Developments and achievements of Feed-In Systems - Key findings from an evaluation conducted for the IFIC

Mario Ragwitz
Fraunhofer Institute Systems and Innovation Research

8th Workshop of the International Feed-In Cooperation (IFIC)

18th/19th November 2010, Berlin

Fraunhofer ISI

Main policy development on EU level

EU Renewable Energy Directive 2009/28/EC

- **New Directive was passed in December 2008**
- **Targets for 2020:**
  - **20% renewable energy in final energy consumption**
  - **Binding targets for Member States**
- **National support schemes will remain the cornerstones for the deployment of renewables in Europe**
- **Flexibility mechanisms between Member States**
  - **Statistical transfer**
  - **Joint projects**
  - **Joint support schemes**
  - **Physical imports from third countries**
- **Measures to reduce non-economic barriers (particularly reduce administrative, regulative, grid related barriers)**

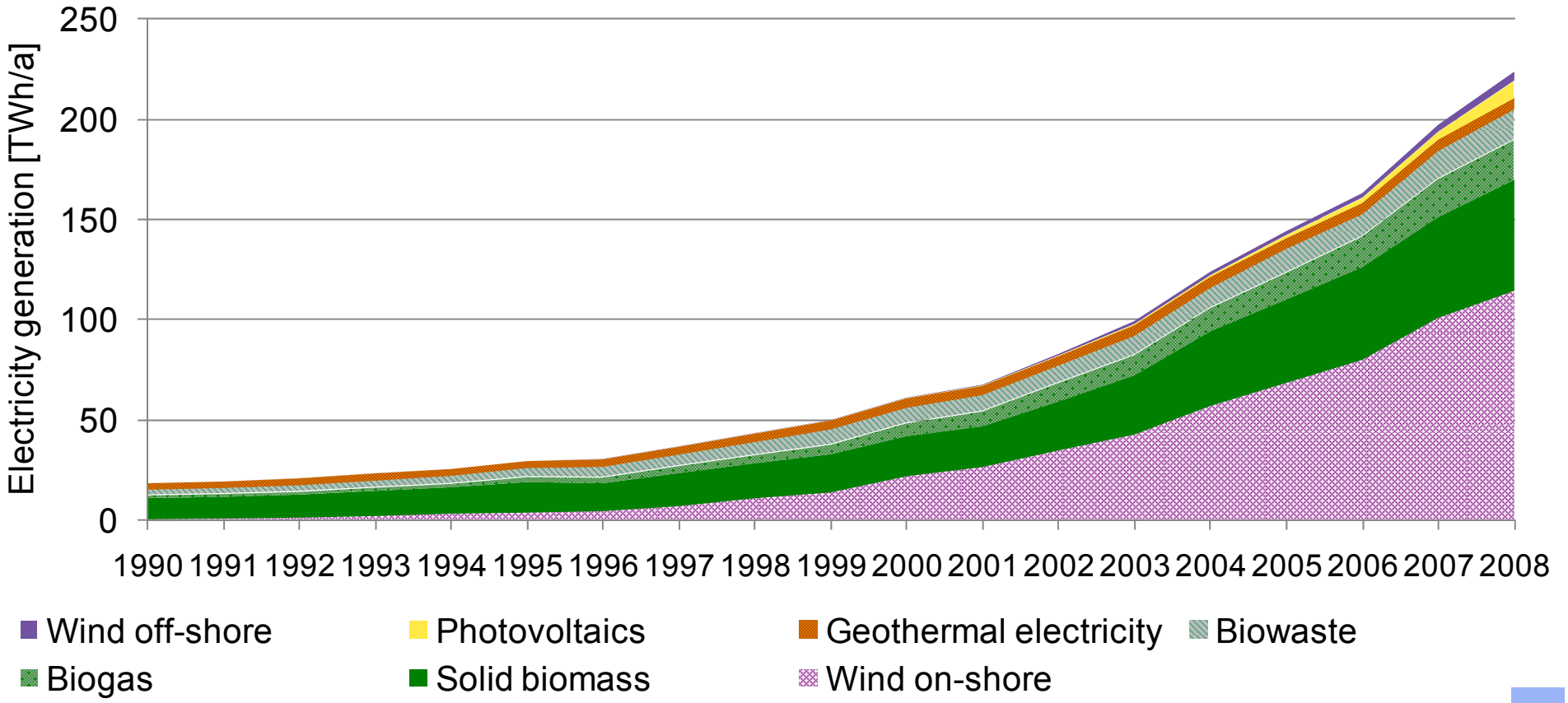
Main policy developments on MS level

- Countries start to adapt ambition level of their policies to target level, e.g. banding of quota system in RO, IT and UK, new tariff levels for RES-E in DE, NL and SI, UK feed-in system for RES-E and RES-H
- MSs start to analyse the impact of specific flexibility measures on their renewable energy sector, first talks between different MSs and between MSs and third countries
- Little progress on the reduction of non-economic barriers
- Financing constraints have been significant during last years
- National Renewable Energy Action Plans currently under evaluation

