EU Renewable Energy Policies – Analysis of historic developments

Transatlantic Climate Bridge

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Patrick Lamers, Ecofys, p.lamers@ecofys.com

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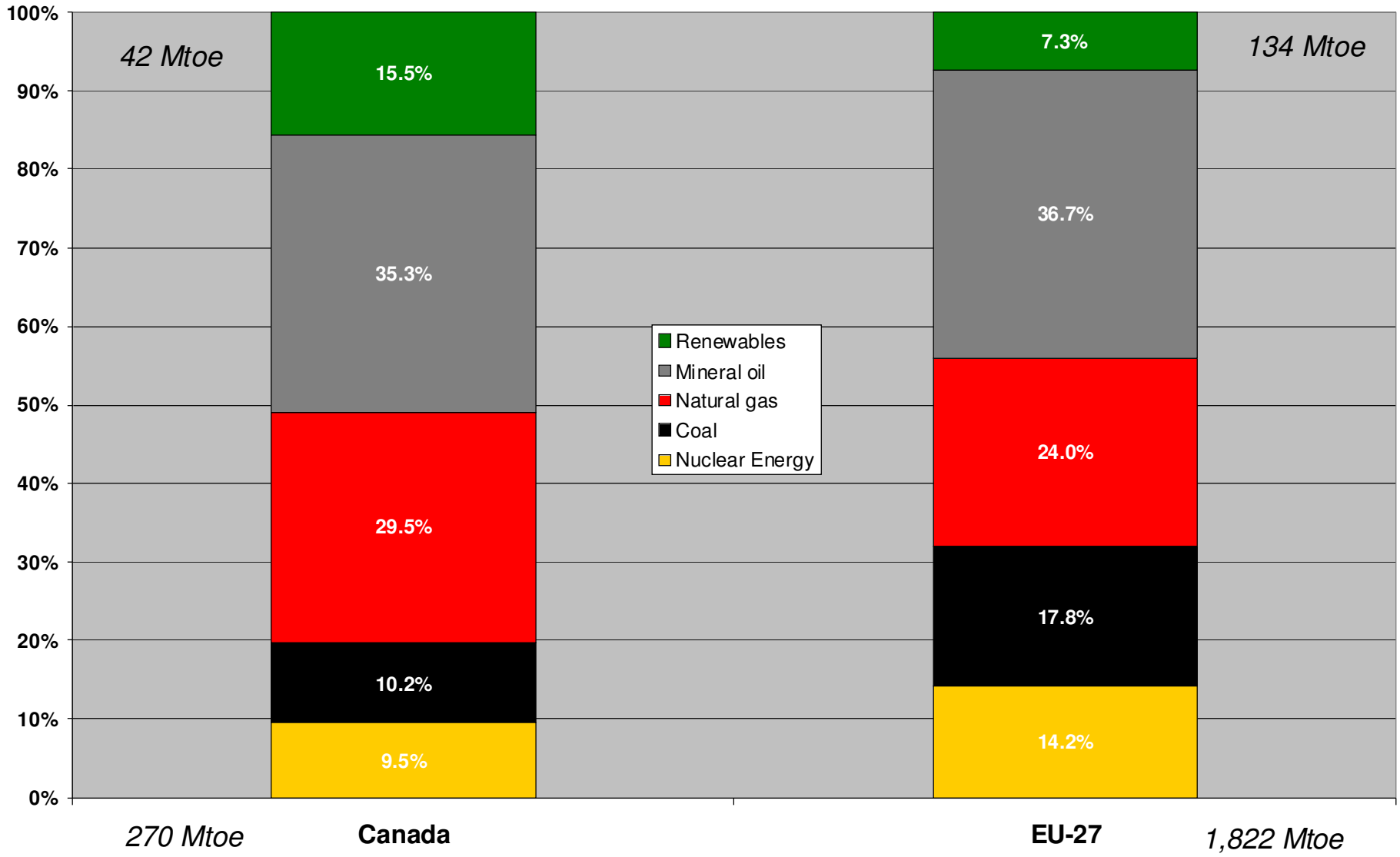
Energy Supply total, 2006 (OECD data)



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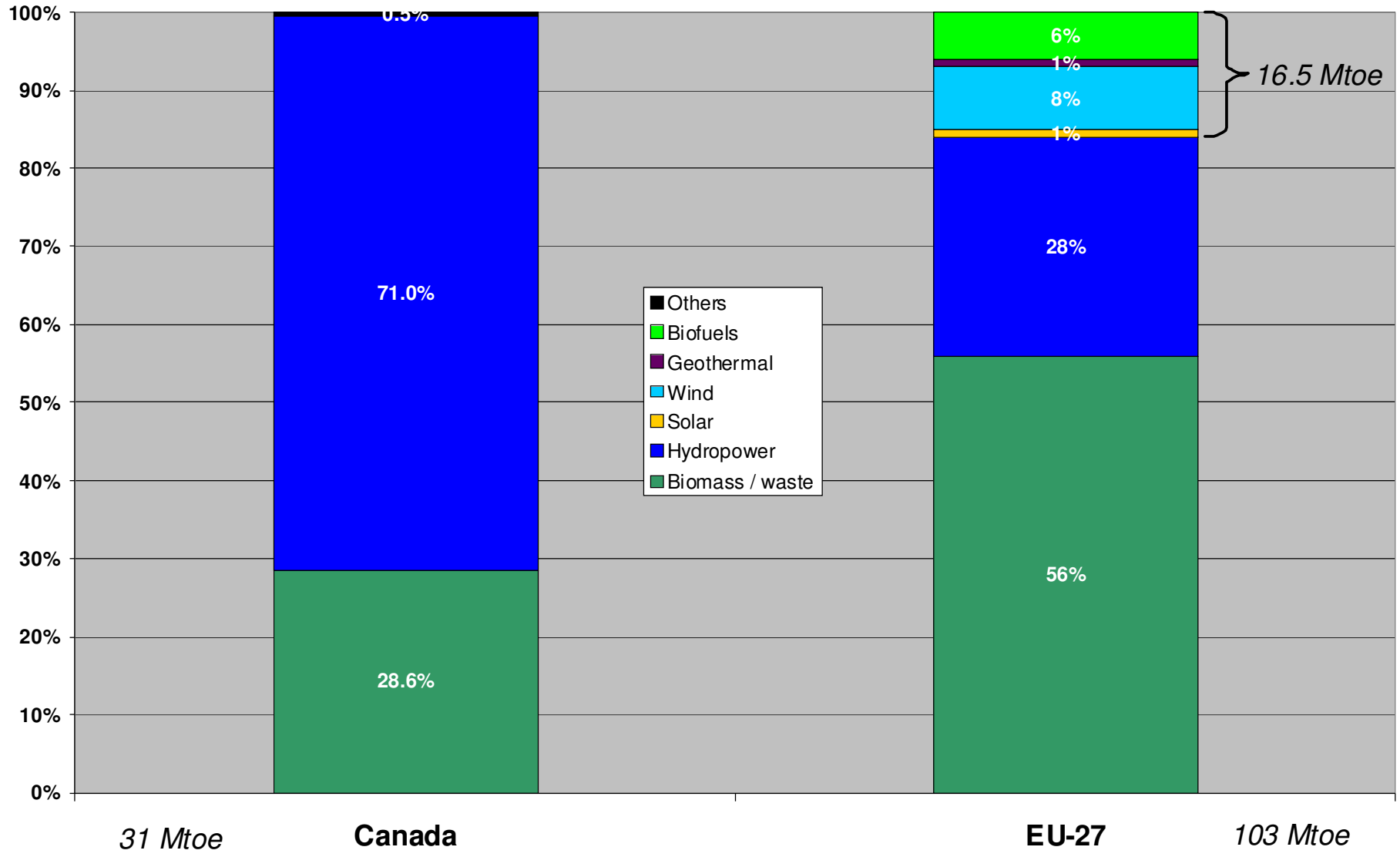
Energy Supply RES, 2006 (OECD data)



