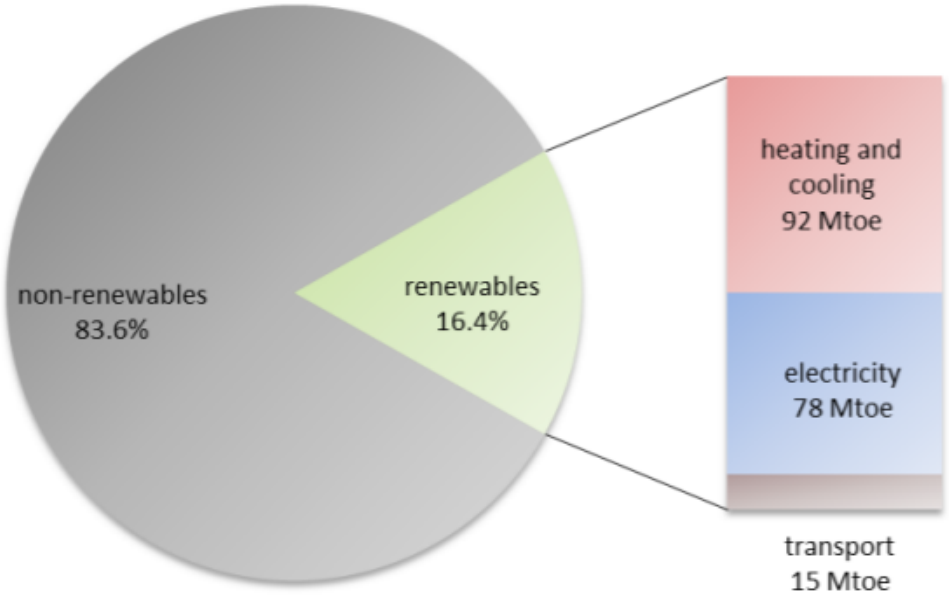
Final Energy Consumption in the EU28 (2015)



RES electricity grew by 1.4 percentage points per year between 2004 – 2014, RES heating and cooling by 0.8 percentage points and transport 0.5 percentage points.