Currently implemented policies in the EU

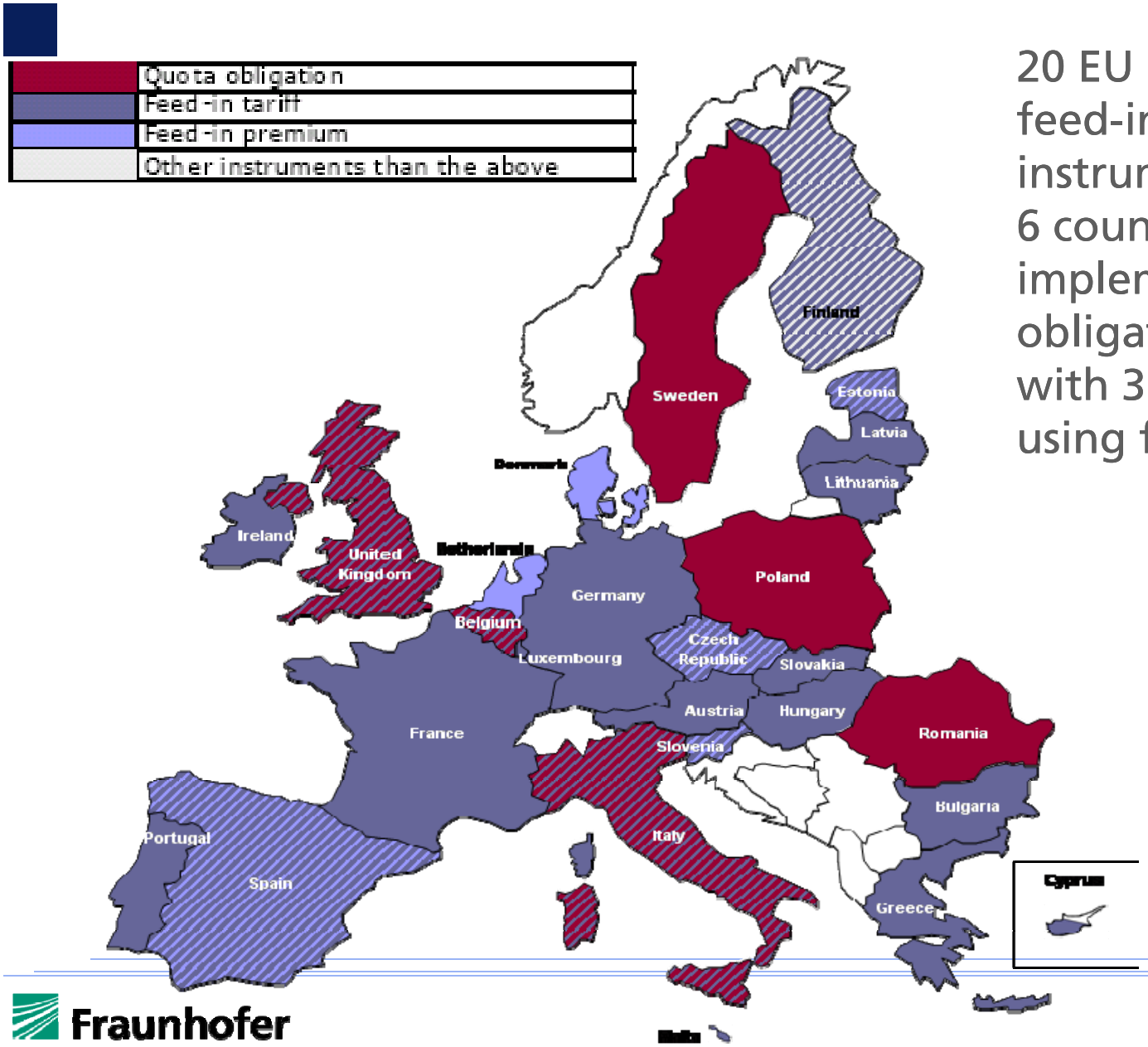
Historical development of new RES-E in the EU-27

- **"New Renewables" in the EU-27**
- Dominating: Wind energy (in the EU-15) & Biomass (in the new member states)



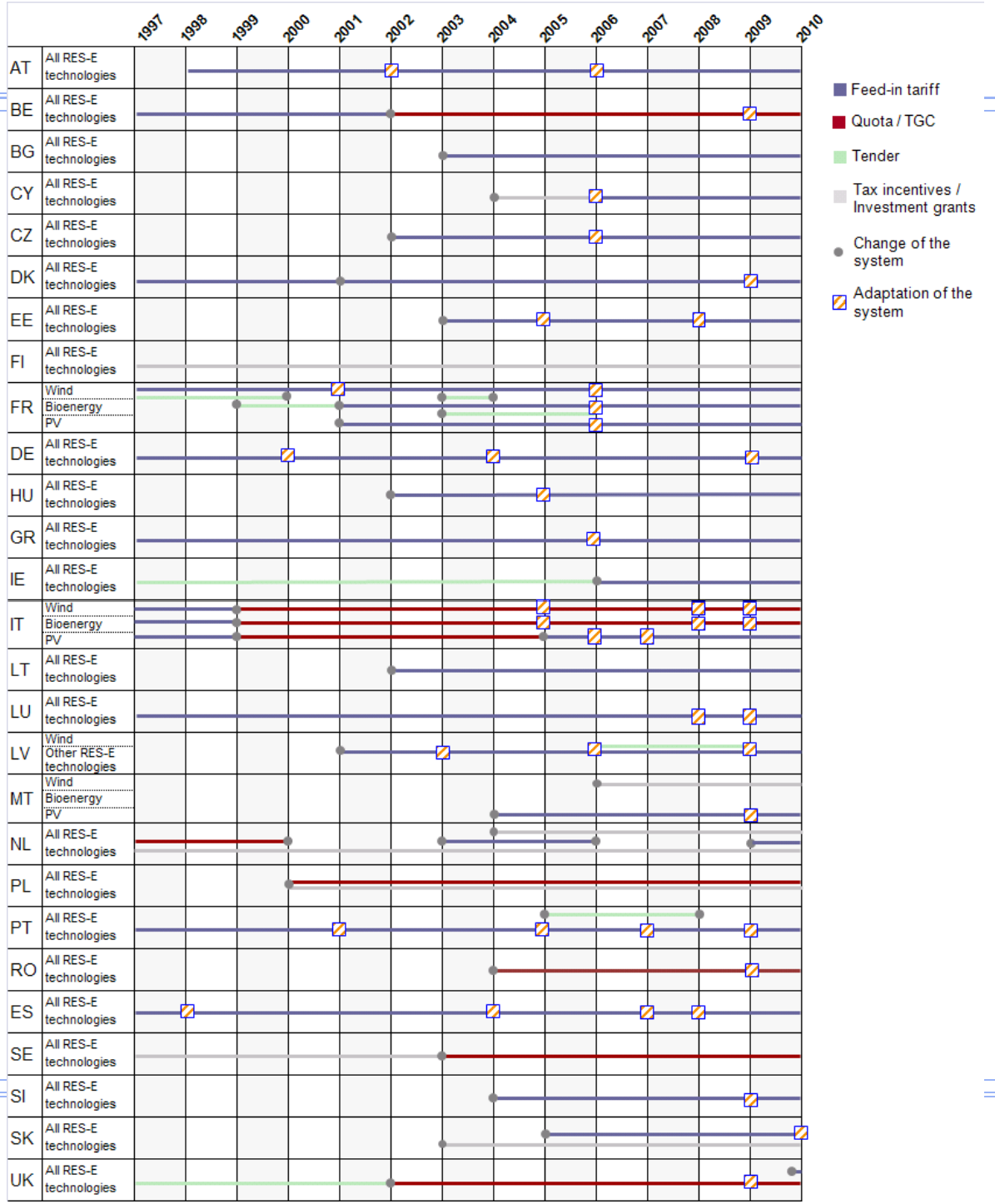
Fraunhofer ISI

Dominating support schemes for RES-E in the EU



20 EU countries use feed-in tariffs as main instrument
6 countries have implemented a quota obligation with TGCs with 3 of them partially using feed-in tariffs