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Outline

1. Overview: EU RES policies and markets
2. Case studies for RES-E development in EU
   - Germany: FITS
   - Spain: FIPS & FITS
   - UK: quota obligation
3. Evaluation: effectiveness and efficiency indicators for RES-E
4. Conclusions

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1. Policies and Markets

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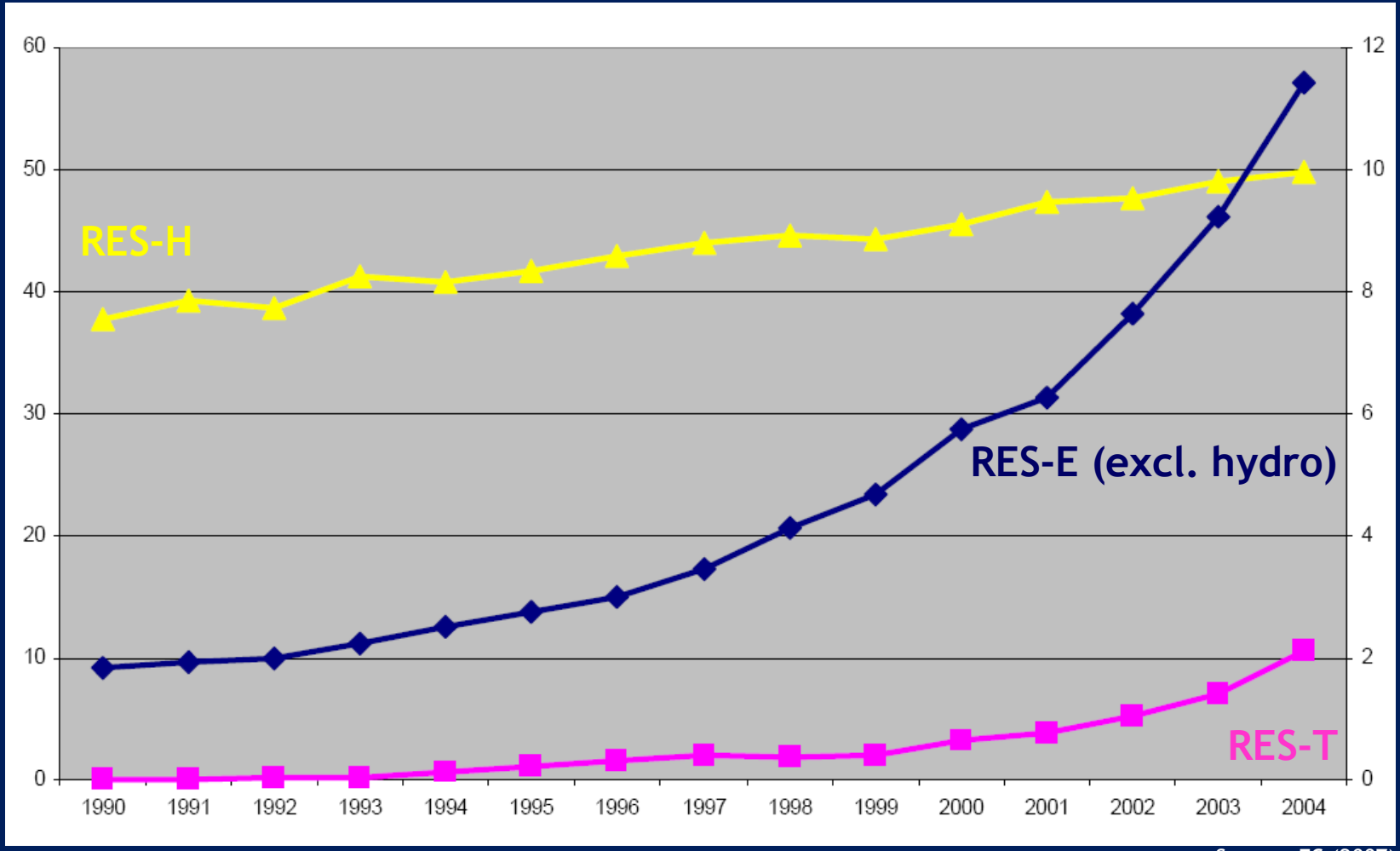
Overall RES development EU-27 (Mtoe)



Source: EC (2007)

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Policy development

2001: Adoption of the EU Directive on the **promotion of RES-E**: EU-wide RES-E target of 22 % (gross electricity consumption) by 2010. (2001/77/EC)

2003: Adoption of the **EU Biofuels Directive**: 2 % and 5 % reference value for market shares of biofuels in 2005 and 2010 respectively. (2003/30/EC)

2007: EC presents its 'Renewable Energy Roadmap'
EU Council agrees on 20 % binding RES share until 2020

2008: EU Climate Energy Package for 2020

Directive for the promotion of RES (2008/16/EC)