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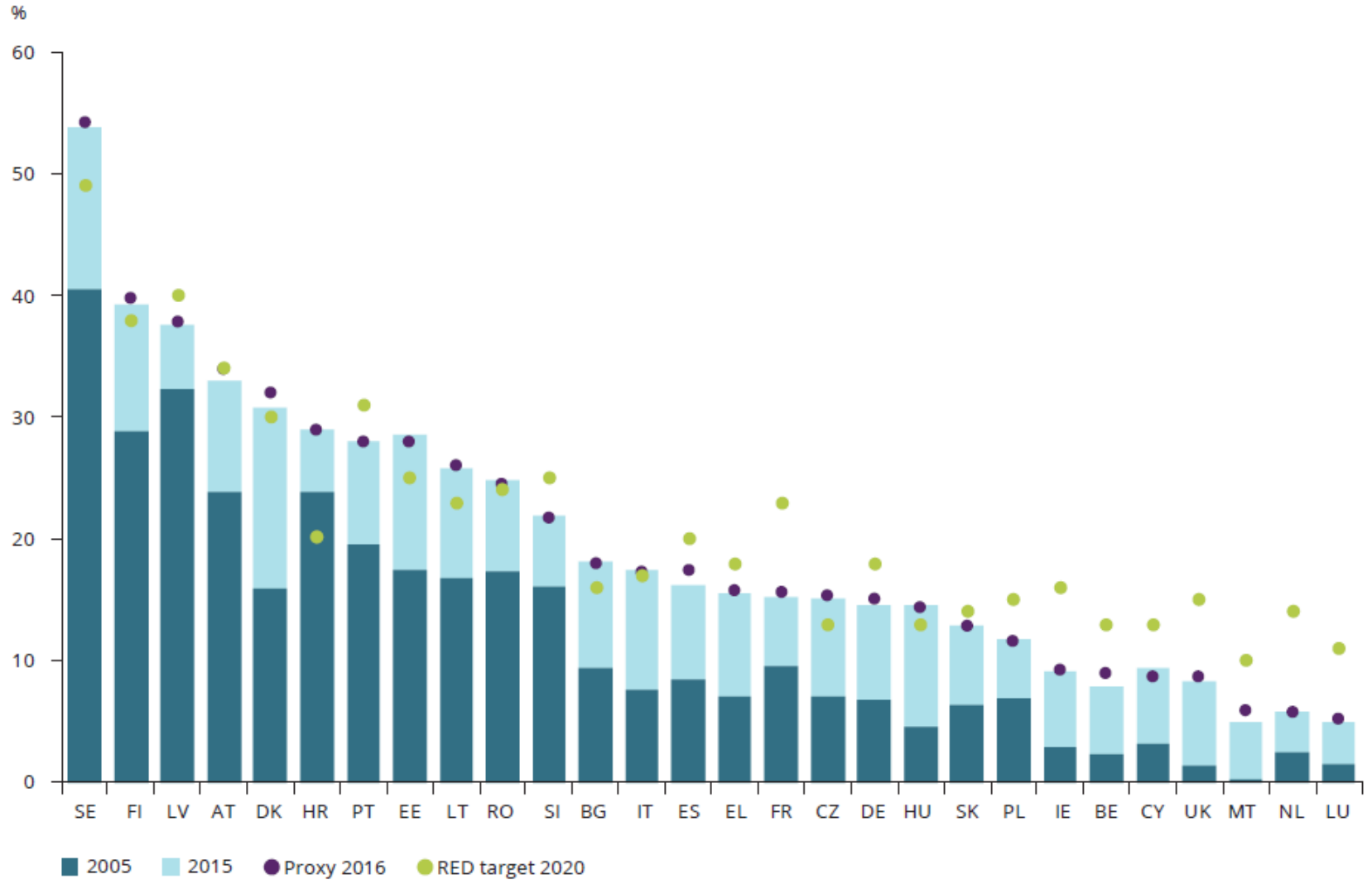
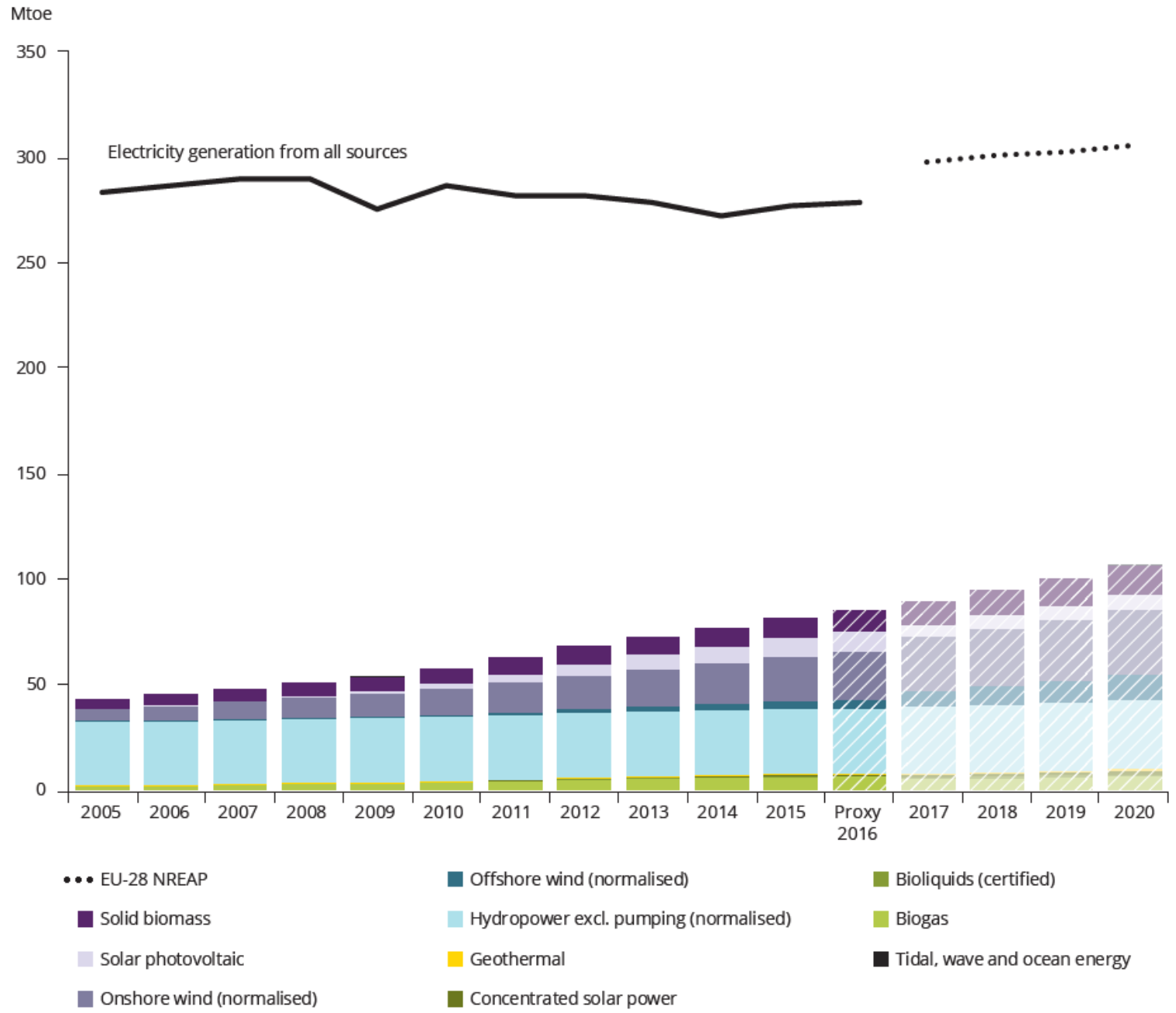
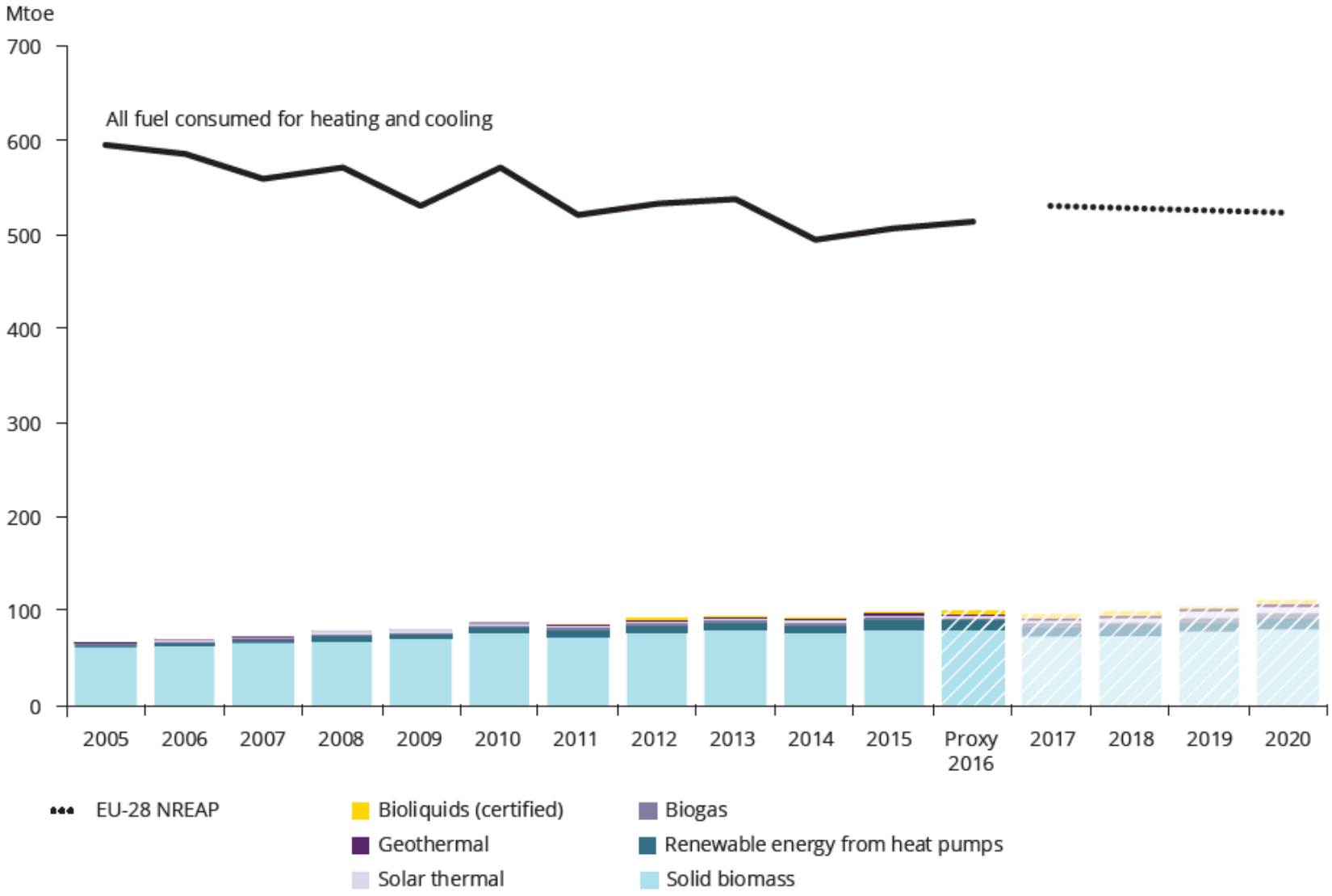
Actual and approximated RES shares in the EU-28