Fraunhofer ISI



Fraunhofer ISI

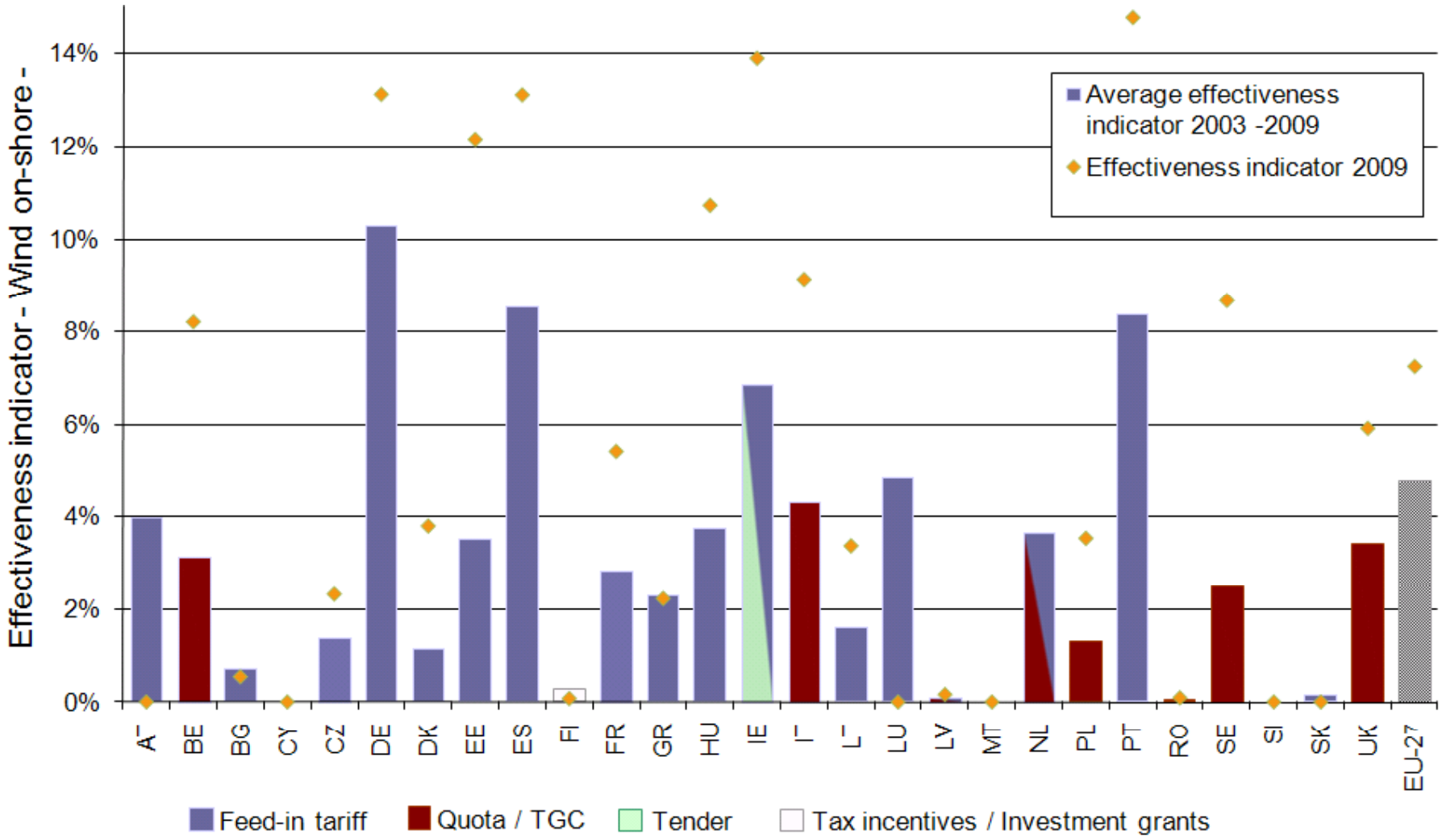
1. **Relative or absolute growth rates** are typically used to demonstrate the achievements of countries, however both measures are biased