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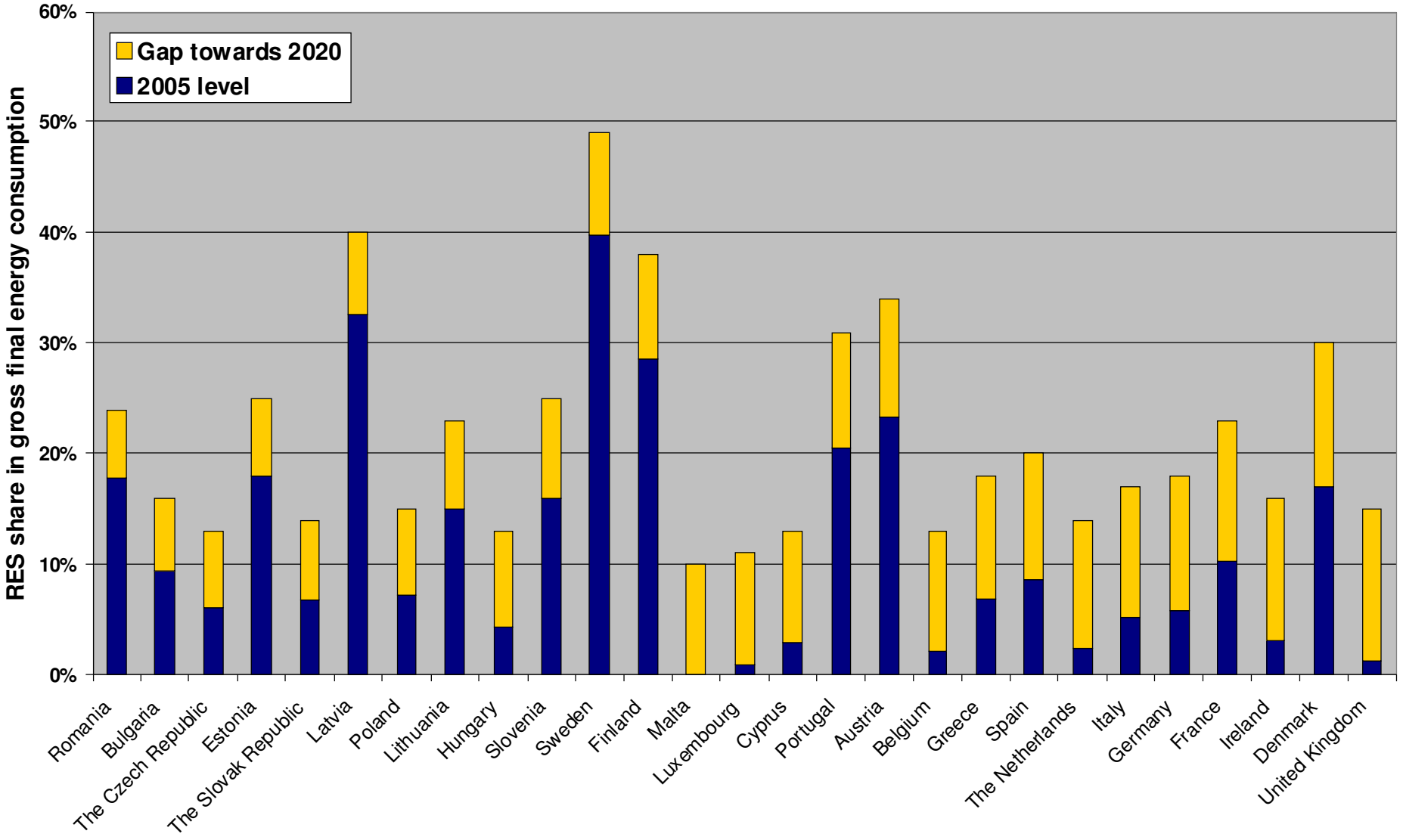
RES Directive (2008/16/EC)

- Part of the Climate Energy Package: 20-20-20 in 2020
- 20 % RES share in final energy consumption (whole sector)
- 10 % minimum target for RES-T
- Individual targets for EU member states
- Option for Guarantee of Origin Trade (green certificates)
- Introduction of flexibility mechanisms
  - Statistical transfer
  - Joint projects
  - Joint support schemes



Source: Lamers et al. (2009)

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RES-E support instruments

Support level		Example
Investment support		Soft loans, capital grants, tax exemptions, reductions on the purchase of goods, etc.
Operating support	Price based	Feed-in schemes, tender schemes, tax exemptions, etc.
	Quantity based	Quota obligations, tradable green certificates, tender schemes, etc.

→ Additional measures: R&D, information campaigns, etc.

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Short comparison of quotas & FIS

Quota obligations based on Tradable Green Certificates

- Volume set by the government (e.g. in MWh or % of sales)
- TGC price determined by the market
- Not necessarily technology specific

→ High risk premium (full market exposure)

Feed-in schemes

- Price set by the government
- Volume determined by the market
- Allow technology specific support at cost level if premiums or tariffs are determined correctly

→ Low risk premium (limited market exposure)

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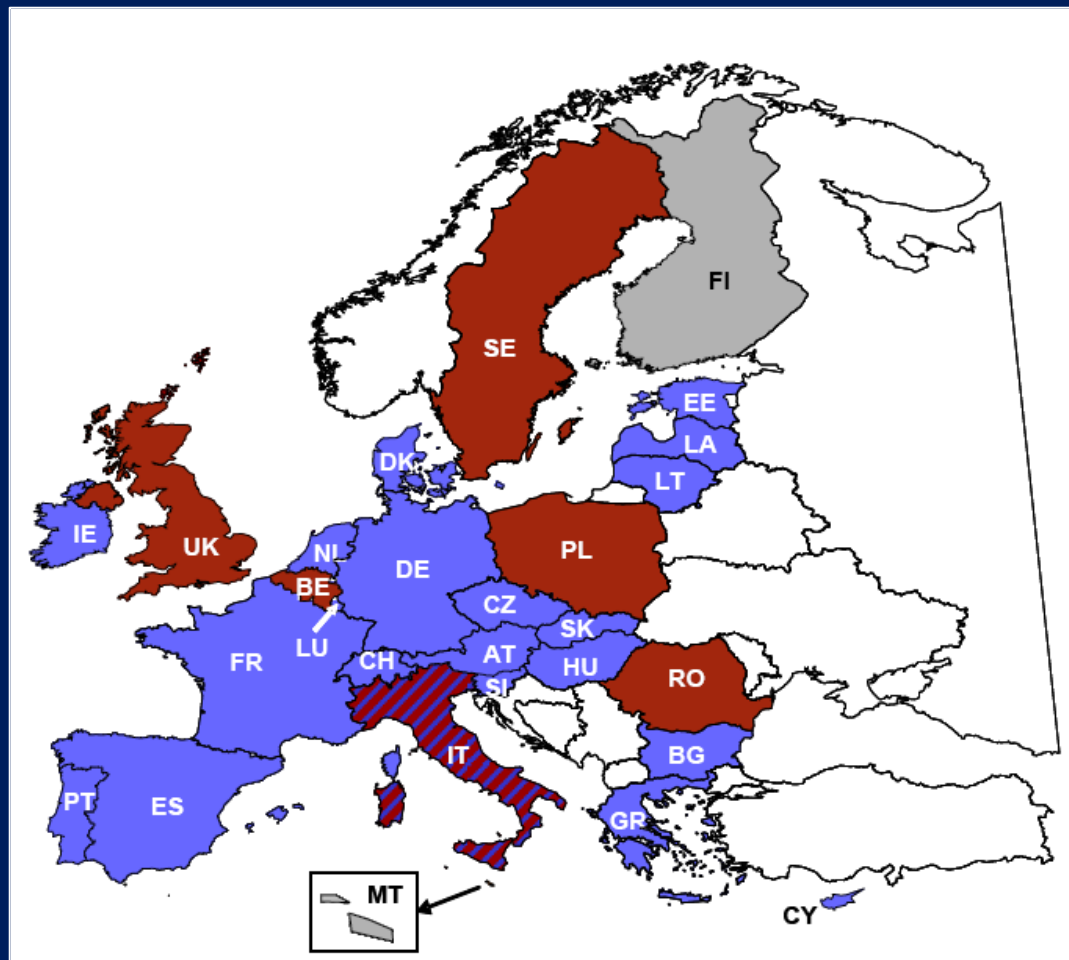
RES-E support schemes in EU-27