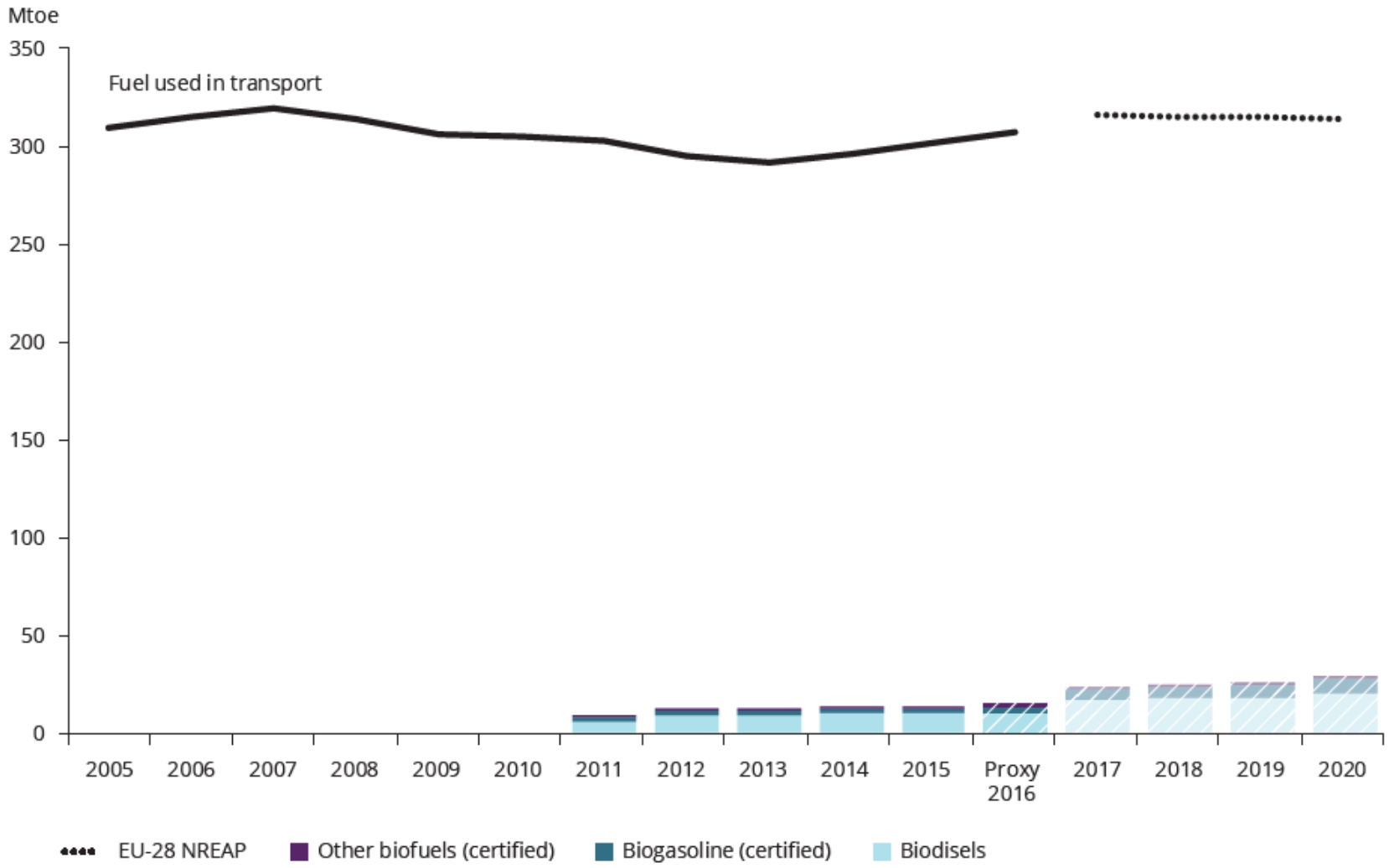
RES-E


Mtoe
350
300
250
200
150
100
50
0
Electricity generation from all sources
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Proxy 2016
2017
2018
2019
2020
EU-28 NREAP
Solid biomass
Solar photovoltaic
Onshore wind (normalised)
Offshore wind (normalised)
Hydropower excl. pumping (normalised)
Geothermal
Concentrated solar power
Bioliquids (certified)
Biogas
Tidal, wave and ocean energy

EU-28 renewable heating and cooling by source



Renewable transportation by source



Biofuels in transportation

Biodiesel

- Vegetable or animal fat-based oil, produced by transesterification. Used in diesel engines (also for heating).
- Rapeseeds, soybeam, palm oil, sunflower, peanut, hemp; waste vegetable oil; animal fats;