2. Better measure to judge the performance is the **absolute growth as ratio of the additional potential**

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

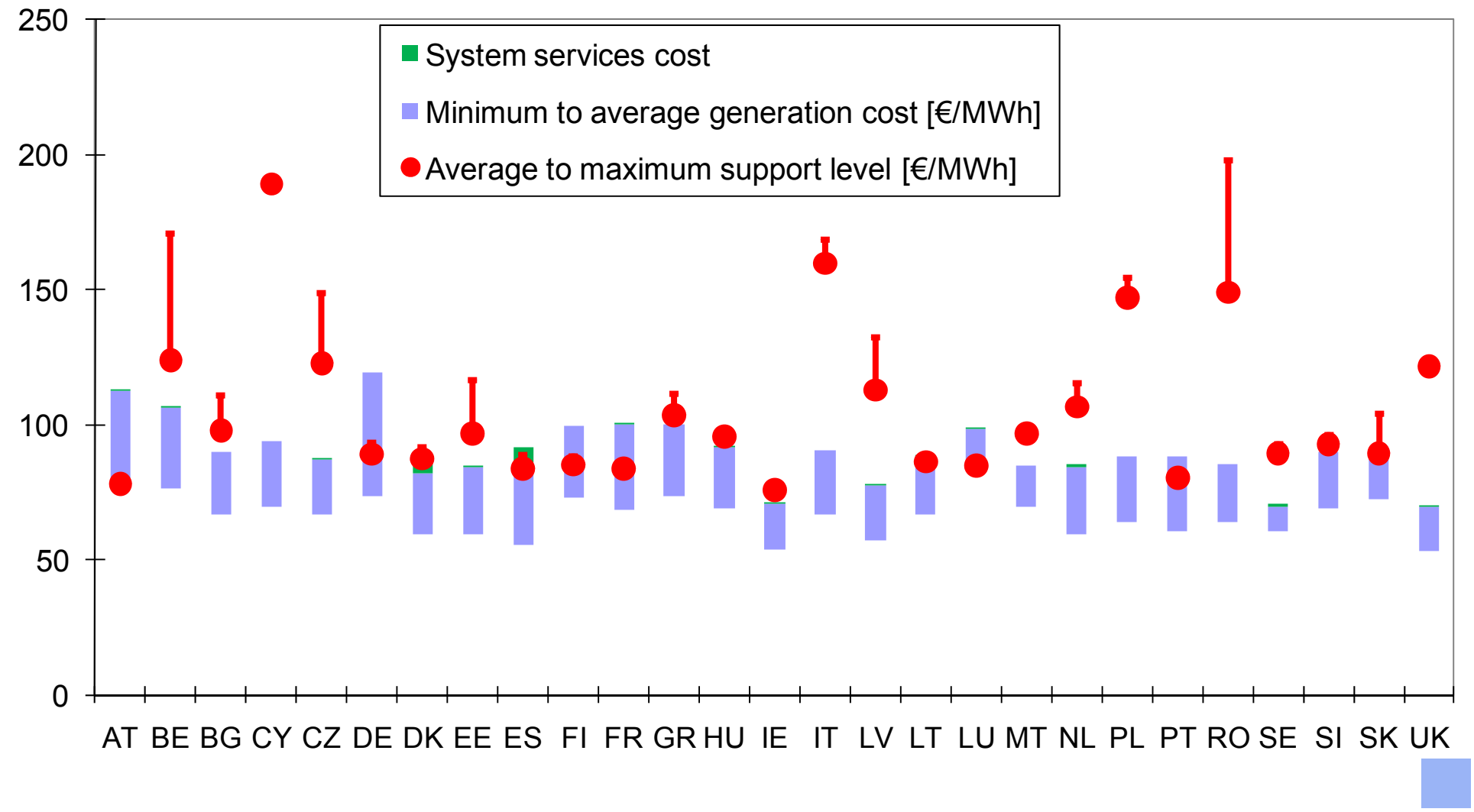
E_n^i	Effectiveness indicator for RES technology i for the year n
G_n^i	Existing electricity generation potential by RES technology i in year n
$ADD-POT_n^i$	Additional generation potential of RES technology i in year n until 2020