- FIS is most common
- 6 MS use quota obligations with TGC

Source: Klein et al. (2008)

- Feed-in tariff system
- Quota obligation with Tradable Green Certificates (TGC)
- Tax incentives / Investment grants

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2. Case studies

a. Germany: Feed-in tariff scheme 

b. Spain: Feed-in premium / tariff scheme 

c. UK: quota obligation 

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German FIT scheme

- Technology-specific FIT-system (20 years) with declining remuneration rates
- Remuneration payment chain (typical for FIS):
  RES plant <> DNO <> TSO <> DNO <...> power customer
- Long-term policy framework allowed strong RES-E growth with broad technology portfolio
- FIT had proven positive impact on domestic industry and employment
- FIT legislation is reviewed and adapted periodically (2000, 2004, 2008/2009)

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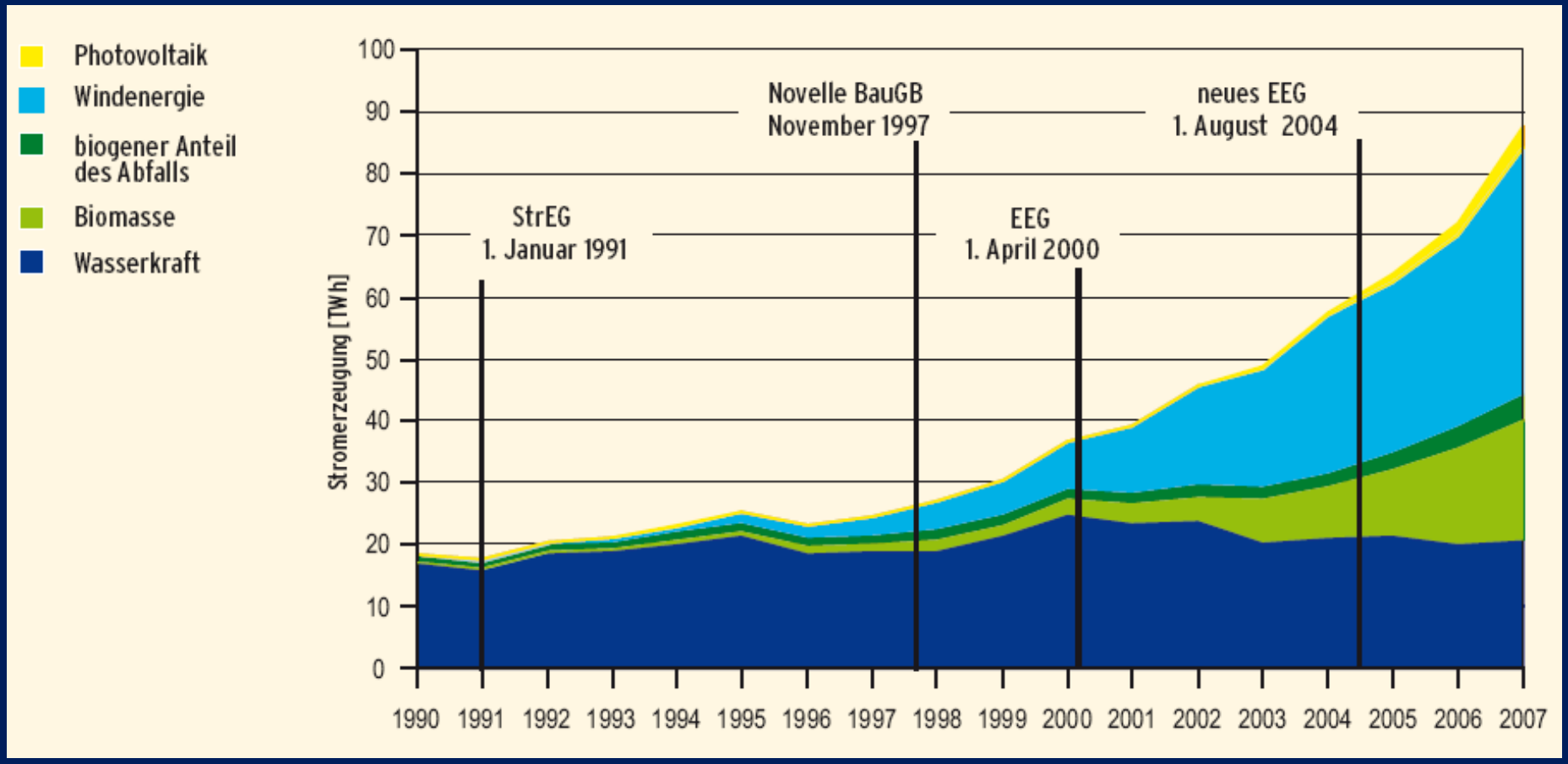
Overall RES-E development



Source: BMU (2008)

