



Consequences of possible harmonisation and coordination scenarios

- Results from the **Green-X** model

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... based on calculations
made with the help of the
computer model **Green-X**

www.green-x.at



Content

Introduction ... New EU target: 20% RES by 2020

- Proposed national RES targets

Prospective analysis of future RES-E support in Europe

- National improvement versus harmonisation

- *Core objective / Method of approach*
- *Background information - investigated cases*
- *Results on the future deployment of RES in the European Union (EU25)*

4. Conclusions

The proposed RES directive ... increasing flexibility with GO-trade

Renewable energy sources (RES) have become more and more relevant in the European and global energy markets.

RE technologies help ...

- **decreasing import dependency**
- **diversifying sources of production, and**
- **contribute to a sustainable development.**

Recent political developments in Europe ...

10 January 2007 ... The Commission publishes the **Renewable Energy Road Map** (COM (2006) 848 final) (as part of the *integrated energy and climate change package "Energy for a changing world"*)

9 March 2007 ... The Council of the European Union agrees ...
 → to increase **RES-share** in EU energy mix up to **20% by 2020**
 → **Binding overall RES target for each Member State**
 i.e. → **National targets** covering the *whole energy sector*.
 → Minimum **10% biofuels** in each Member State.

23 January 2008 ... The Commission publishes the Proposal of the new RES directive ...
 ... *the overall 20% target for RES was broken down into national RES targets for 2020* ...



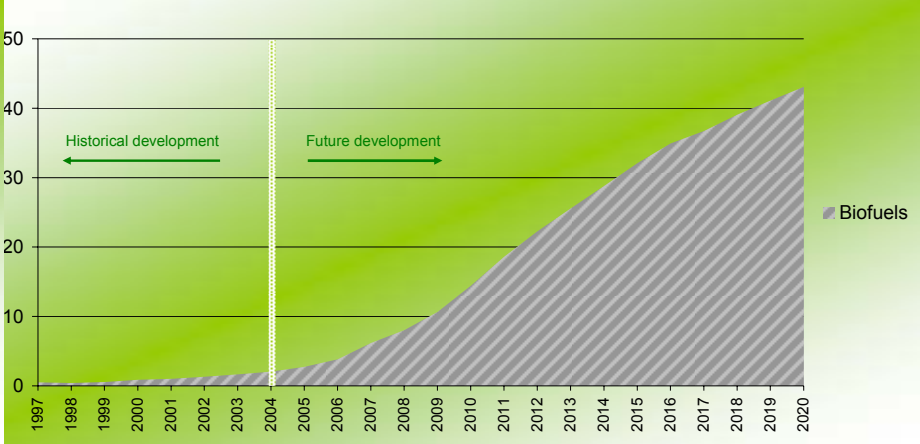
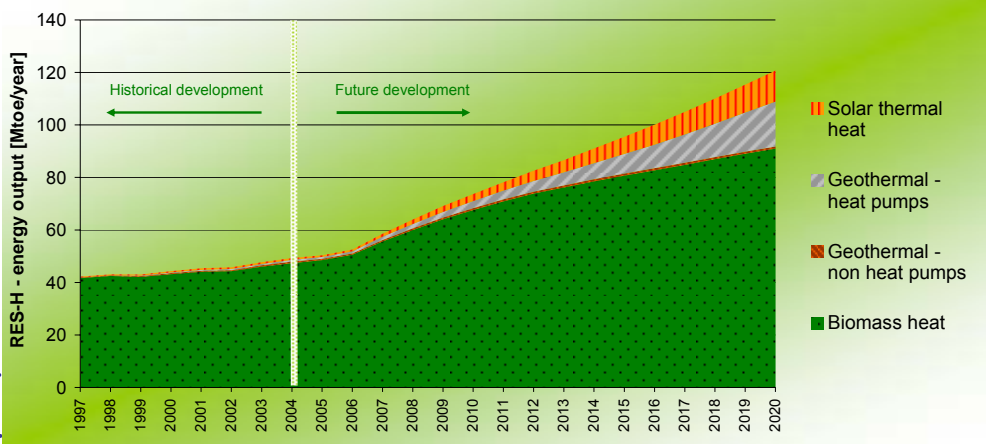
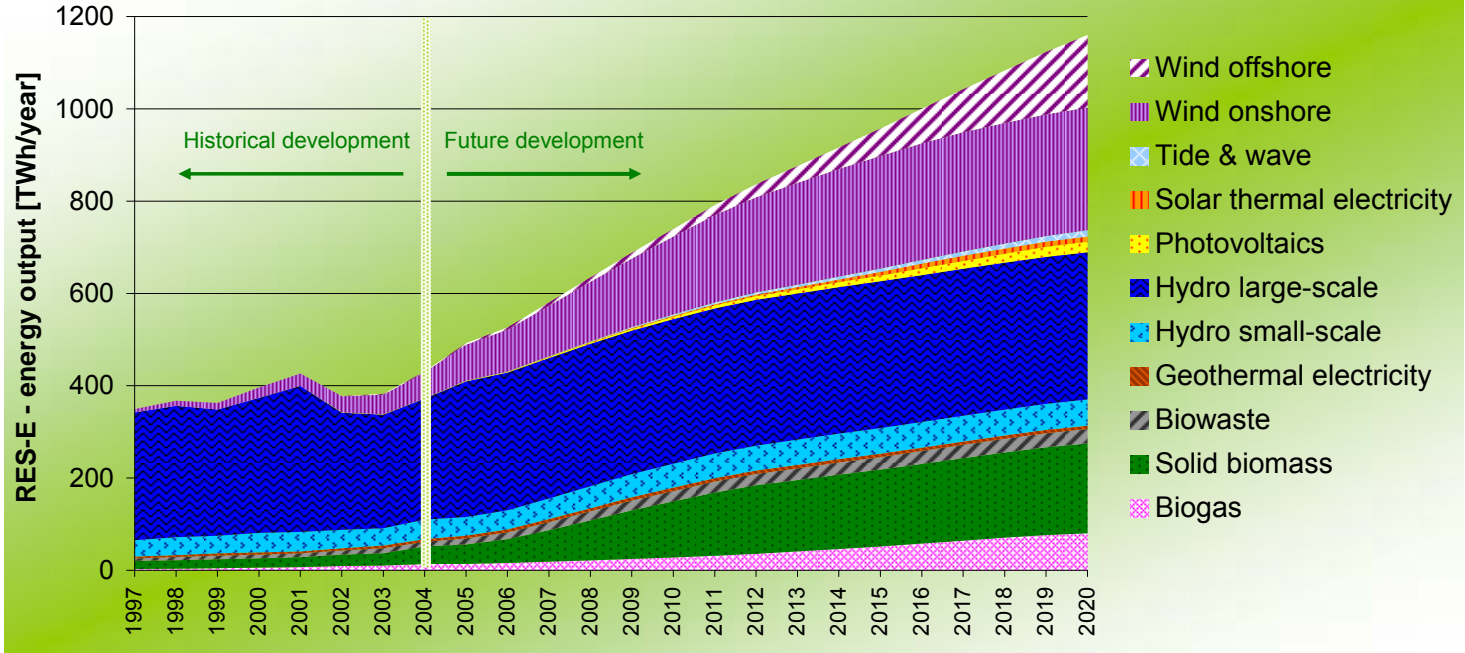
Introduction

► *Future perspectives: ... a scenario on how to meet the new challenge ...* **Renewable Energy Roadmap**