Effectiveness for wind on-shore in the period 1998-2009 in EU-27



Current level of support and costs per Member State

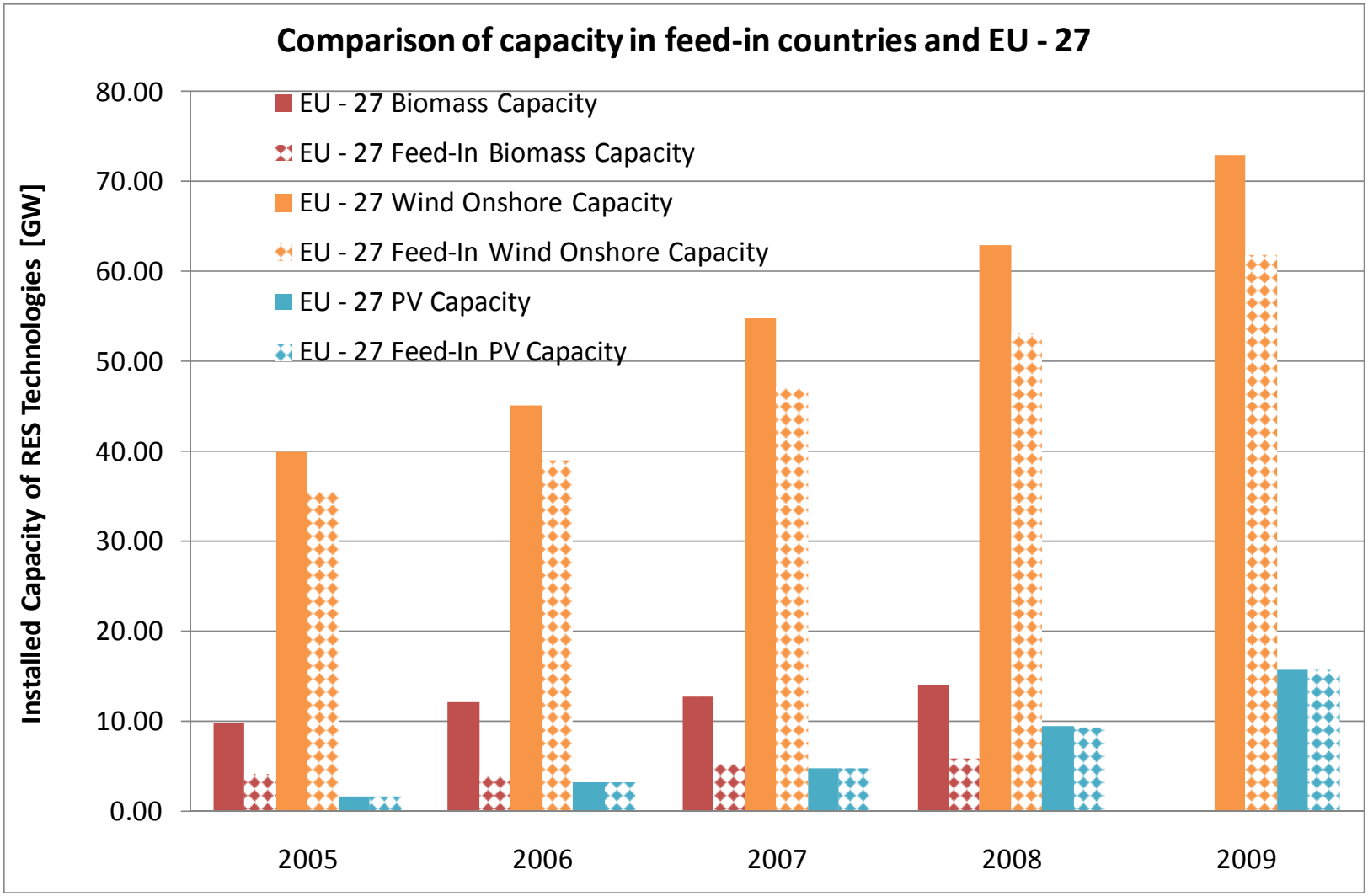
Example of wind onshore – Dec. 2009



Performance of Feed-in Systems in the EU

Fraunhofer ISI

Share of feed-in systems in EU RES capacity until 2009



Fraunhofer ISI

Some feed-in tariff success stories

- By 2008 77% of all new RES-E generation installed after 1997 in the EU was achieved by countries using feed-in tariffs, which are responsible for 61% of the EU electricity consumption
- 85% of all new wind capacity (after 1997) was installed in countries using feed-in tariffs
- By the end of 2009, wind energy accounted for 6.7% of German electricity production; in Spain 12.7%, in Denmark even 19.5%
- 100% of the new PV capacity was installed in countries using feed-in tariffs
- 68% of all new biomass capacity (after 1997) was installed in countries using feed-in tariffs

When renewable energy technologies become **mainstream** the **compatibility** with **electricity markets** becomes crucial

Fraunhofer ISI

Design elements to improve system and market integration

- Implementation of a feed-in premium (higher compatibility with liberalised markets e.g. through an improved demand orientation)
- But: potentially higher risks for RES-E producers in case of fixed premium
- Sliding premium (e.g. NL) may reduce these risks
- Cap and floor system for the overall remuneration (e.g. ES)
- Premium tariffs are applied in Spain, the Czech Republic, Slovenia, Estonia the Netherlands, Denmark (for onshore wind energy) and Italy (for PV)
- Requirement of RES-E producers to contribute to grid stability.

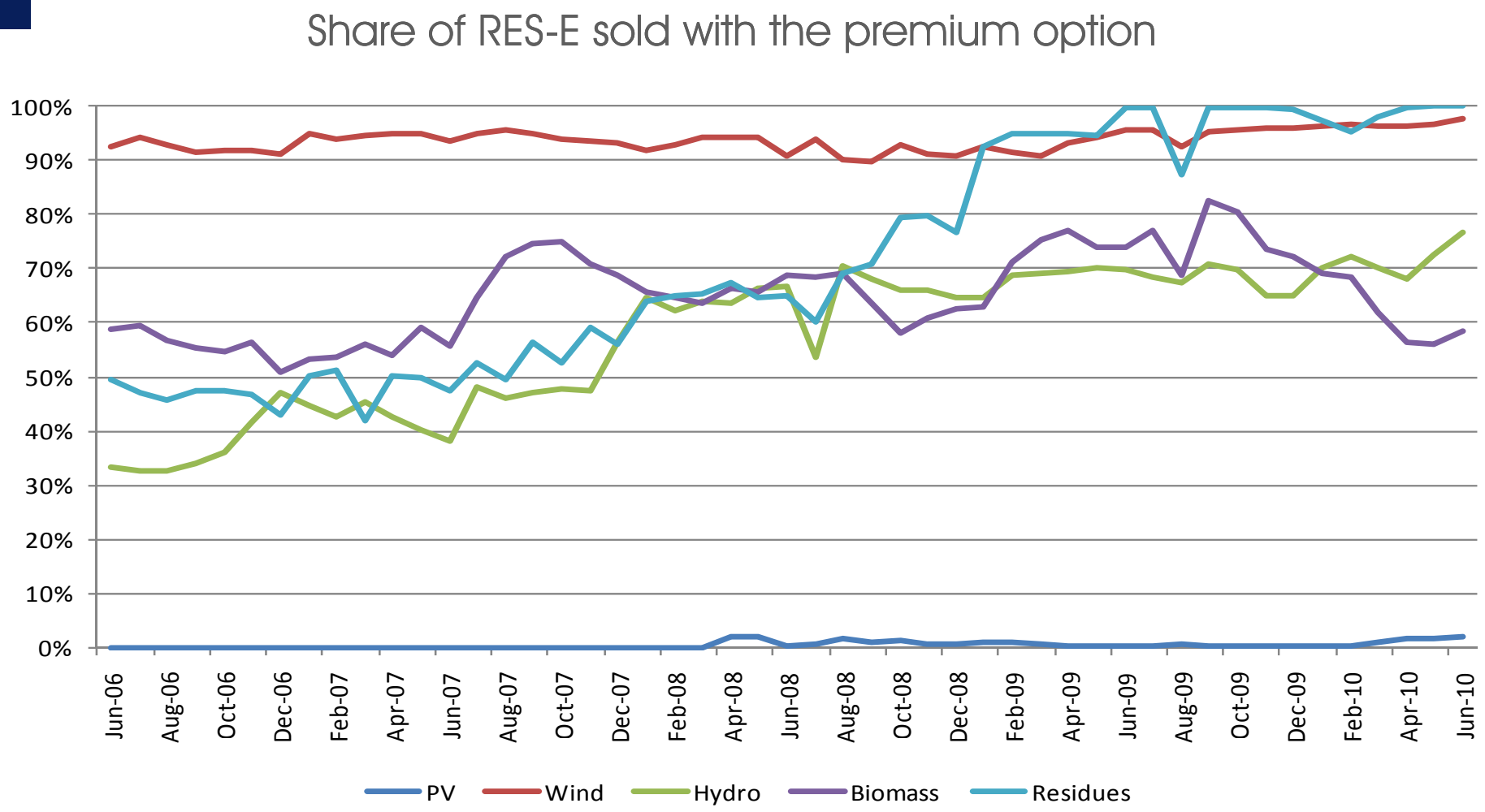
  Germany:

  – Onshore wind turbines connected between 2009 and 2014 have to fulfil technical standards regarding reactive and real power

  – receive an increased FIT (by 0.5 €ct/kWh - Systemdienstleistungs-Bonus)

  – Incentive for older turbines on a voluntary basis (0.7 ct/kWh during 15 years).