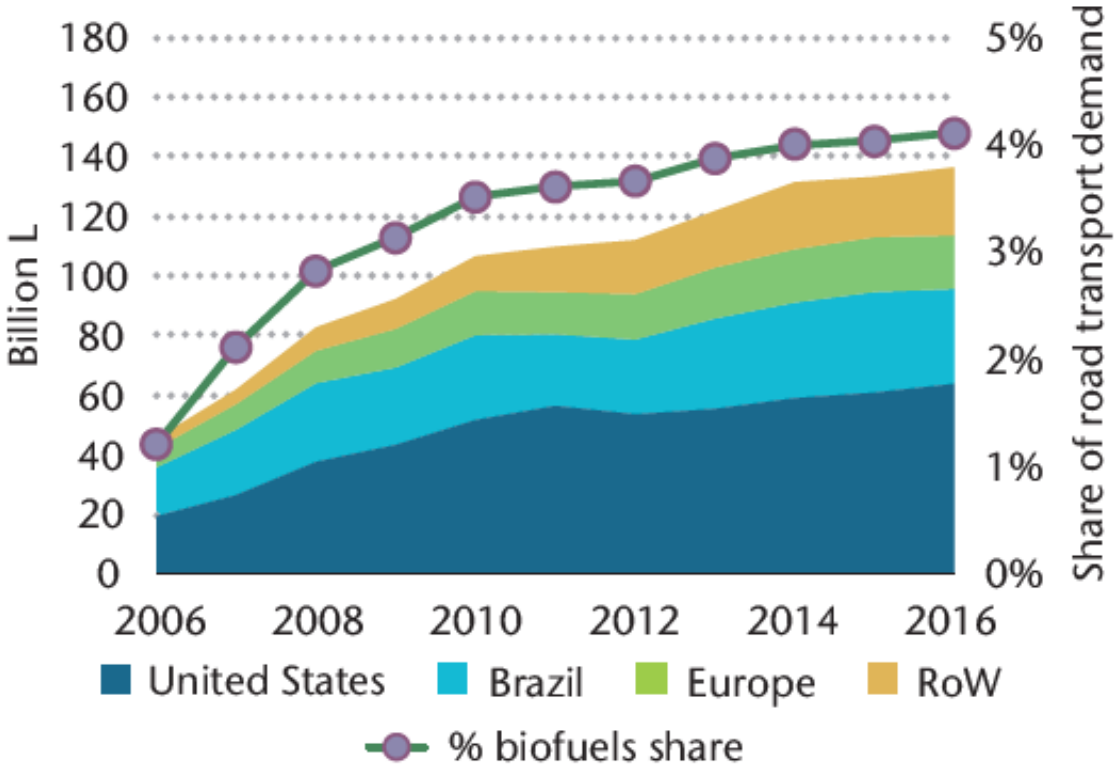
Bioethanol

- Ethanol produced by fermentation.
- Sugar and starch based feedstock (corn-maize, sugarcane).

Biofuels in transportation

- Global production of conventional biofuels at 136,5 bn. litres – around 4% of energy used in transportation.
- Double digit global output prior to 2010 slowed to about 4% y-o-y over 2010-2016 (economic and structural challenges, policy uncertainty in key markets). Growth of around 3% a year anticipated over the next five years.
- Ethanol production concentrated in a handful of countries (USA, Brazil, EU, China, Canada, Thailand, Argentina, India), biodiesel production more evenly distributed (US, Brazil, Germany, Argentina, Indonesia, France, Thailand, China, Canada…).
- Growth expected in China (10% blend goal), Latin America, Asia.

Global biofuels production and share of world road transport fuel demand



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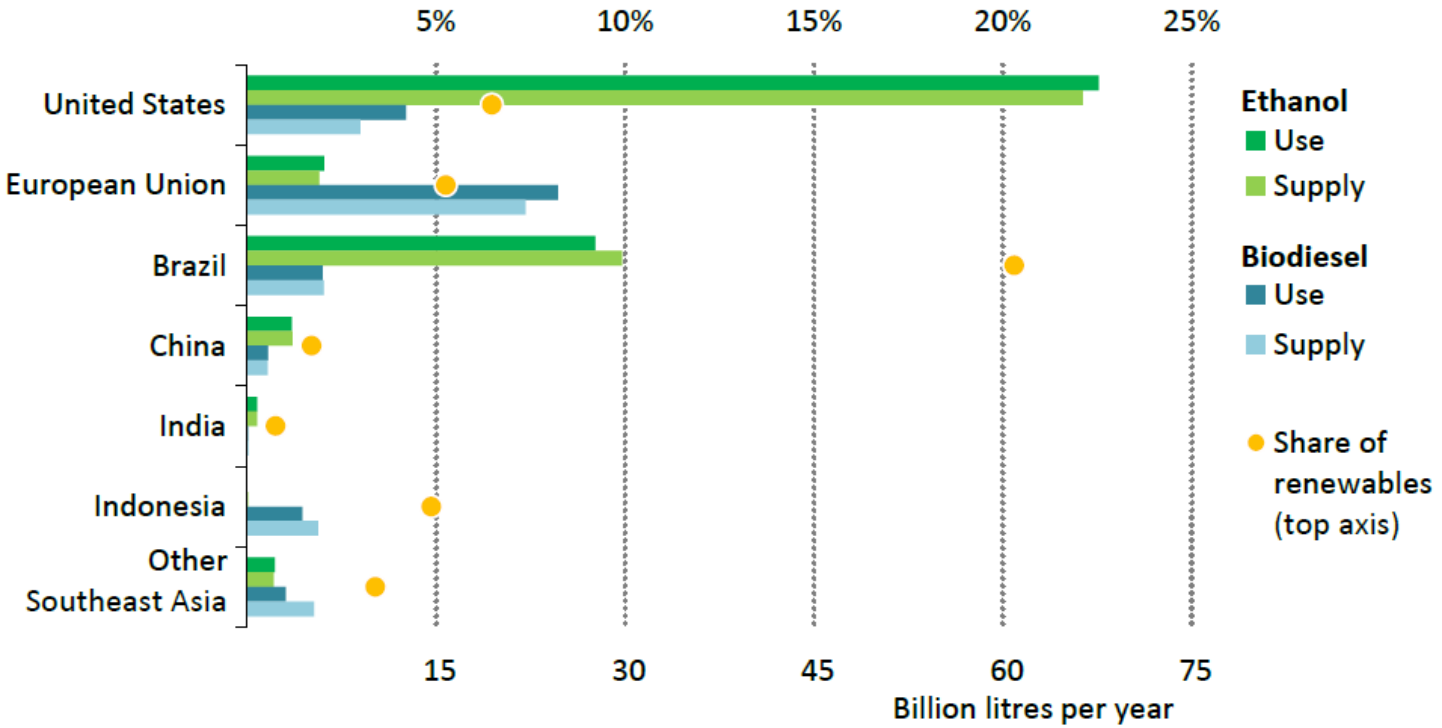
Biofuels production, consumption, and share of RES in transport energy use in selected regions, 2017