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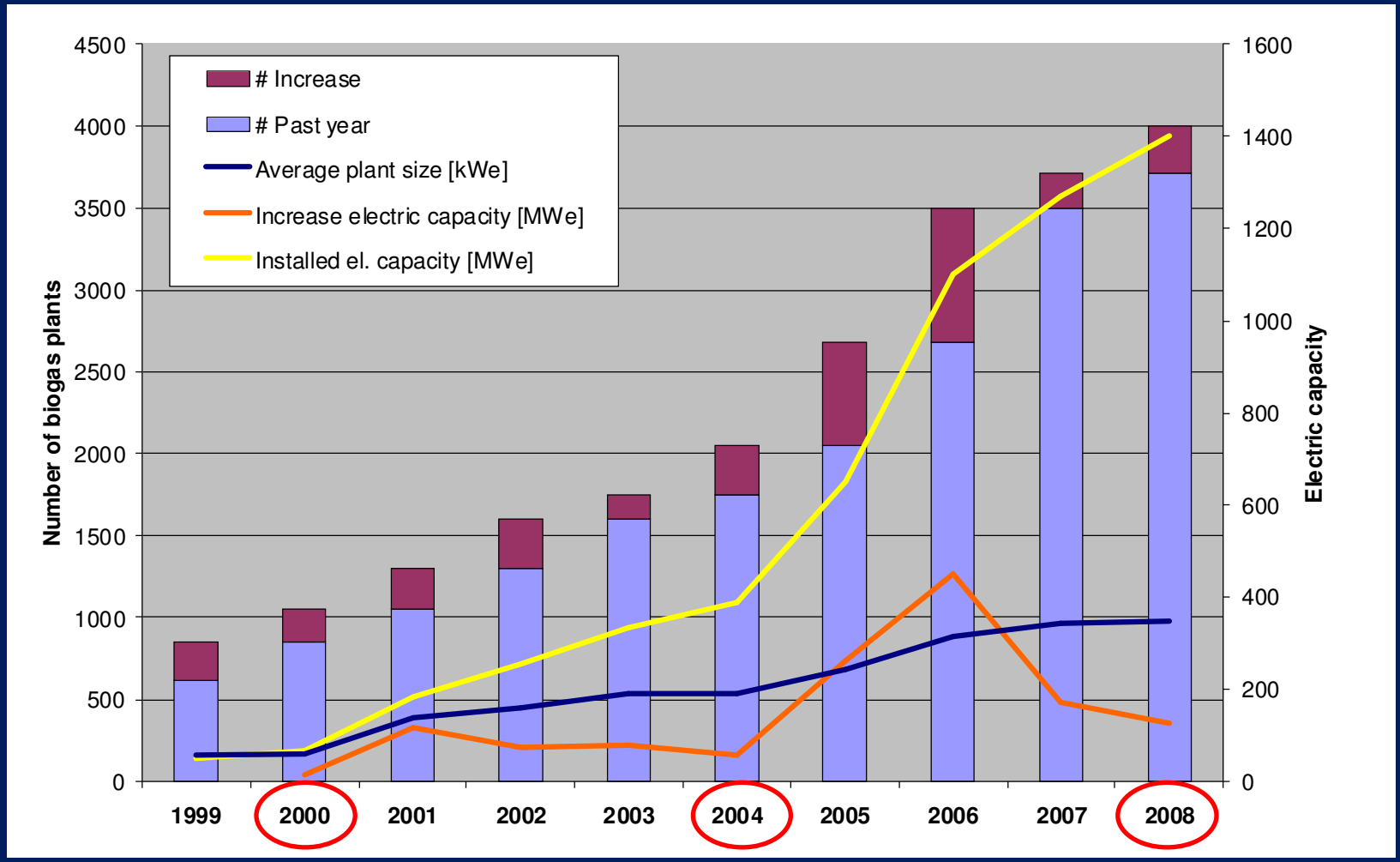
FIT adaptation – e.g. biogas



Source: Lamers & Hofmann (2009)

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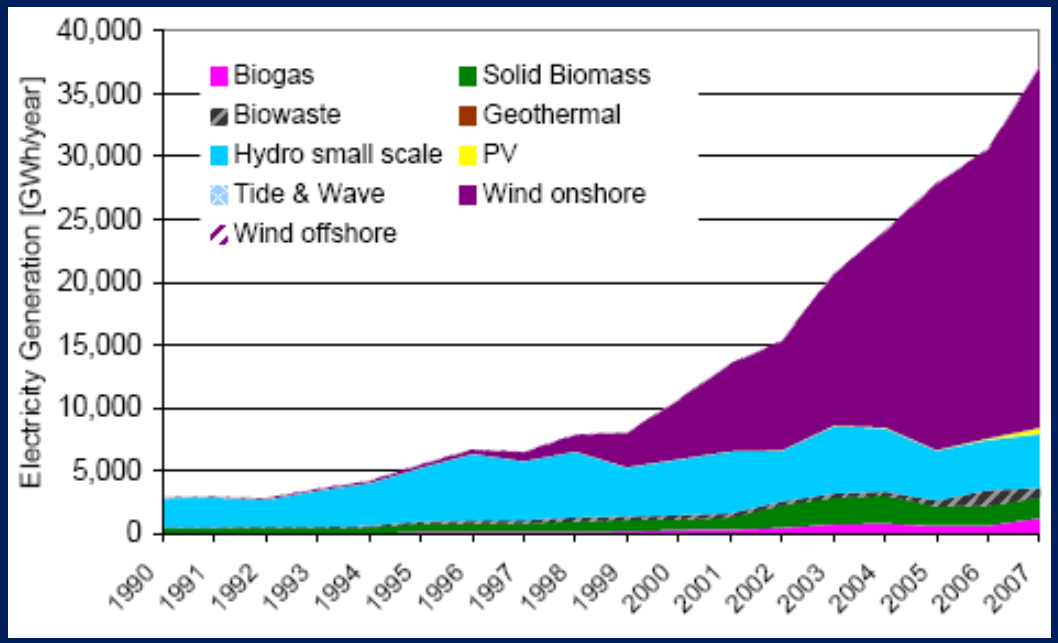
Spanish FIT/FIP scheme

- Annual FIP or FIT option for lifetime of RES-E system
- Floor and cap prices set a fixed range of the overall remuneration (since 2007)
- Very effective for wind energy
- Changes in policy have created uncertainty among investors (e.g. reduction of PV-tariffs by 30 %)



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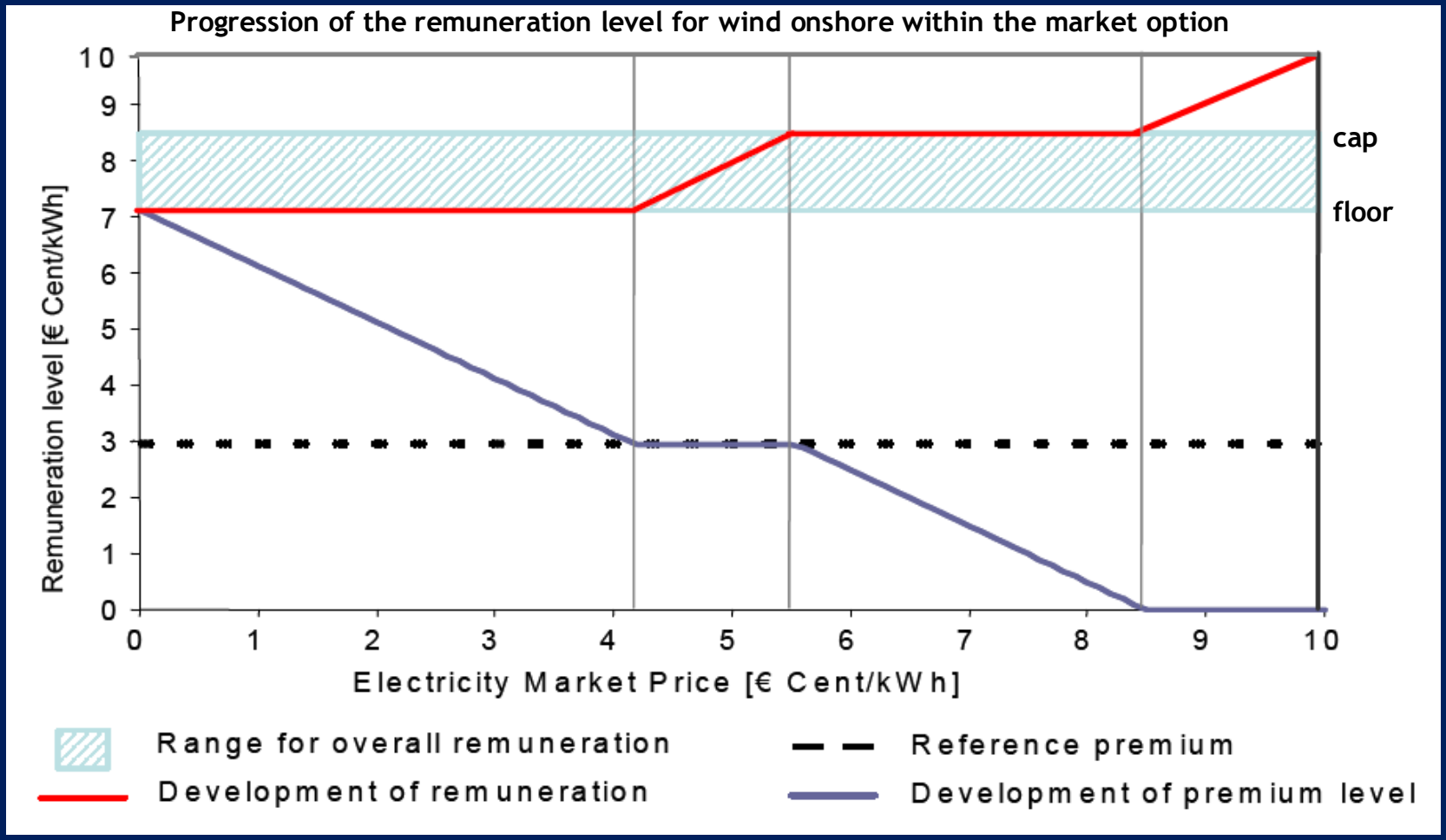
FIP wind on-shore