Premium tariff design – Case study Spain

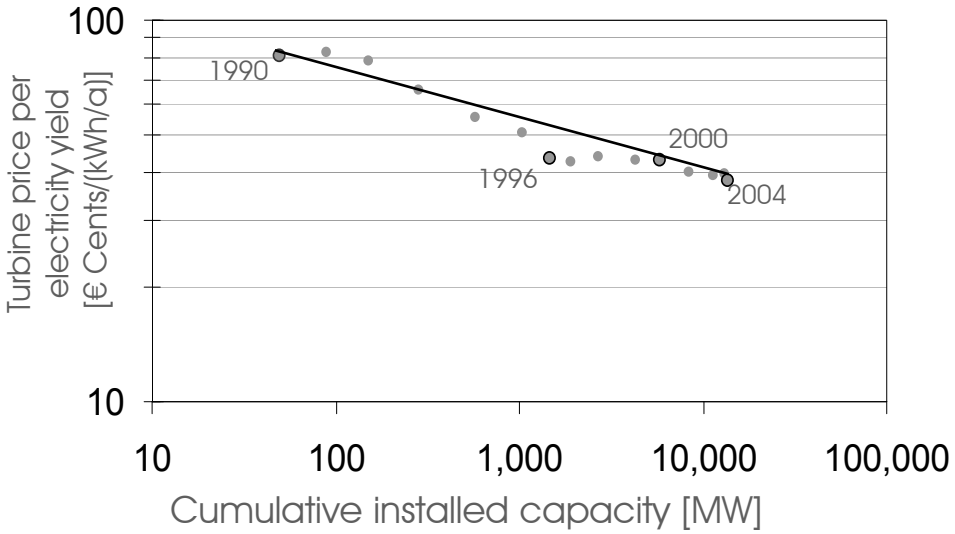


Support levels for **new plants** are **continuously decreasing in many countries**

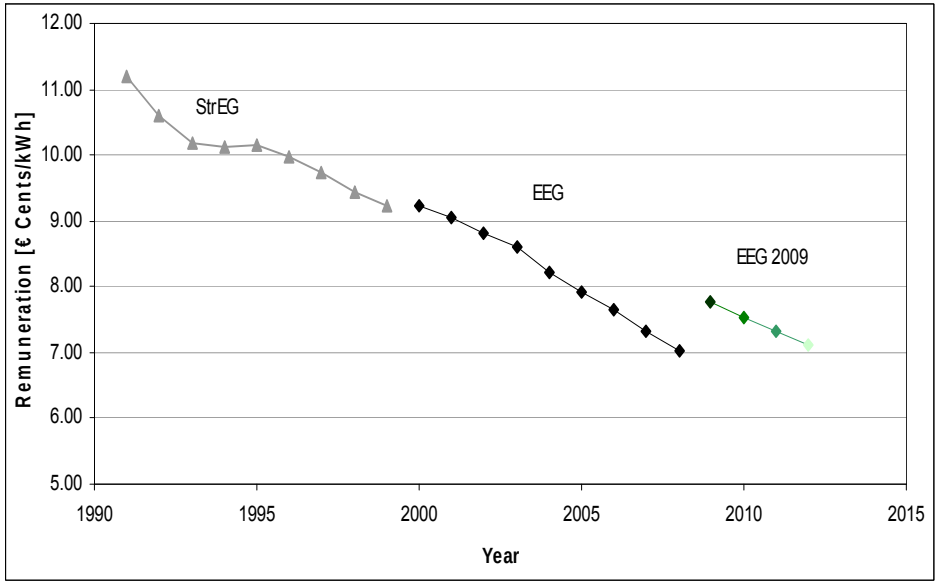
Fraunhofer ISI

Tariff degression – Case study Germany

Experience curve for onshore wind energy



Support for onshore wind energy



- Reduction of 53% from 1990 – 2004
- High decrease in costs between 1991 and 1996, lower decrease since 1997
- Technology learning overestimated due to decreasing raw material prices

- Reduction of 36% from 1991 – 2011
- Tariff degression of 1-2% per year

Fraunhofer ISI

Tariff degression in feed-in countries (1)

Germany

- Annual tariff reduction
- Technology-specific (1% for wind power plants and, once in July 2010 up to 13% and in October 2010 another 3% for PV
- Consideration of cost reductions induced by learning curve effects

  → Continous incentive for efficiency and cost improvements

Greece

- Tariff degression for small photovoltaic systems (<10 kWp)
  → 5% is foreseen for new entrants between 2012 and 2019

France

- Tariff degression of 2% annually is for wind since 2008

Italy

- Tariff degression for Solar PV FIT since 2007 → 2% annually
- Plants commissioned in 2010 receive a premium reduced by another 2%

Tariff degression in feed-in countries (2)

Czech Republic

- Annual adjustment of 2-4 % depending on inflation.
  Exception: Biogas and biomass plants
- Reduction in the following year limited to 5% of the tariff in force at the time of the calculation of the new tariff

Slovenia

- Recent adjustment of support scheme:

  RES-E plants <= 5MW supported through a feed-in tariff
  Larger plants (> 5MW) support from a feed-in premium
- No degression for fixed feed-in tariff (except PV: 7%)
- Adjustment of FIT-premium based on energy market prices