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Biofuels in transportation

Demand driven by

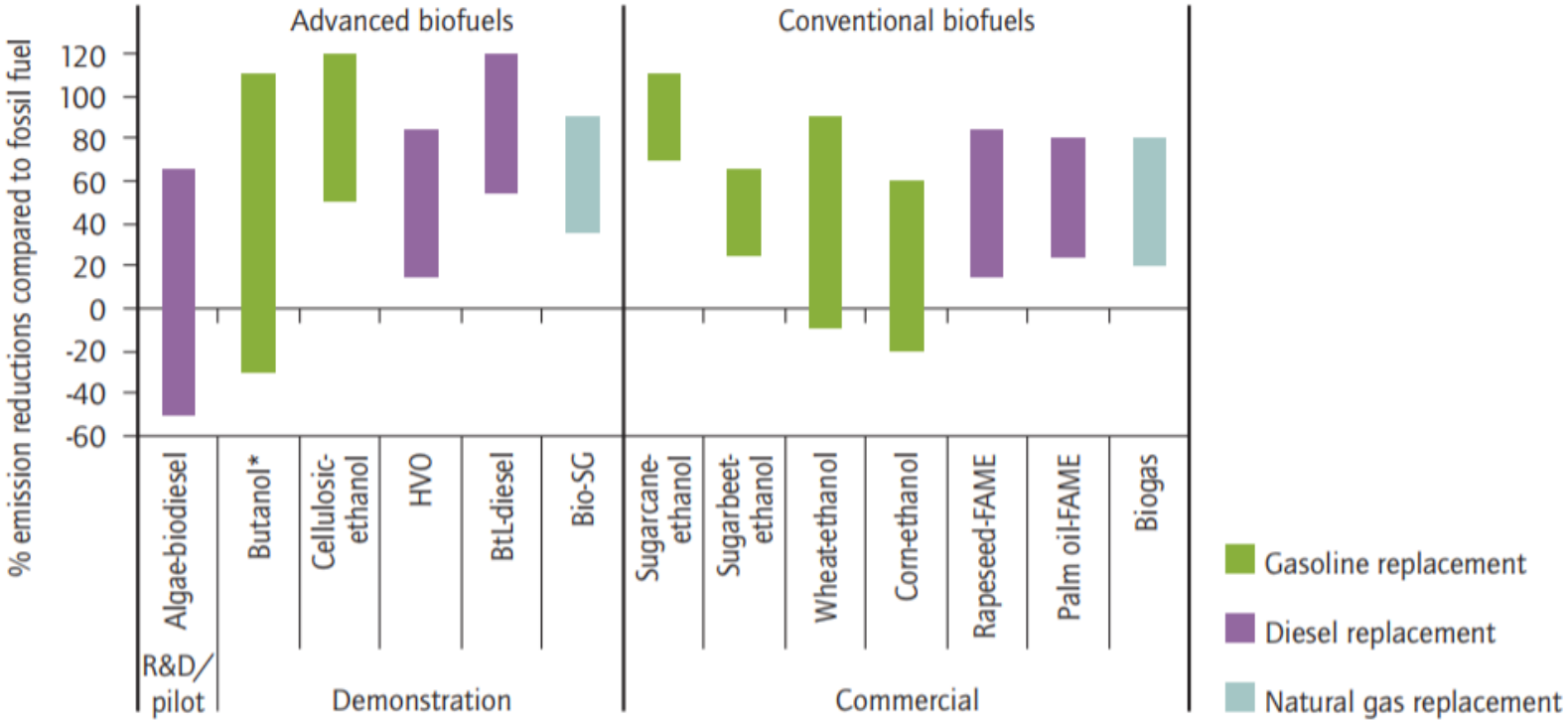
- Exemption from excise duty on fuels.
- Mandates stipulating blending.
- Agriculture support.

Biofuels in transportation

Controversy due to the

- environmental impact - The other conventional biofuels deliver savings under 40% compared to fossil fuel alternative (plus land use - soil acidification, fertilizer use, biodiversity loss, toxicity of agricultural pesticides). Also growing global trade.
- impact on food prices – crisis in 2005-2008. Corn prices almost tripled, wheat increased by 130%, rice 170%. Traditional biofuels compete with food for the same arable land. Peak probably combination of high prices of oil, poor harvests, speculations and biofuels.