Green-X balanced scenario

*(European Commission, January 2007)
European Union*

20% Renewable Energies by 2020



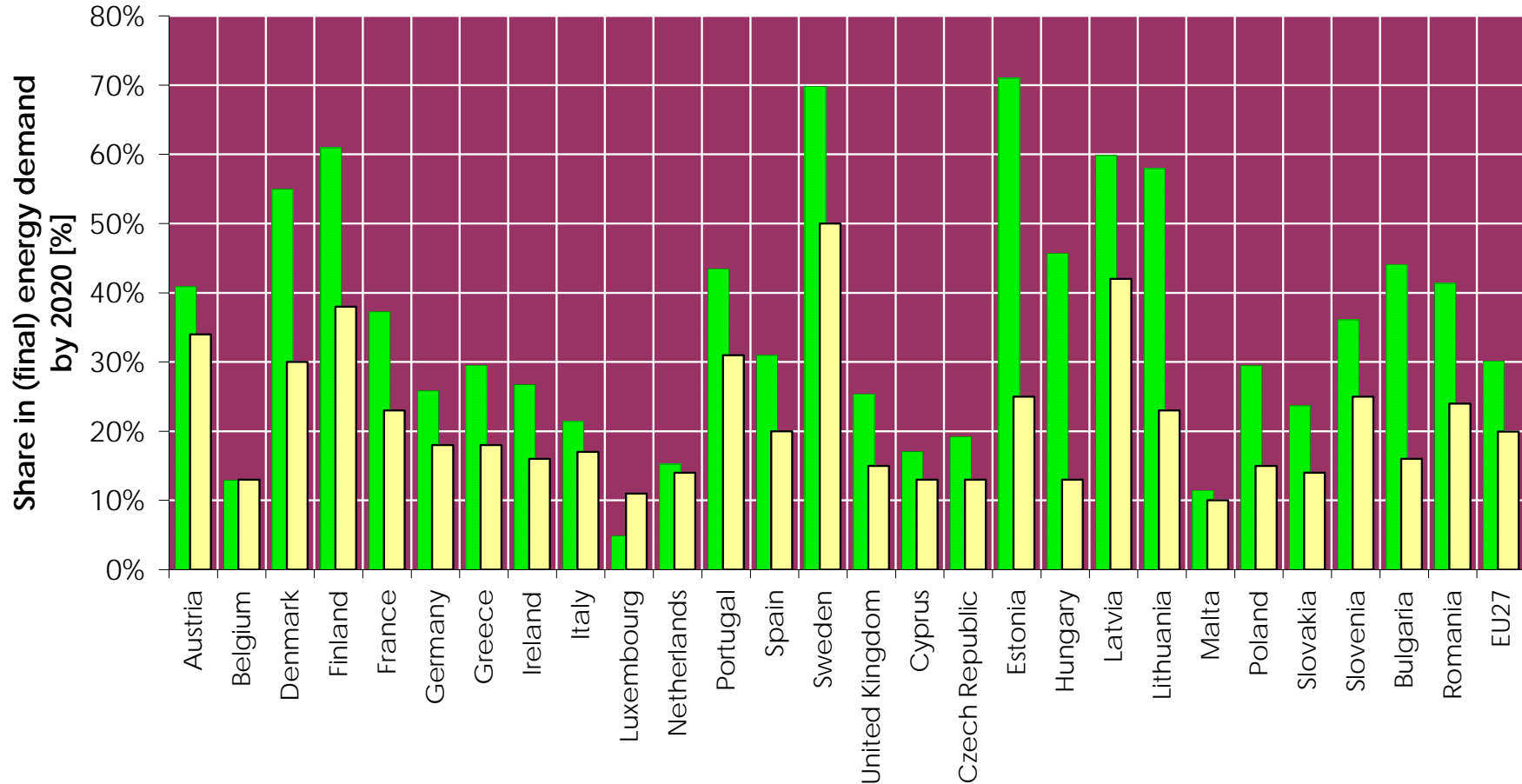
Introduction

► National RES targets for 2020 - the proposed definition

20% RES by 2020

- proposed national RES targets

■ Total realisable RES potential up to 2020
■ Proposed RES targets for 2020



How the European Commission set the targets ... „FLAT RATE“ & „GDP-Variation“

... i.e.: $RES\text{-target}_{2020} = RES_{2005\%} + 50\% * RES_{NEW\%} + 50\% * "RES_{NEW\%} GDP\text{-weighting}" - "first mover bonus"$

(1) Core objective

► **Core Objective - Method of approach**

Support instruments have to be

- **effective** for **increasing** the **penetration** of RES-E and
- **efficient** with respect to **minimising** the resulting **public costs** over time.

Public costs or **transfer cost for consumer / society** (due to the promotion of RES-E) are defined as direct premium financial transfer costs from the consumer to the producer due to the RES-E policy compared to the case that consumers would purchase conventional electricity from the power market.

This means that these costs do not consider any indirect costs / benefits or externalities (environmental benefits, change of employment, etc.).

Example:

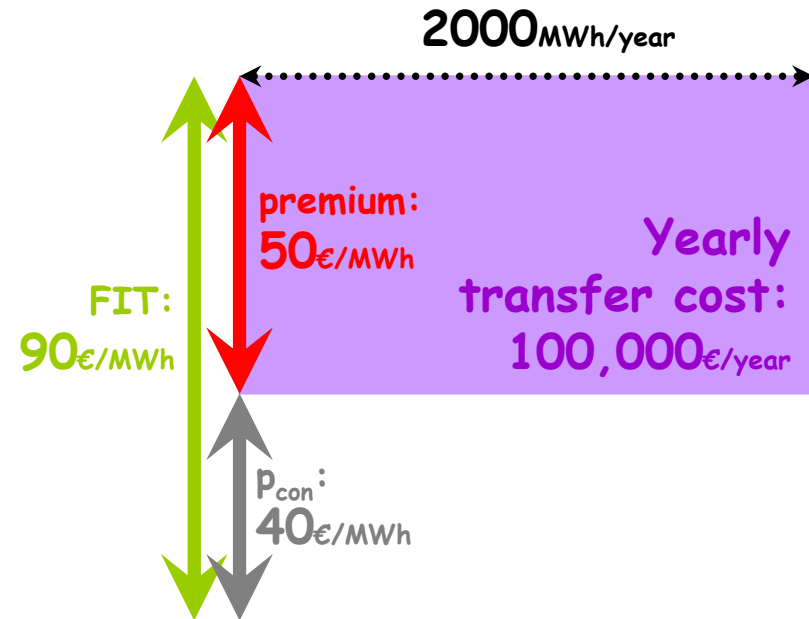
Feed-in tariff for a wind power plant (1 MW, 2000 MWh/year)