Technology specific and plant specific tariffs reduce policy costs

Fraunhofer ISI

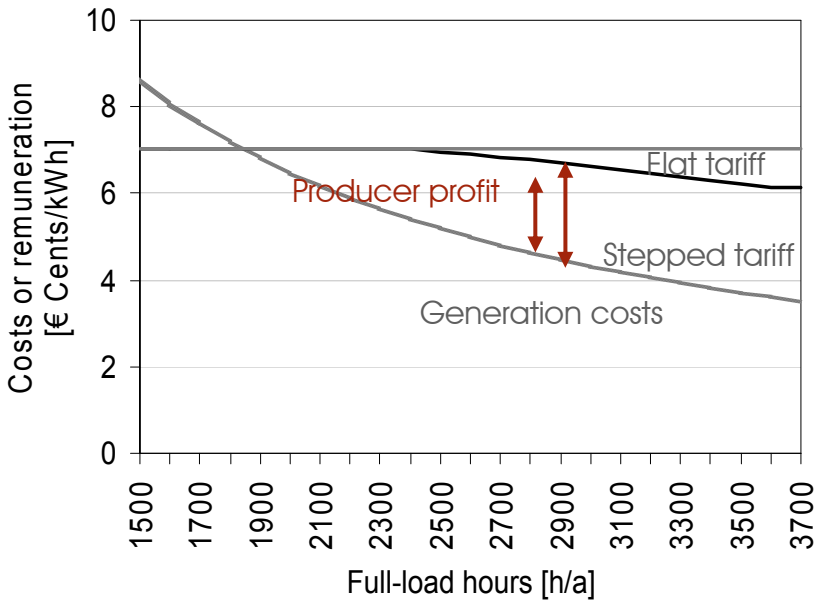
Stepped tariff design

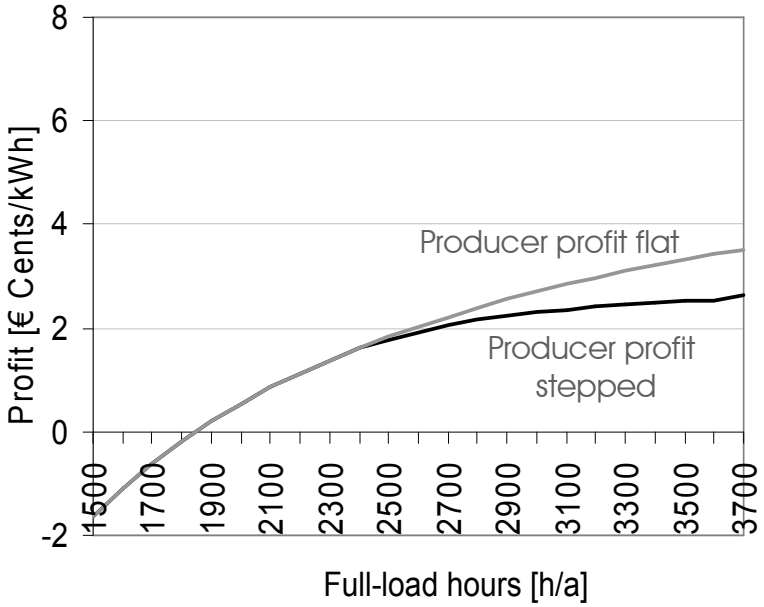
Electricity generation costs may vary due to:

- Local conditions (wind & solar yield)
- Power plant size
- Fuel type (biomass and biogas)

A stepped tariff design takes the different costs into account

Stepped tariffs – Level depending on local conditions: case study France





Support for onshore wind energy in FR:

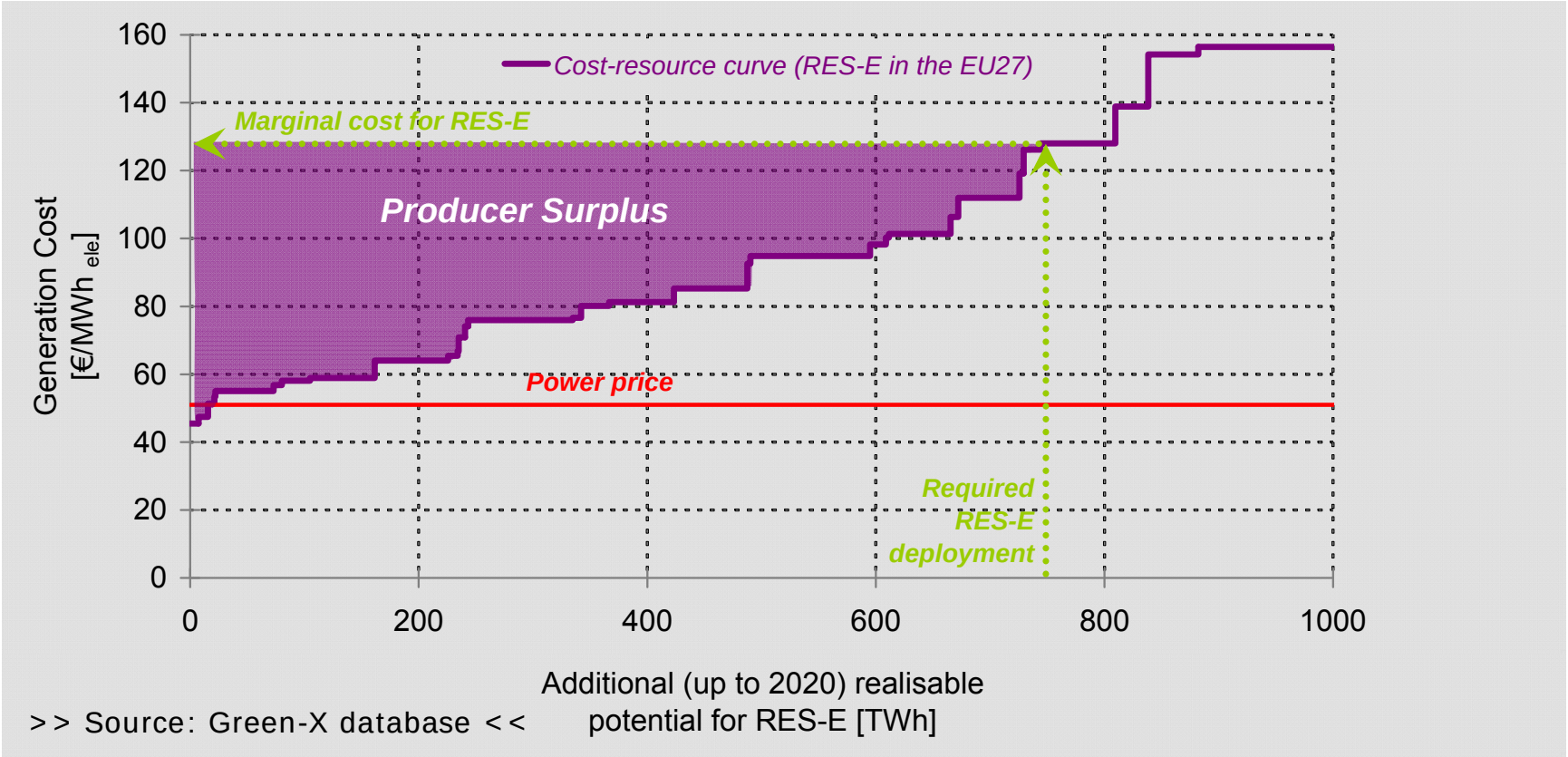
- 8.2 € Cents/kWh for 10 years
- Between 2.8 and 8.2 € Cents/kWh for the remaining 5 years (depending on the electricity yield during the first 10 years)

Fraunhofer ISI

For achieving an ambitious target a portfolio of RES technologies – being in a different stage of development (cost) - is required.