Impact on environment



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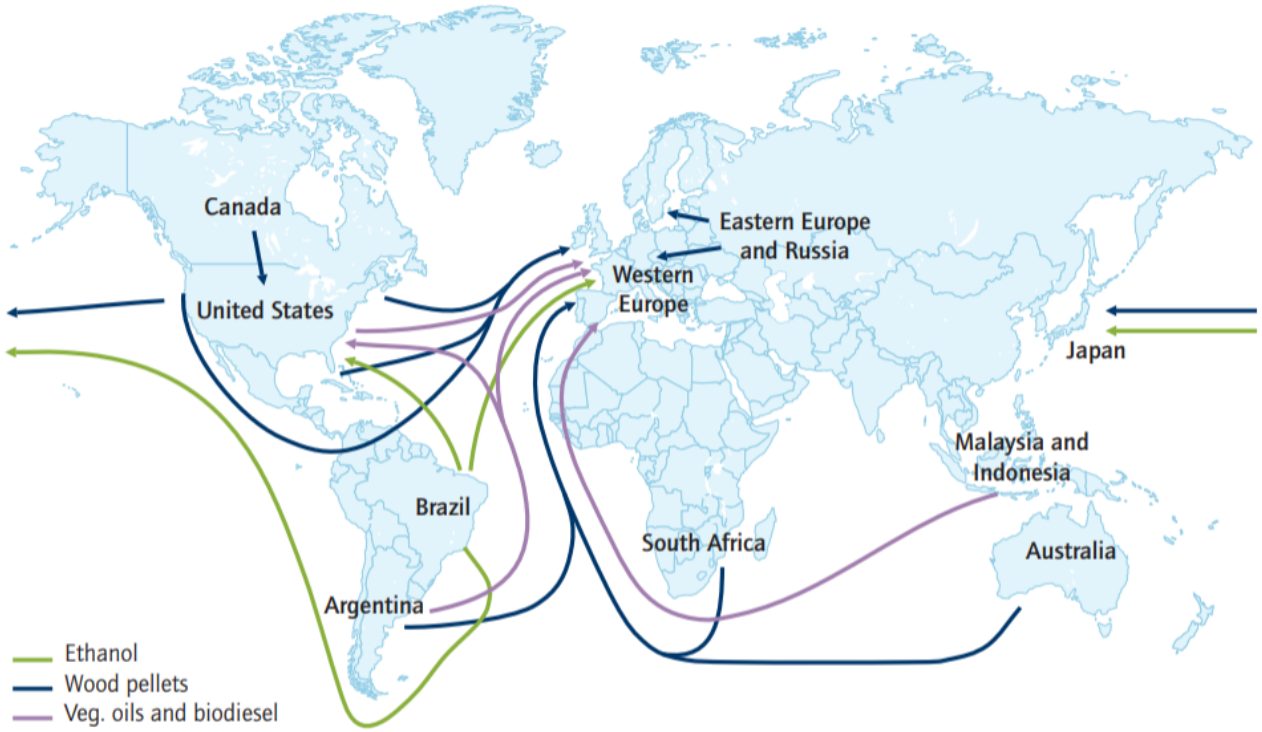
World biomass shipping today



Source: Based on Bradley *et al.*, 2009.

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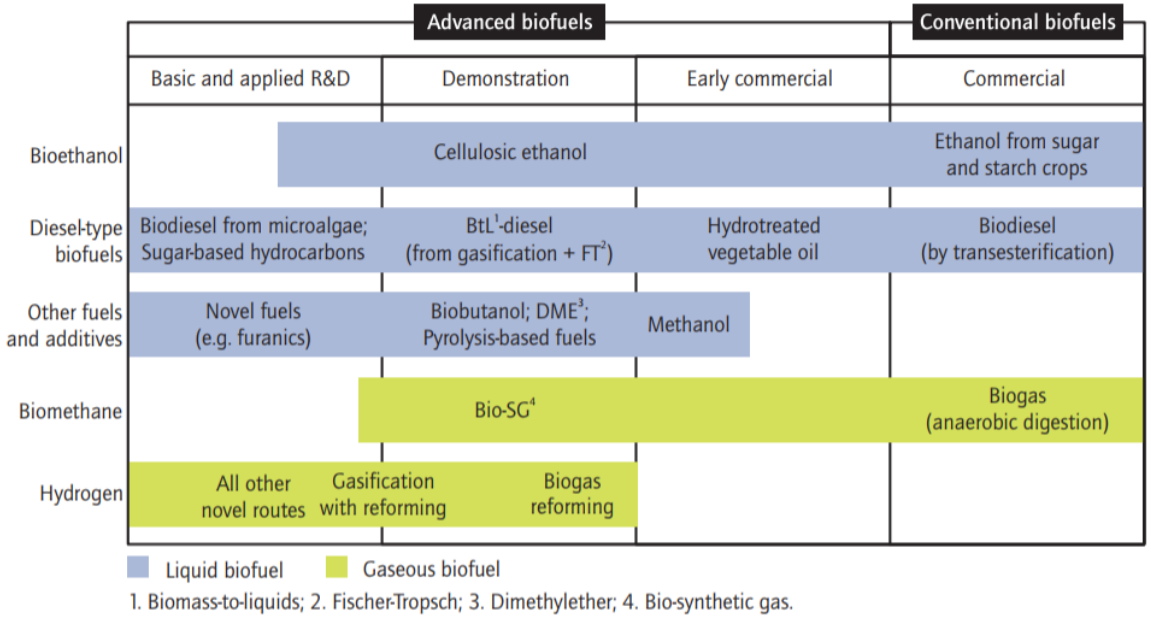
Future of biofuels

- Dependent of successful development of advanced biofuels - fuels produced from non-food crop feedstocks, with significant life-cycle GHG emissions savings compared with fossil fuel alternatives, and which do not directly compete with food and feed crops for agricultural land or cause adverse sustainability impacts.



1. Biomass-to-liquids; 2. Fischer-Tropsch; 3. Dimethylether; 4. Bio-synthetic gas.

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Biofuels – imports and move to the 2nd generation

- In 2014, up to 10% of bioethanol (wheat, maize, sugar beet) and around 26% of biodiesel (rapeseed, waste oils, palm oil) consumed in the EU was imported – Malaysia for biodiesel, Guatemala, Bolivia, Pakistan, Russia, Peru for bioethanol.
- Non-EU feedstock - bioethanol (up to 10%) from Ukraine (maize, wheat), Canada (wheat), Russia and Moldova (barley, ray), Serbia (sugar beet). Biodiesel (up to 40%) Indonesia and Malaysia (palm oil), Brazil and the US (soybean).
- Share of biofuels from wastes, residues, ligno-cellulosic and non-food cellulosic material in the EU´s biofuel mix has increased from 1% in 2009 to 23% in 2015. (Sweden, the United Kingdom, Germany).

Biofuel targets

- 14% share of renewable energy in the transport sector by 2030
  - A non-food based biofuels blending target of 3.5% by 2030 (according to the list of second-generation biofuels that are eligible to receive subsidies).
  - Implementation of additional sustainability criteria for biofuels limiting imports of feedstock with risk of deforestation.
  - Conventional biofuels in transport at maximal level of 3.8% in 2030. (7% in 2021).
  - Low emissions fuels (RES electricity, advanced biouels) in transport 6.8%.