Feed-in tariff = 90 €/MWh

Market price conventional electricity = 40 €/MWh

→ **Financial premium = 90 - 40 = 50 €/MWh**

→ **Yearly transfer cost = Premium * Generation = 50 * 2000 = 100 k€/year**

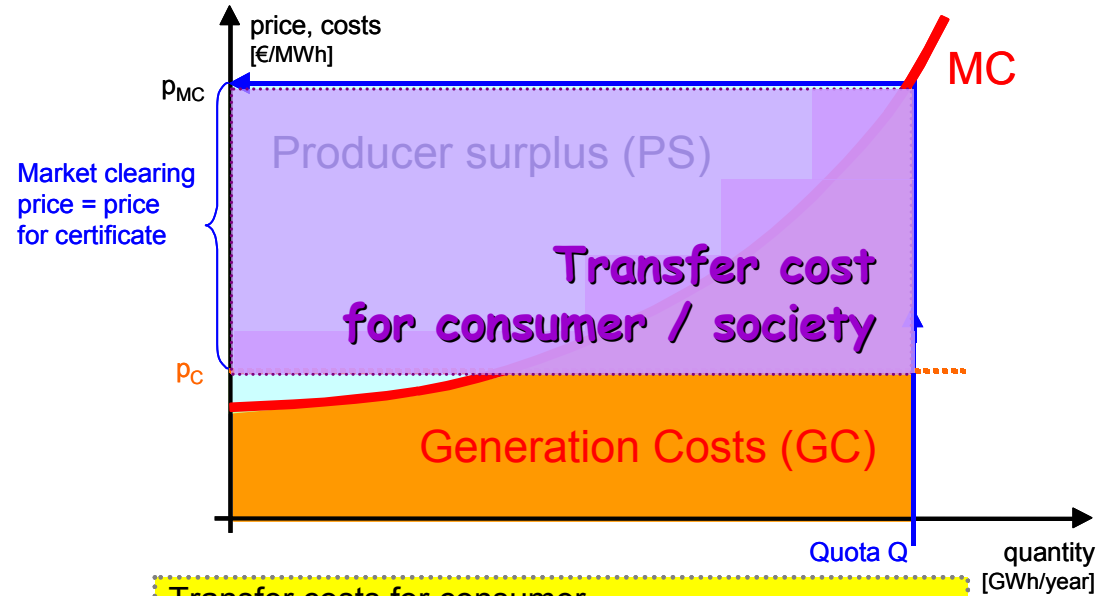


(1) Core objective

► **Core Objective - Method of approach**

The criteria used for the evaluation of various instruments are based on:

- **Minimise generation costs**
- **Lower producer profits**



Transfer costs for consumer (additional costs for society) = $PS + GC - p_C * Q$

p_C ... market price for (conventional) electricity

p_{MC} ... marginal price for RES-E (due to quota obligation)

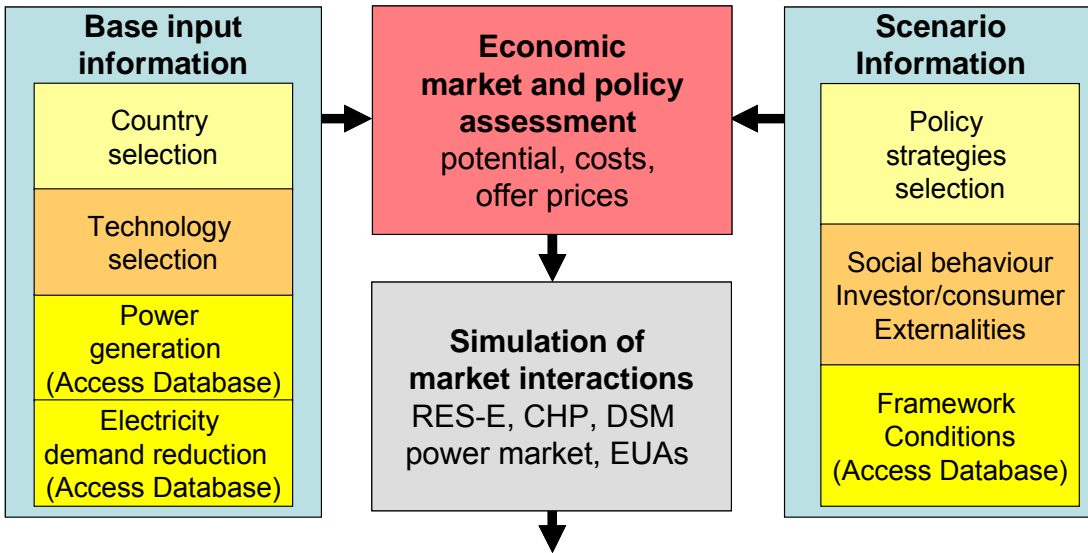
MC ... marginal generation costs



The Green-X model

Simulation model for energy policy instruments in the European energy market

- RES-E, RES-H, RES-T and CHP, conventional power
- Based on the concept of dynamic cost-resource curves
- Allowing forecasts up to 2020 on national / EU-27 level



Results Costs and Benefits on a yearly basis (2005-2020)



General Results	
Total Electricity Consumption	19,96 %
Share of total electricity consumption	19,96 %
Total Electricity Generation	558,582,81 GWh
Share of total electricity generation	17,97 %
Share of total electricity consumption	17,80 %
Share of total electricity generation	51,991,61 GWh
Share of total electricity generation	1,80 %
Share of total electricity consumption	1,97 %
Generation Costs	
Total Generation Costs due to renewable energy sources (RES)	24,835,04 MBl. Euro per year
of which due to electricity plants (ELs)	26,741,35 MBl. Euro per year
Share of total generation costs	83,51 %
of which due to combined heat and power plants (CHP)	4,694,72 MBl. Euro per year
Share of total generation costs	15,49 %
Total Costs for Society	

Reference clients: DG RESEARCH, DG TREN, DG ENV, Sustainable Energy Ireland, German Ministry for Environment, European Environmental Agency, etc.

(2) Background

The **Green-X** approach:
Dynamic cost-resource curves

Potentials

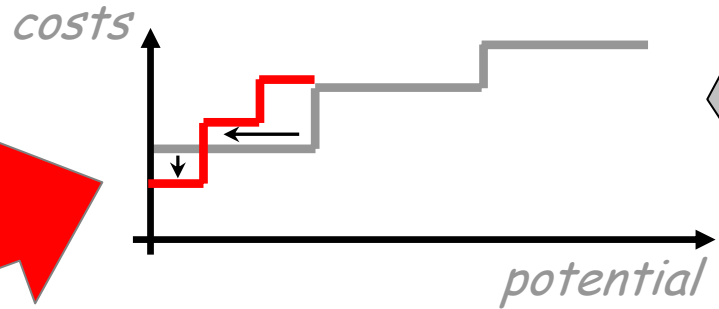
- by RES-E technology (*by band*)
- by country

Costs of electricity

- by RES-E technology (*by band*)
- by country

DYNAMIC
COST-RESOURCE CURVES

- by RES-E technology
- by country
- **by year**



(*technological change*)
(*technology diffusion*)