Therefore **technology specific support is key** to reduce policy costs and to incentivise deployment of less advanced technologies.

Technology neutrality leads to high producer surplus



>> Source: Green-X database <<

A technology-neutral support leads to high policy costs

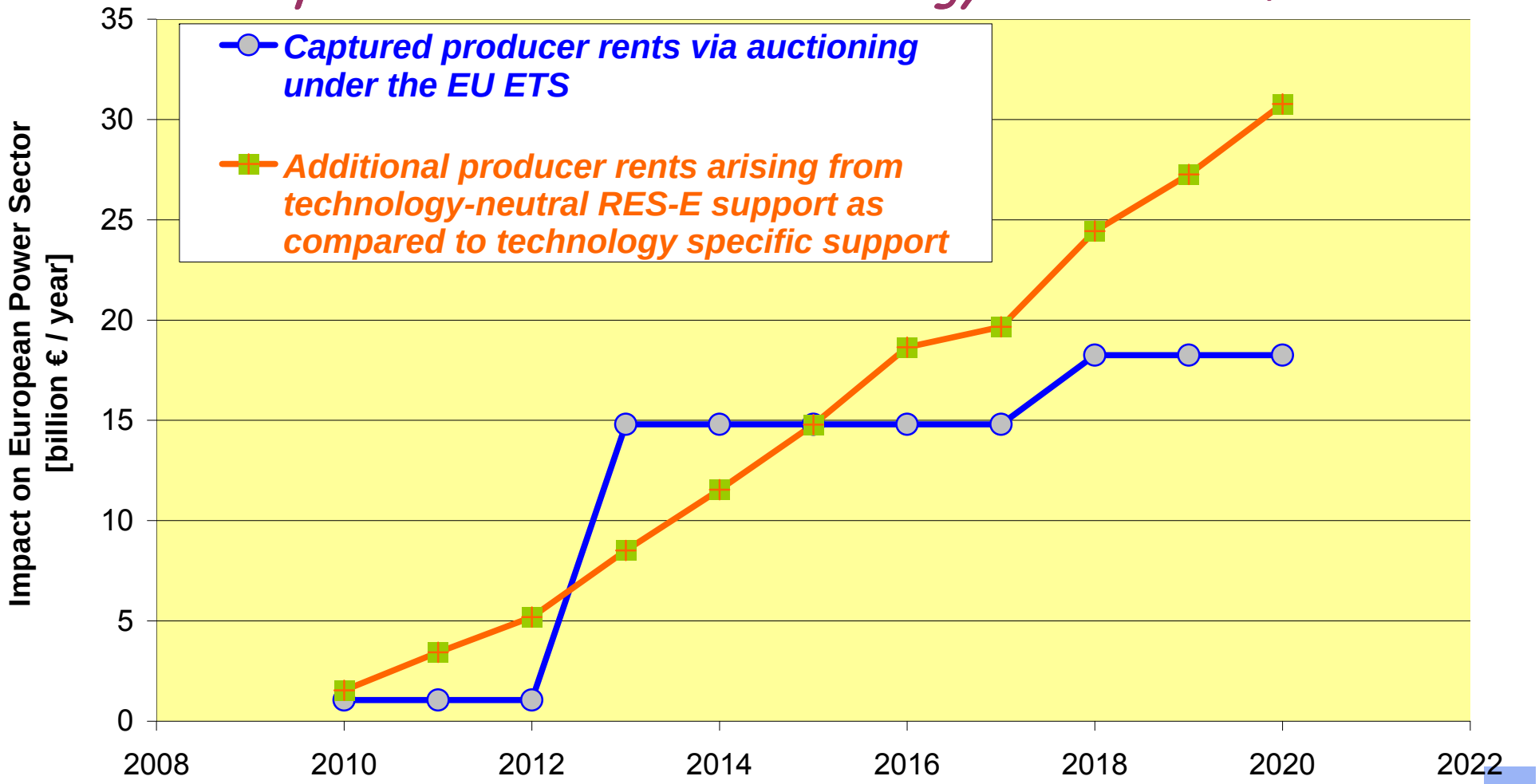
→ *technology banding has been introduced in UK, Italy and Romania*

Fraunhofer ISI

Source: schematic depiction of aggregated cost curve for RES-E technologies at EU level

Common EU quota based on TGCs compared to technology specific support

Comparison of captured producer rents via auctioning in EU ETS with increased producer rents due to technology neutral certificate trade



High public transfer cost may arise (high consumer expenditures)

Fraunhofer ISI

Conclusions on EU trade

In order to tap potential efficiency gains of optimal resource allocation but avoid large windfall profits the EU Commission, Parliament and Member States have implemented flexibility between Member States and with third countries based on the cooperation mechanisms. Therefore:

- Currently functioning national support systems will not be undermined
- Excessive policy costs can be avoided
- National governments have the information to deliver necessary regime for planning, grid access, balancing and congestion management

Conclusions on RES policy design

- Renewable energy technologies need a long term oriented and risk mitigating deployment policy.
- Instruments should be technology specific to reduce policy costs and to promote less mature technologies.
- Feed-in tariffs have shown the major contribution to the EU RES development until now
- Compatibility with general energy markets should be ensured, when higher market shares of RES are reached.
- Innovations need long term, stable and degressive support
- Effective instruments for RES-E support are frequently economically efficient as well!

Thank you very much

Kontakt:

Mario Ragwitz

Mario.Ragwitz@isi.fraunhofer.de