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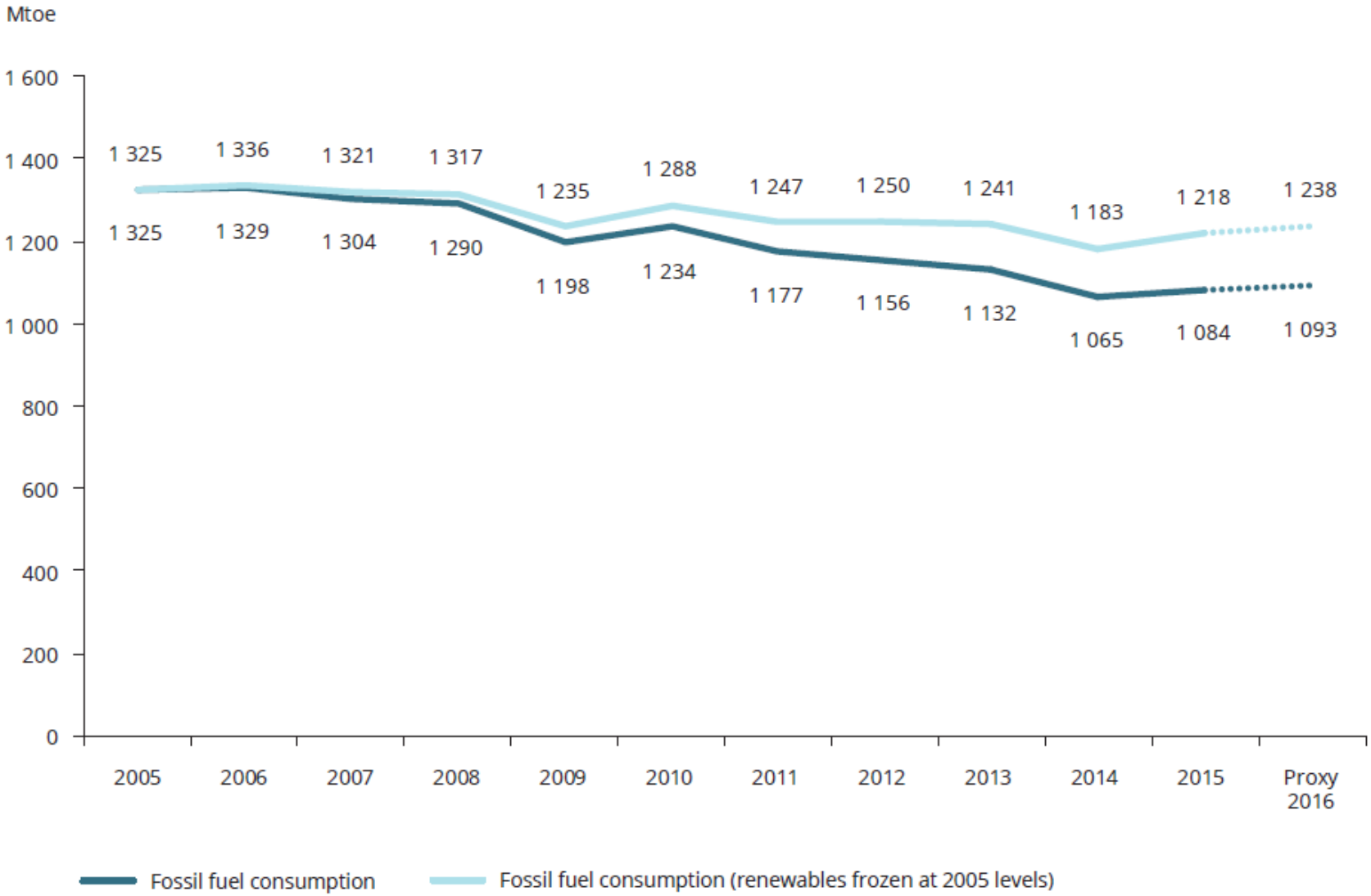
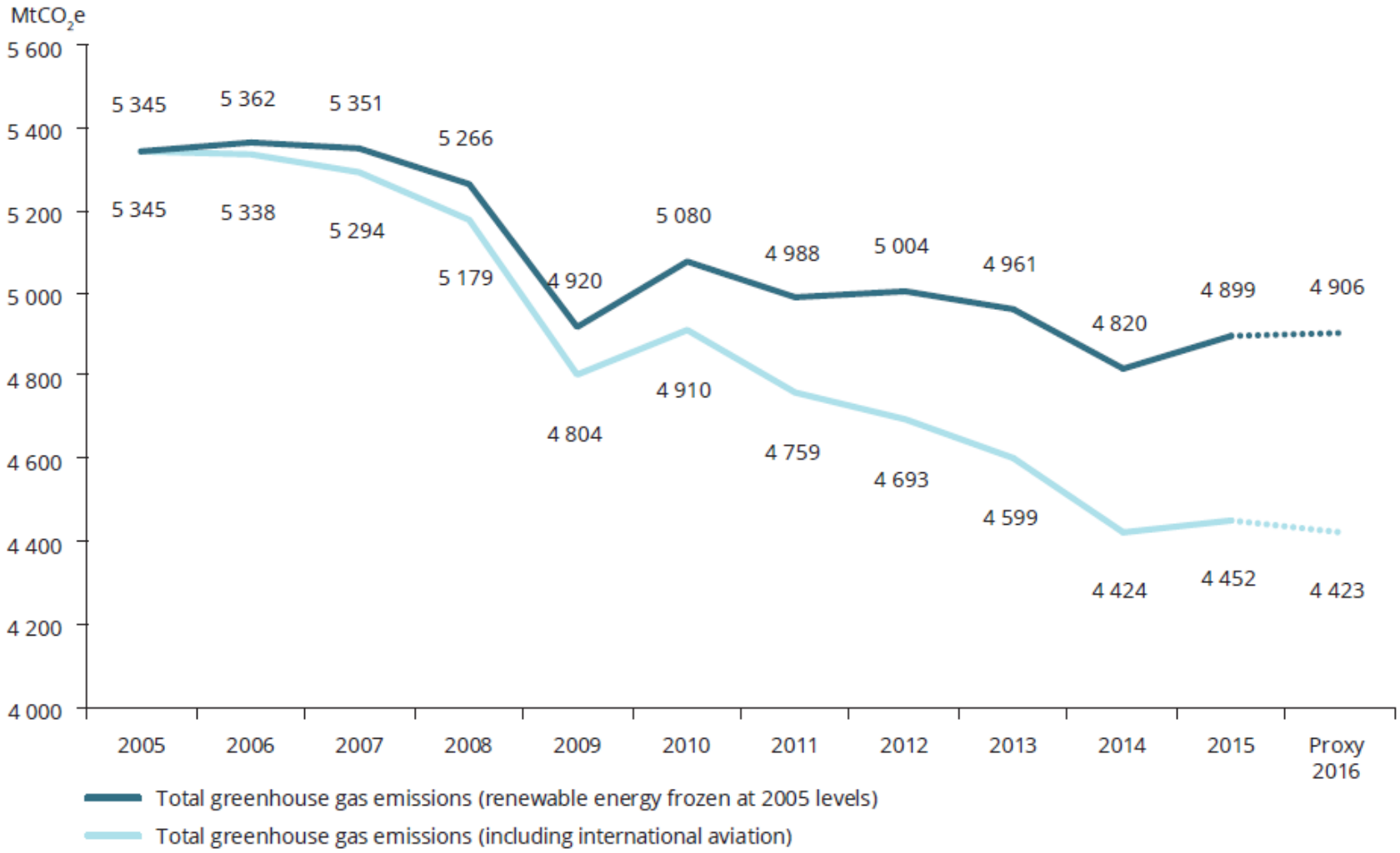
Estimated effect on fossil fuel consumption in the EU 28