Dynamic aspects

- **Costs: Dynamic cost assessment**
- **Potentials: Dynamic restrictions**

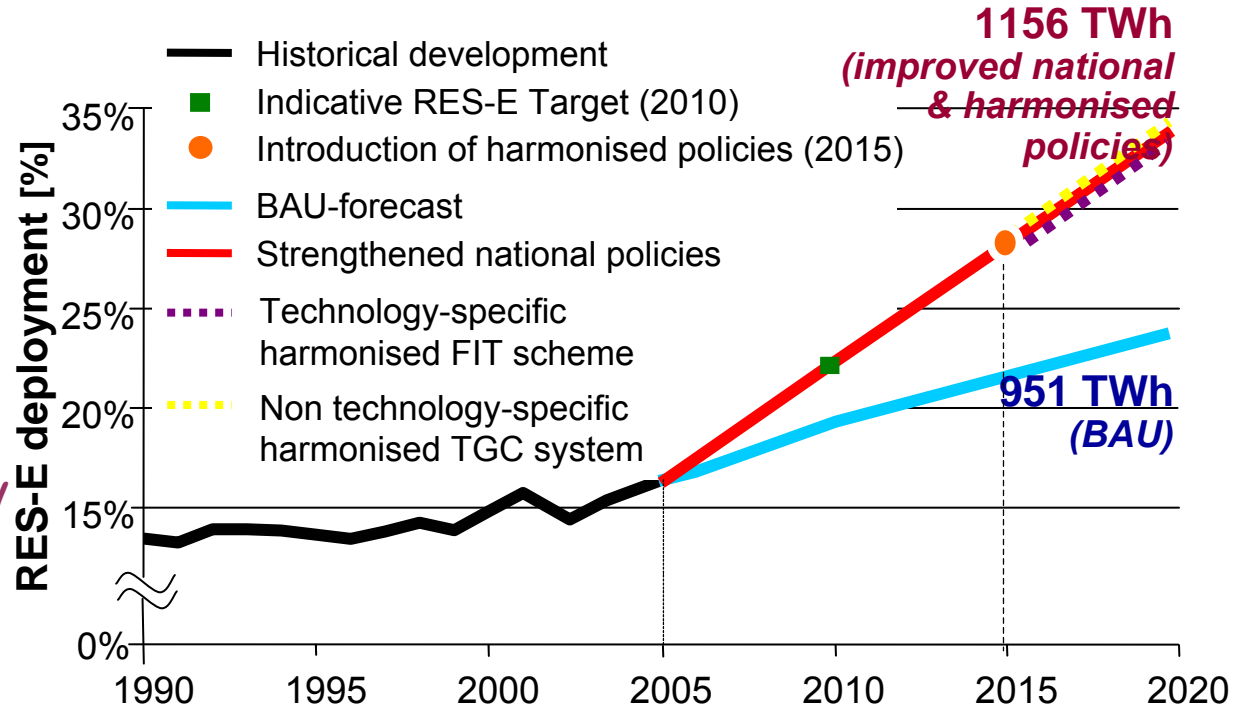


"National policy optimisation versus harmonisation"

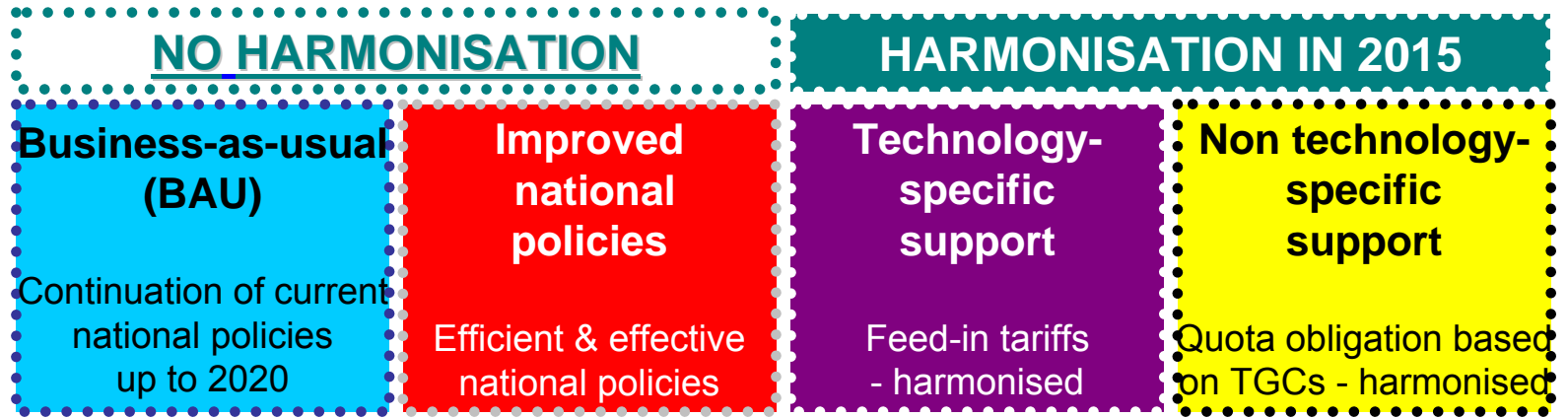
- Results of **Green-X** model runs recently conducted within the **EIE** project



... currently updated and extended (GO-trade, etc.)



Investigated cases:

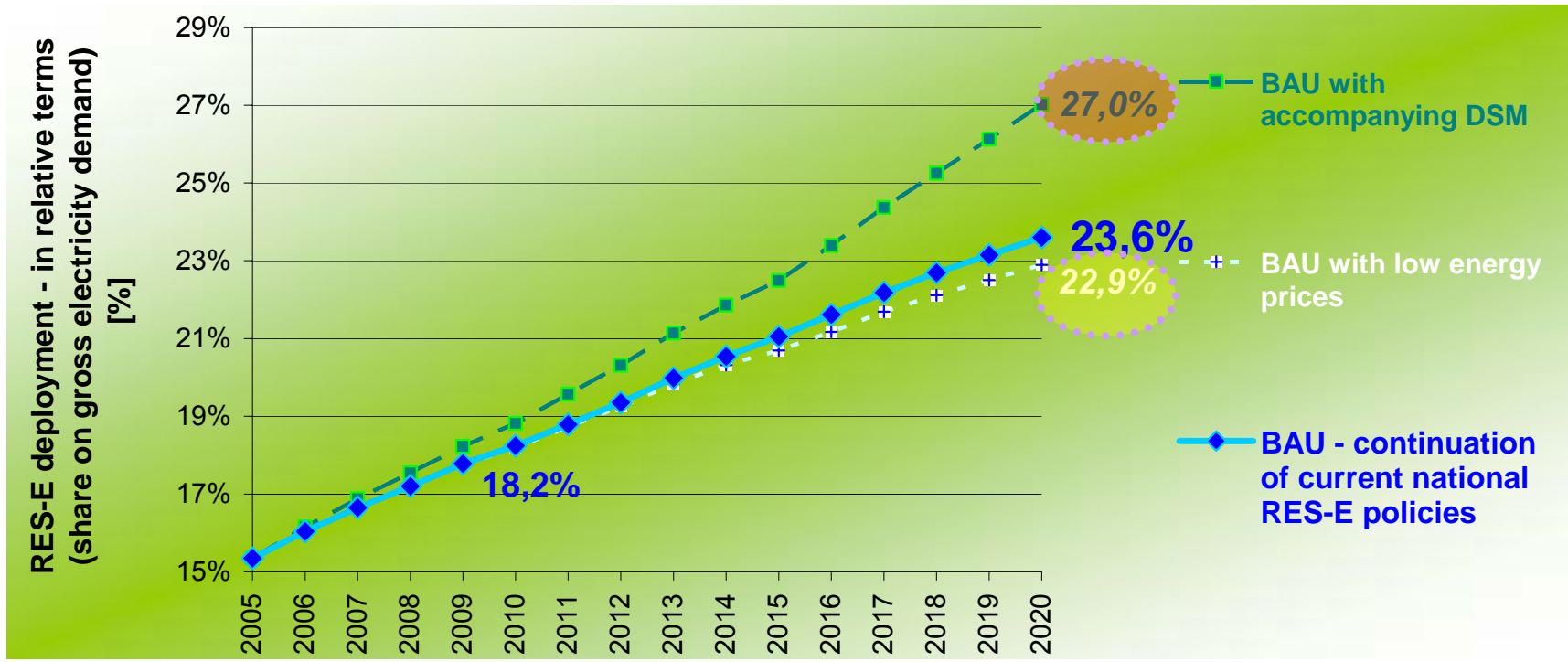


(3) Results

Total electricity generation from RES (EU25) as share of gross electricity demand

BAU scenario

... how far will we come with current RES policies?