Source: Held et al. (2008)

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UK ROC scheme

- Renewable obligations for electricity providers (6.7 % in 2007)
- Proof through certificates (ROC) issued by the regulator:
  1 ROC = 1 MWh
- So far no technology banding i.e.
  1 MWh of any technology = 1 ROC (might change in 2009)
- Penalty for non-comliance (adjusted annually)
- Penalty is stacked in a buy-out fund
- Fund is recycled annually to electricity providers in proportion to the ROCs surrendered during the compliance period
  → ROC value = buy-out price + recycle payment
- So far the scheme has not been effective

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3. Evaluating RES-E policies

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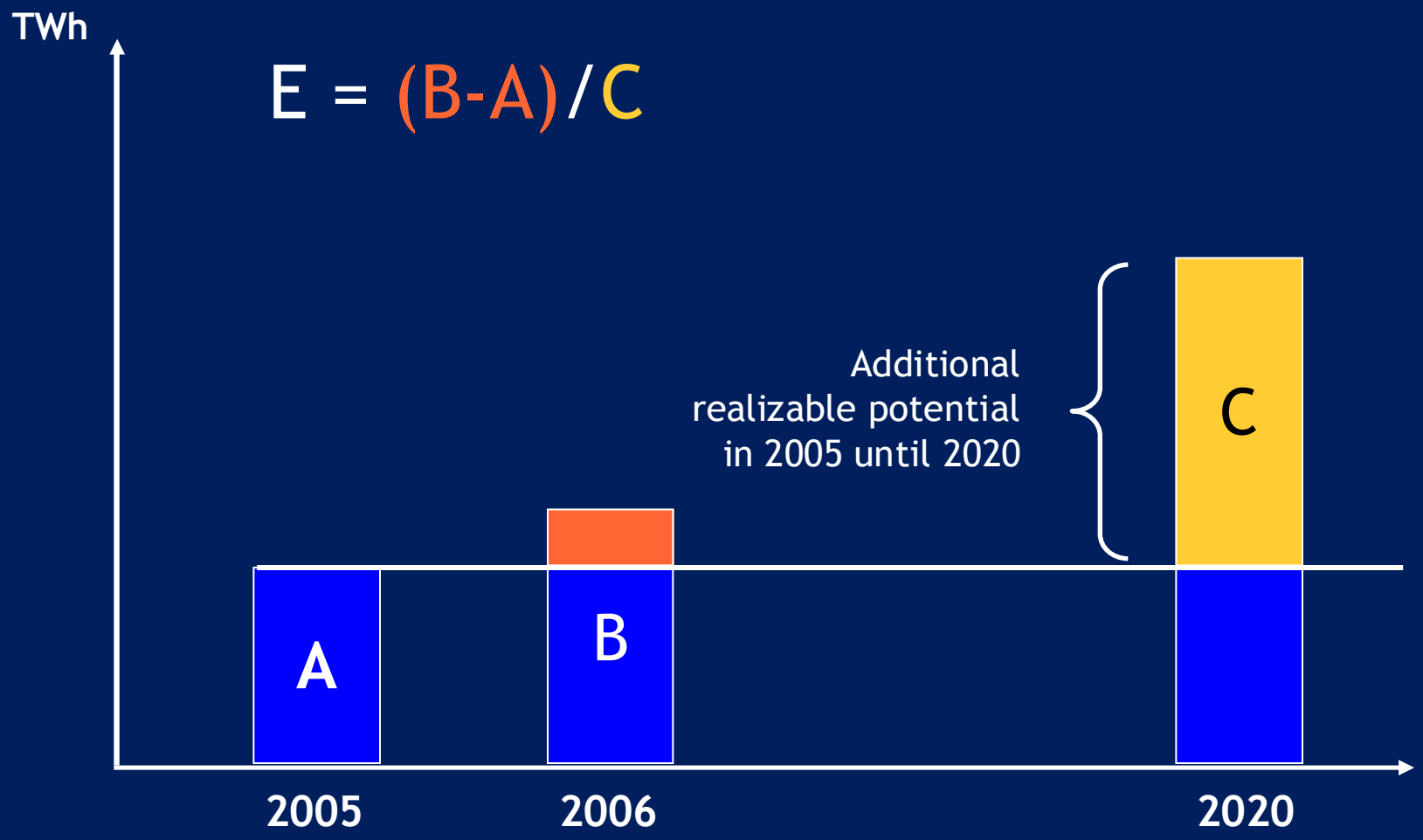
RES-E support effectiveness indicator



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RES-E support effectiveness indicator

Absolute growth of normalised RES-E generation compared to the additional realisable mid-term potential to 2020 for a specific technology*

$$E_n^i = \frac{G_n^i - G_{n-1}^i}{POT_n^i}$$

E_n^i	Effectiveness indicator for RES technology i for the year n
G_n^i	Existing electricity generation potential by RES technology i in year n
POT_n^i	Additional generation potential of RES technology i in year n until 2020

* The realisable potential represents the maximum achievable potential assuming that all existing barriers can be overcome and all driving forces are active.