Estimated gross effect on GHG emissions in the EU 28



Integration of RES to the system

- Electricity generation evercapacity 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 - In 2012, more than €40bn, in 2013 €50bn.

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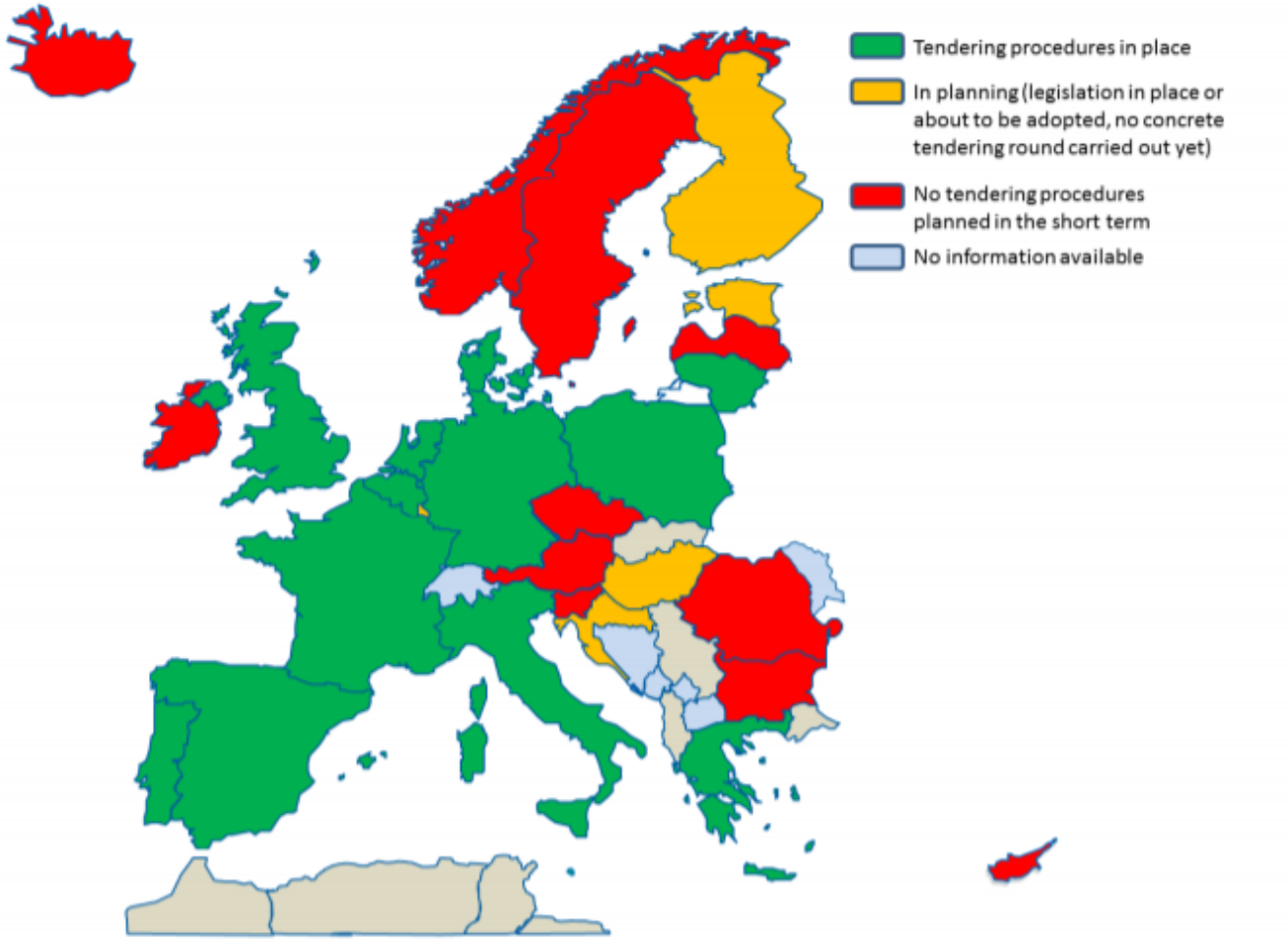
Integration of RES to the system

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).

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2030 aims

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

- A binding target of 40% reduction of emission (below the 1990 baseline) – fully domestic reduction.
- A binding target for an average renewable share of total energy consumption of 27%, for the whole EU. No national targets.
- An Indicative target of a 27% increase in the EU energy efficiency, no national targets.
- + reforms of EU ETS
- + interconnection of isolated energy markets of the Baltic states, Spain, Portugal.

Sources

- IEA (2014): Energy Policies of IEA Countries – The European Union
- Yeo, S.(2017): EU energy package: What it means for coal, renewables and efficiency
- EC (2017): Renewable Energy Process Report
- CEER (2018): Tendering procedures for RES in Europe: State of play and first lessons learnt.
- IEA: World Energy Outlook 2018

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