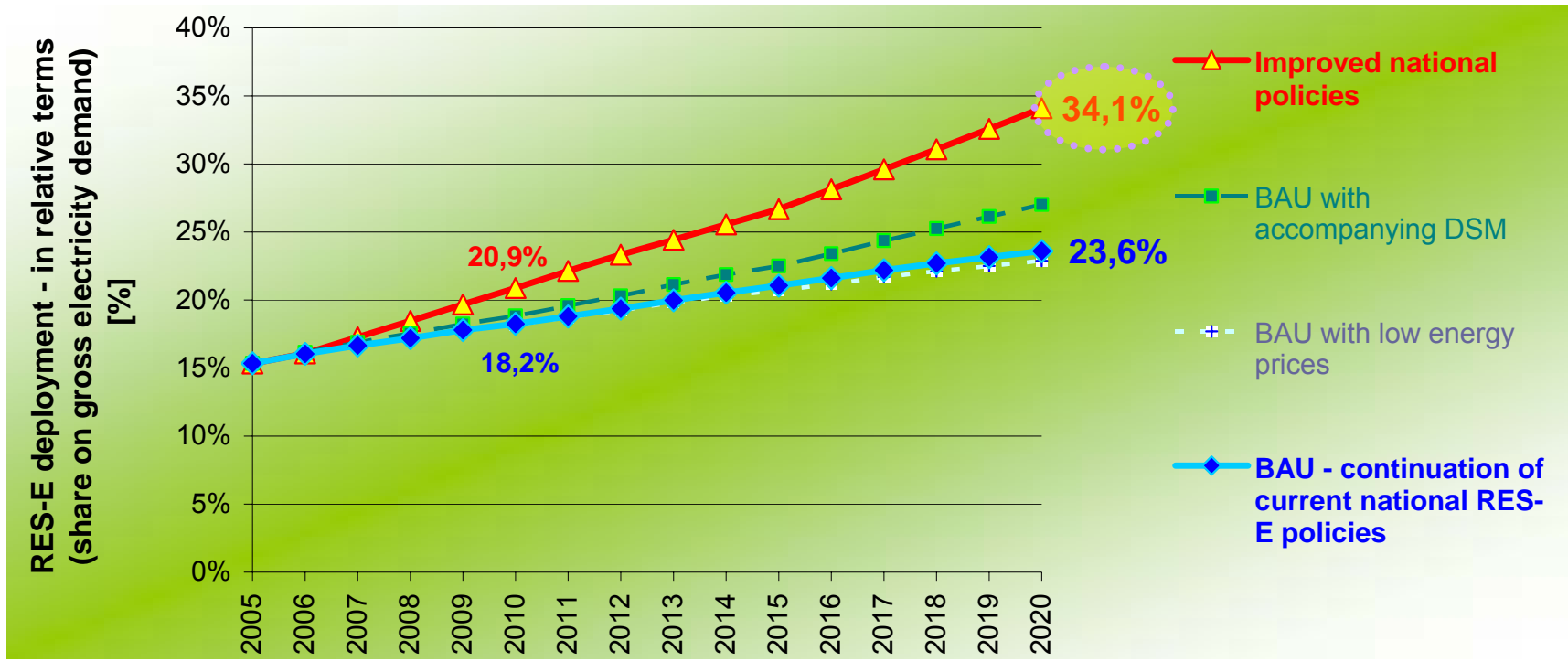


... the impact of an active DSM policy and conventional energy prices

(3) Results

Total electricity generation from RES (EU25) as share of gross electricity demand

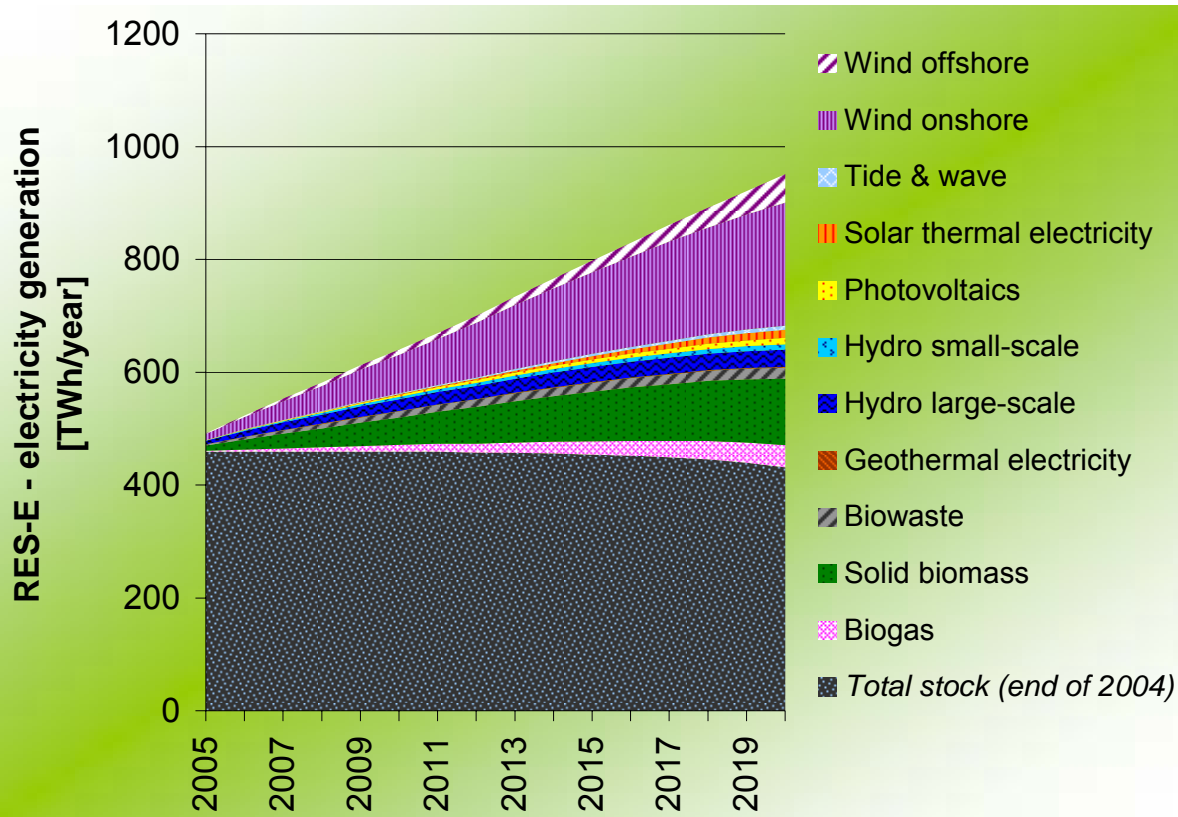
BAU versus **Improved national policies**



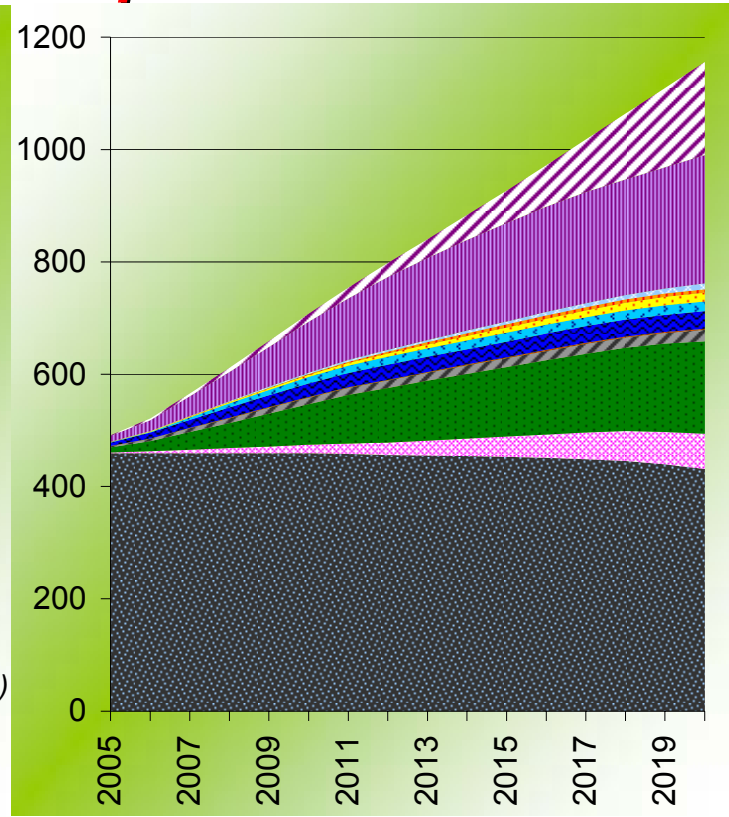
... improving national RES support schemes accompanied by an active DSM policy