Source: Ragwitz et al. (2007)

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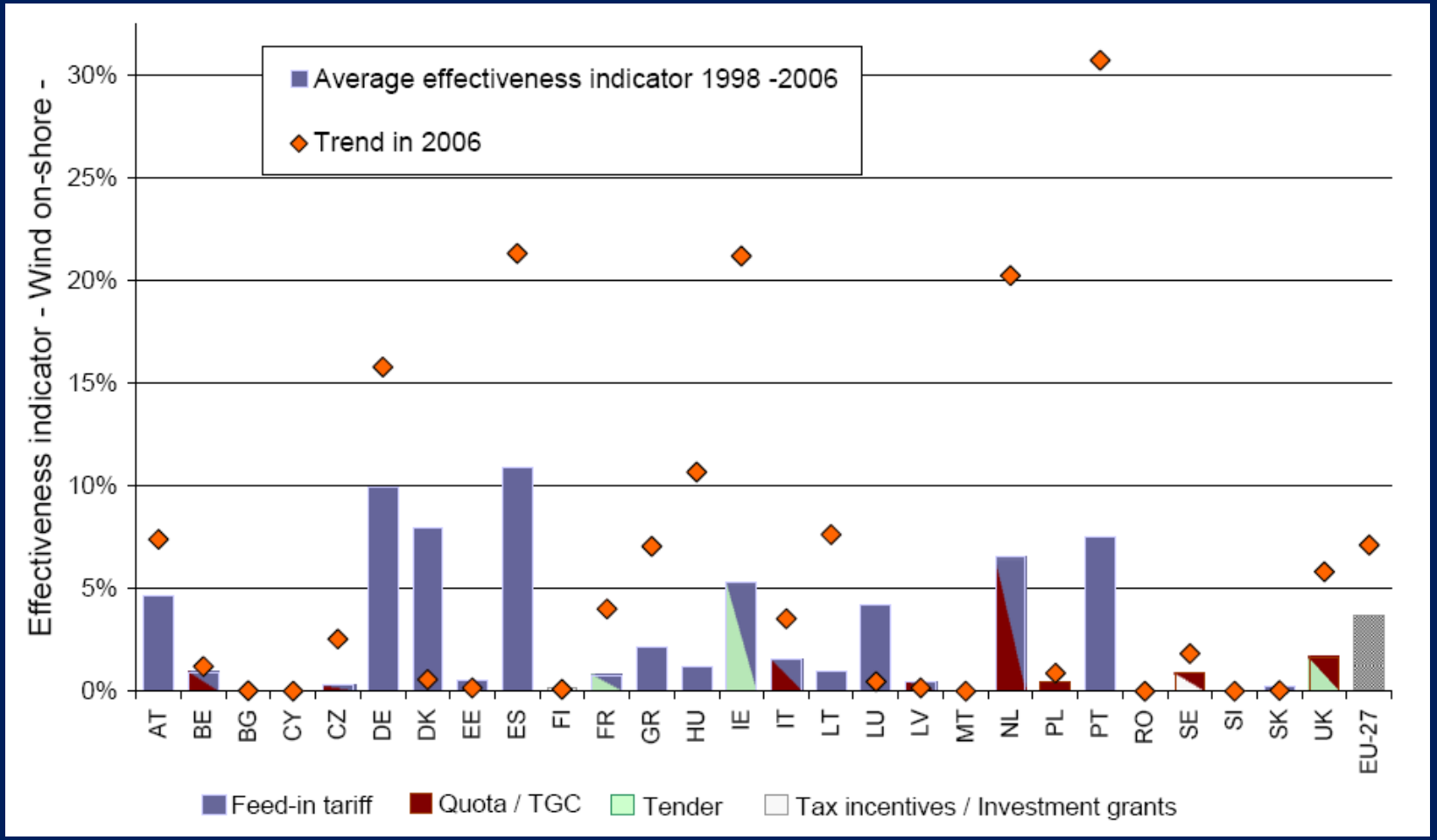
Effectiveness of on-shore wind energy development 1998-2006 across EU-27



Source: Ragwitz et al. (2007)

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RES-E efficiency indicator

- Basis: expected profit from RES-E installation
- Economic efficiency of a RES-E support instrument: **levelised profit** of the investment
  - Investor's perspective
  - Duration of support
  - Country specific cost-resource conditions
  - Interest rate in different countries

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Methodology: marginal costs & country specific support level

- Long run marginal costs

$$C = C_{VARIABLE} + C_{FIX} = \left(\frac{C_{O\&M}}{H} \right) + \frac{I * CRF}{H} \qquad CRF = \frac{(1+i)^n * i}{(1+i)^n - 1}$$

$C_{O\&M}$: Operation & Maintanance Costs;

I: Investment;

H: Full-Load-Hours;

CRF: Capital Recovering Factor

n: Lifetime - 15 a;

i: Interest rate – 6,5%;

- Different support levels in different countries: normalised to a uniform duration of the instrument given by the lifetime

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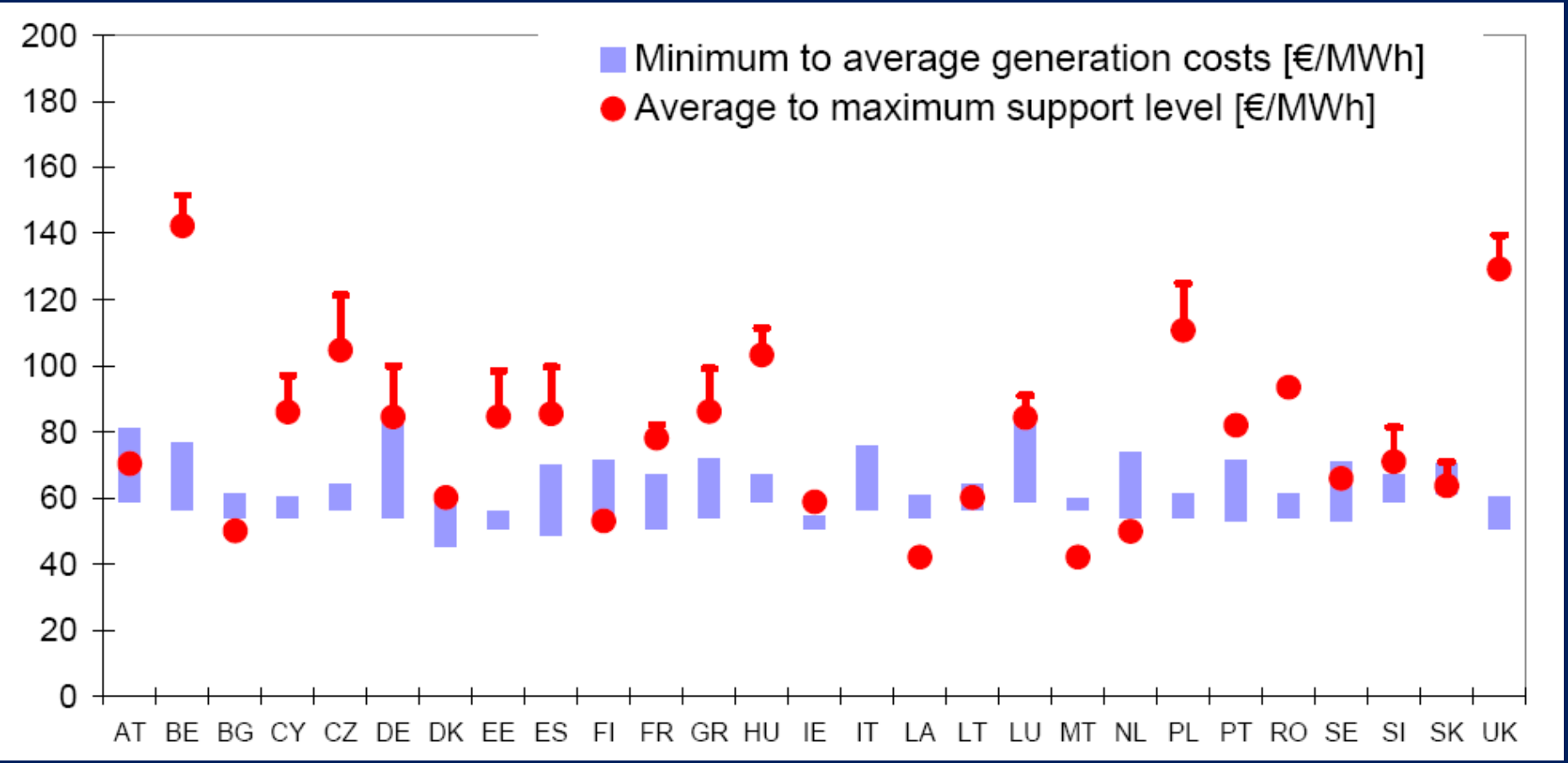
Generation costs vs. support levels for on-shore wind across the EU-27