Total electricity generation from RES (EU25)

BAU scenario



Improved national policies scenario



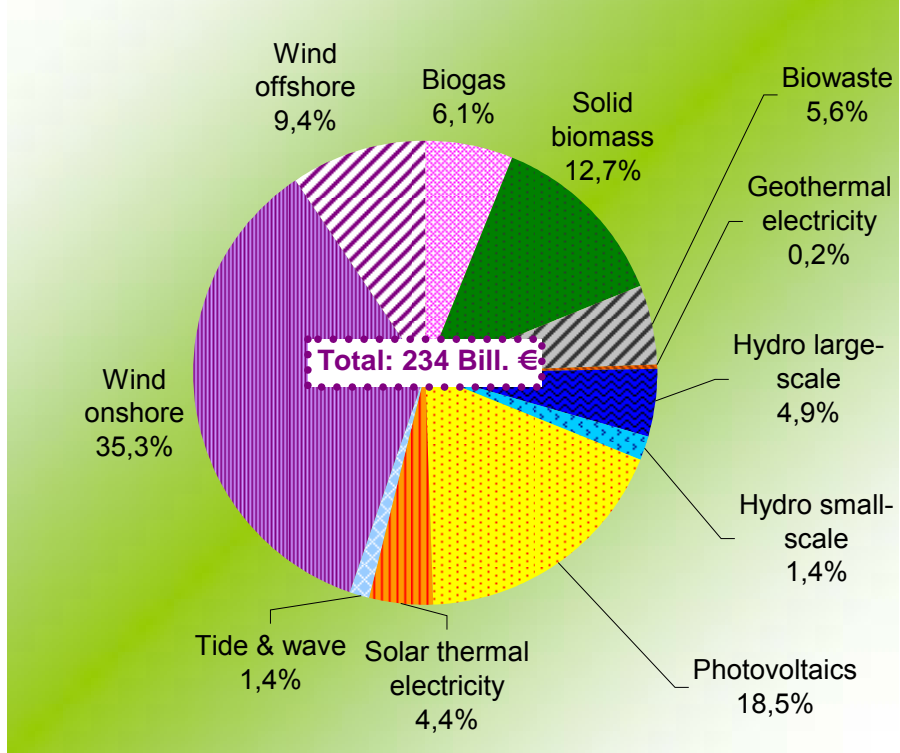
... both cases based on purely national support schemes

Breakdown of investment needs for new RES-E plant

(installed in the period 2005 to 2020) on EU-25 level

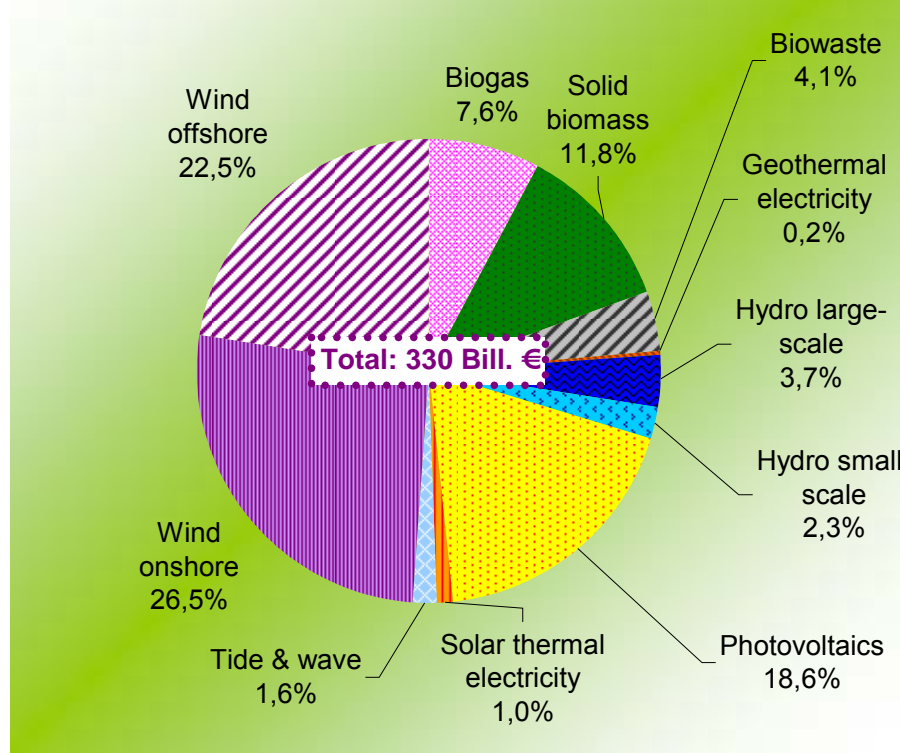
BAU scenario

Breakdown of cumulative investment needs for new RES-E plant (installed 2005 to 2020)



Improved national policies scenario

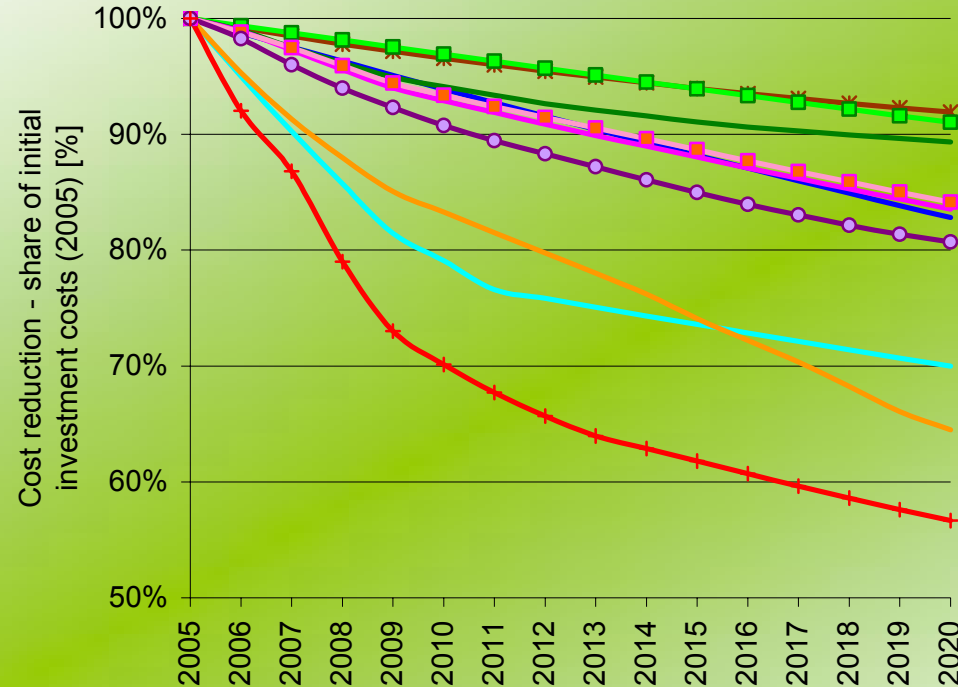
Breakdown of cumulative investment needs for new RES-E plant (installed 2005 to 2020)



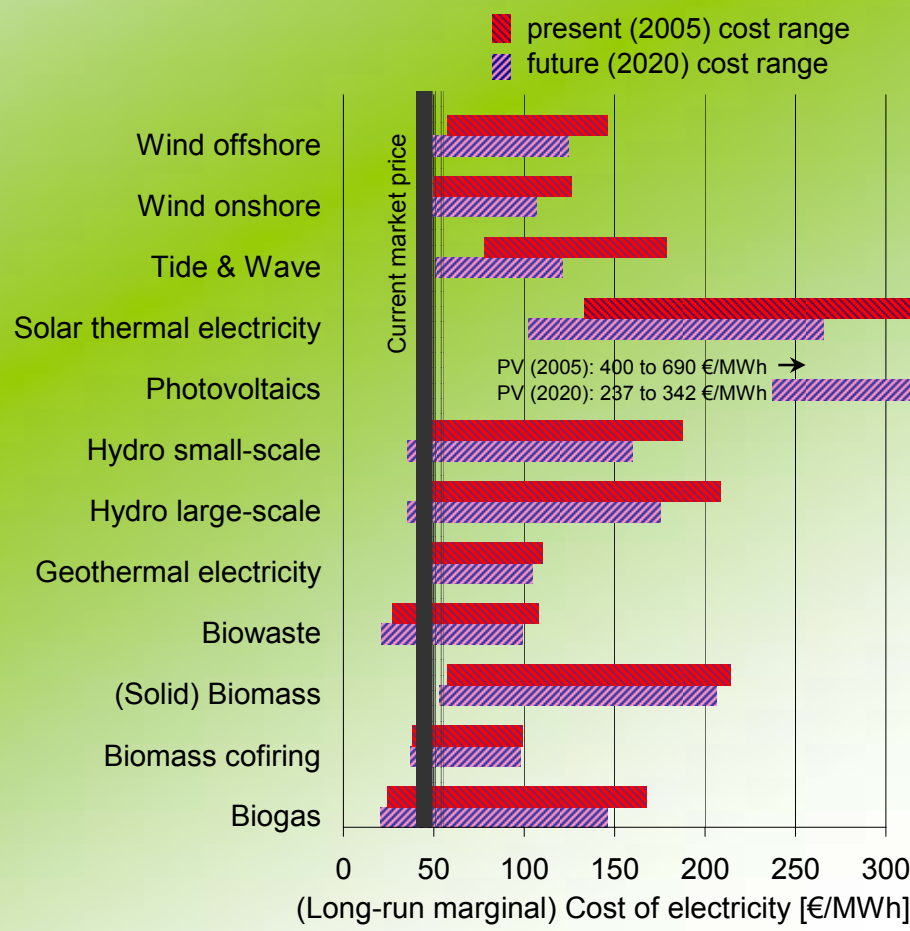
Cost reduction within the BAU-scenario due to technological learning

Resulting cost reduction for RES-E technologies

- Hydropower
- * Geothermal electricity
- Biomass - cofiring & large-scale plant
- Solid biomass - small-scale CHP
- Gaseous biomass
- Gaseous biomass CHP
- Wind energy
- Tidal & wave
- Solar thermal electricity
- + Photovoltaics



Cost of electricity - at present (2005) & future expectations (2020)



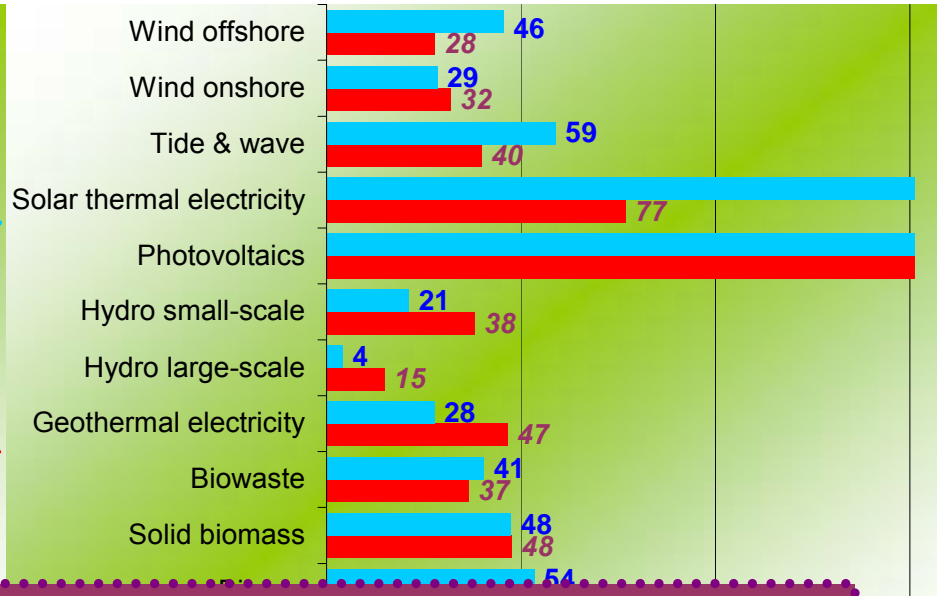
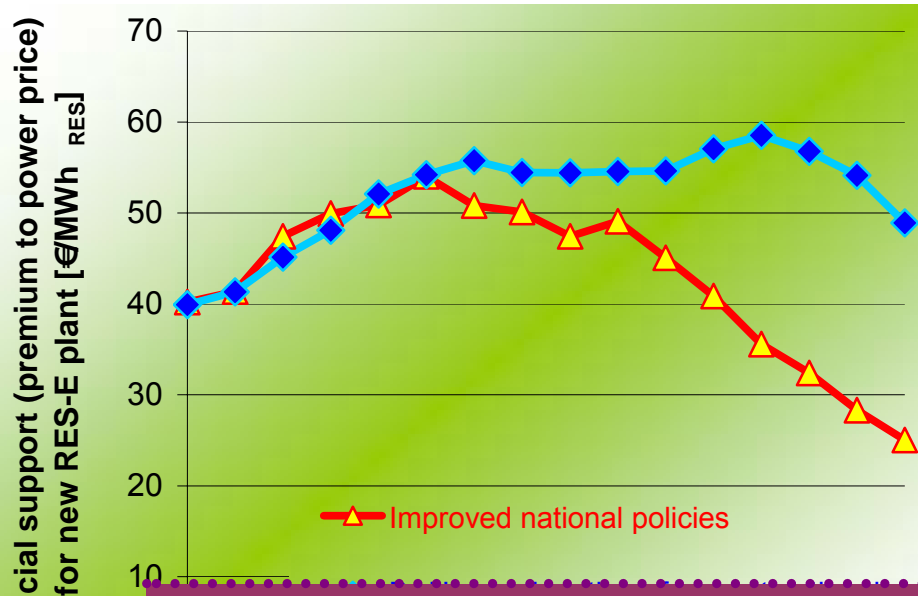
(3) Results

(Average) financial support for new RES-E plant

Unit: €/MWh_{RES}

This indicator shows the dynamic development of *necessary financial support for new RES-E installations (on average)*. ... The amount represents *from an investors point-of-view the average additional premium on top of the power price guaranteed (for a period of 15 years) for a new RES-E installation in a certain year*, whilst from a consumer perspective it indicates the required additional expenditure per MWh_{RES-E} for a new RES-E plant compared to a conventional option (characterised by the power price).