Source: Ragwitz et al. (2007)

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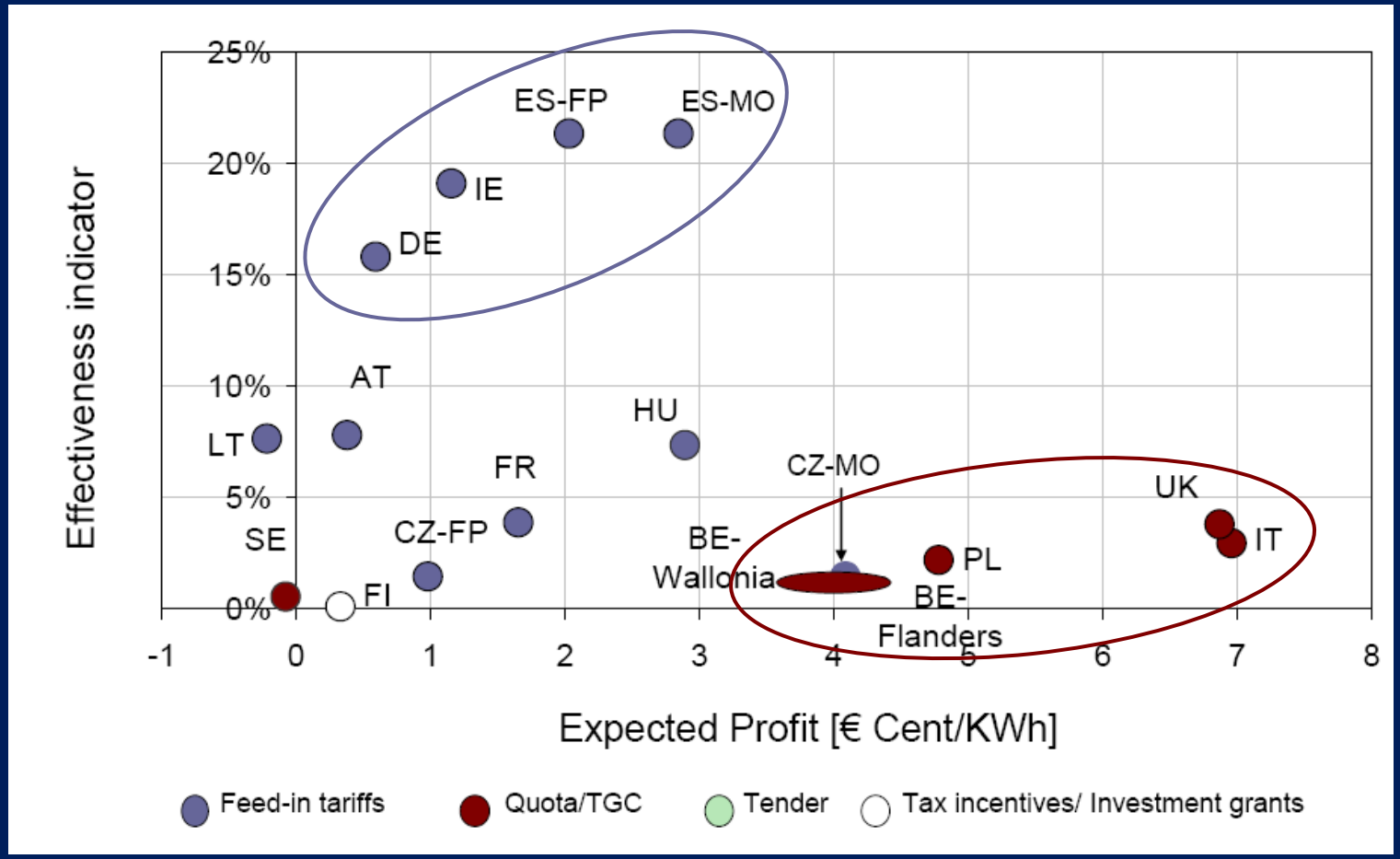
Efficiency & Effectiveness for on-shore wind energy in 2006 across the EU-27



Source: Ragwitz et al. (2007)

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4. Conclusions (1)

- Current policy frameworks define the future market for RES
  - RES require long term policy framework
  - low risk for new investments (i.e. long-term price guarantees)
- Indicators show that there is no optimum or „one fits all solution" i.e. over all countries and technologies
- Important for effectiveness of RES-E deployment
  - Low administrative barriers combined with
  - high investment security
- Effective instruments for RES-E support are frequently also economically efficient

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4. Conclusions (2)

- Effectiveness for wind, biogas, and solar PV RES-E has been highest in countries using FIS as main support instrument
- Low cost RES-E technologies grow particularly strong in countries with non-technology specific support schemes
- Combination of investment grants and tax rebates has proven to be successful in countries with high taxation rates
- Technology specific seem superior to technology neutral instruments (larger technology portfolio, economic benefits)

Thank you for your attention!

Patrick Lamers

Ecofys Germany GmbH

Stralauer Platz 34, 10243 Berlin

Tel. +49 (0) 30 29773579 25

p.lamers@ecofys.com

www.ecofys.com

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