Improved national policies
versus
BAU



...improving national policies: higher RES deployment with less specific support!

(3) Results

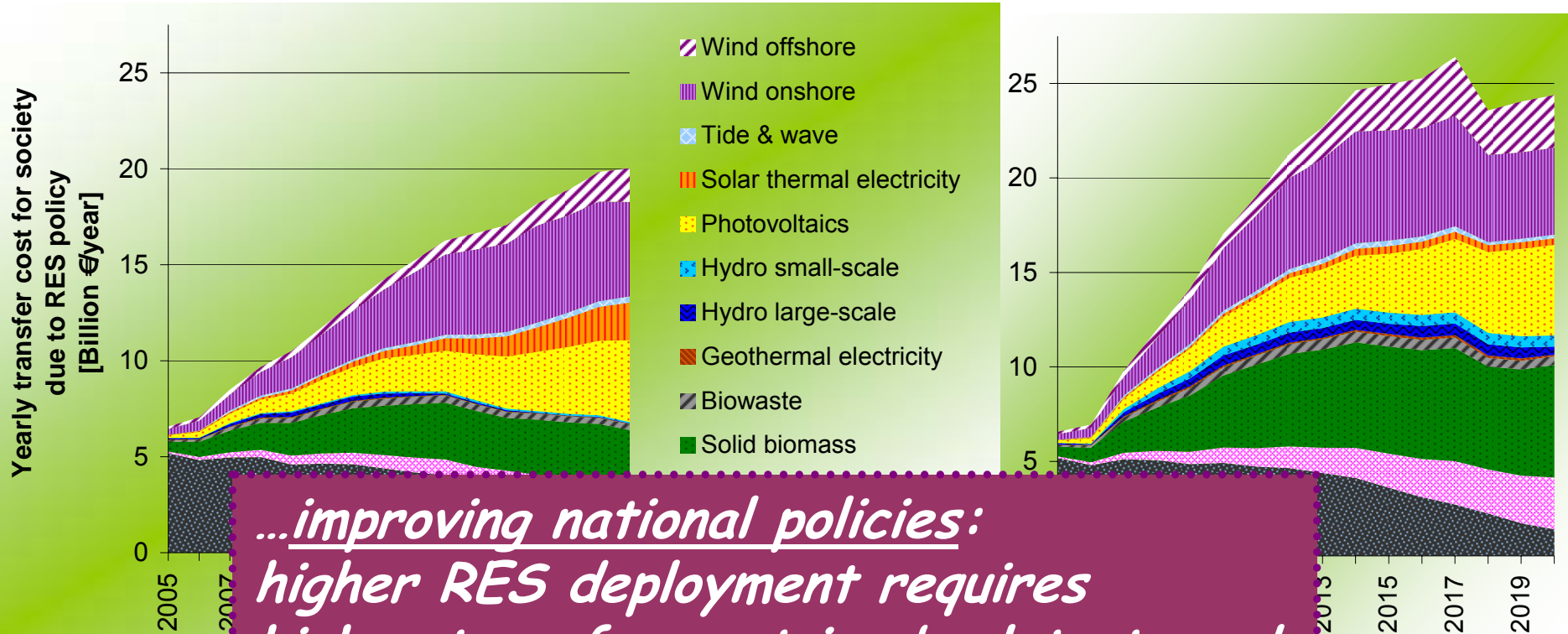
Transfer costs for consumer

(due to the promotion of RES-E)

Unit: M€/year or €/MWh_{DEMAND}

Transfer costs for consumer / society (sometimes also called additional / premium costs for consumer / society) are defined as *direct premium financial transfer costs from the consumer to the producer due to the RES-E policy compared to the case that consumers would purchase conventional electricity from the power market.*

Improved national policies versus BAU



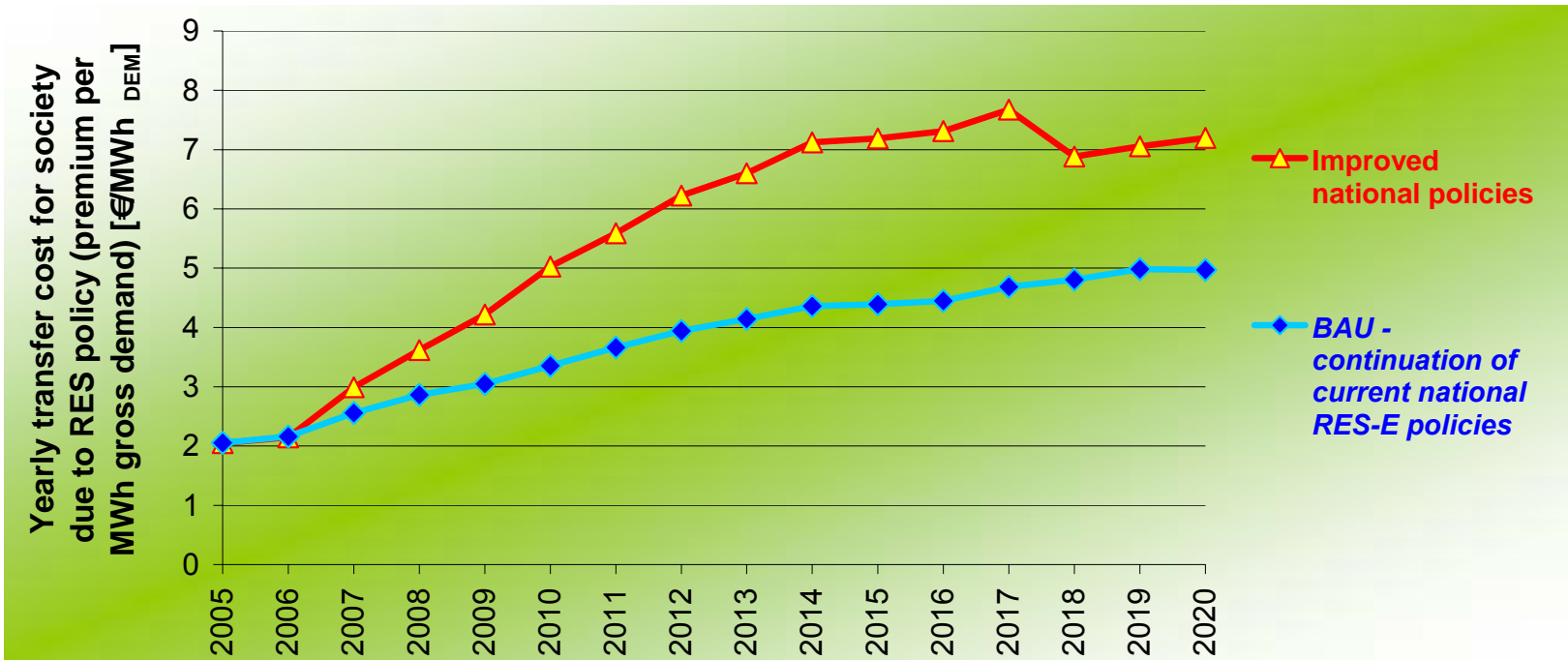
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Improved national policies
versus
BAU



Remark:

*How can (national) support policies
be strengthened / improved?*

**Improved
national
policies**

versus

BAU

▶ ***Remove non-financial deficits***

- i.e. administrative barriers (planning, bureaucracy), technical barrier (grid connection / extension)

▶ ***Target new support schemes solely to new RES-E installations***

▶ ***Guarantee, but strictly limit the duration of financial support***

▶ ***Include the full basket of available RES-E options***

▶ ***Set incentives to accelerate future cost reductions***

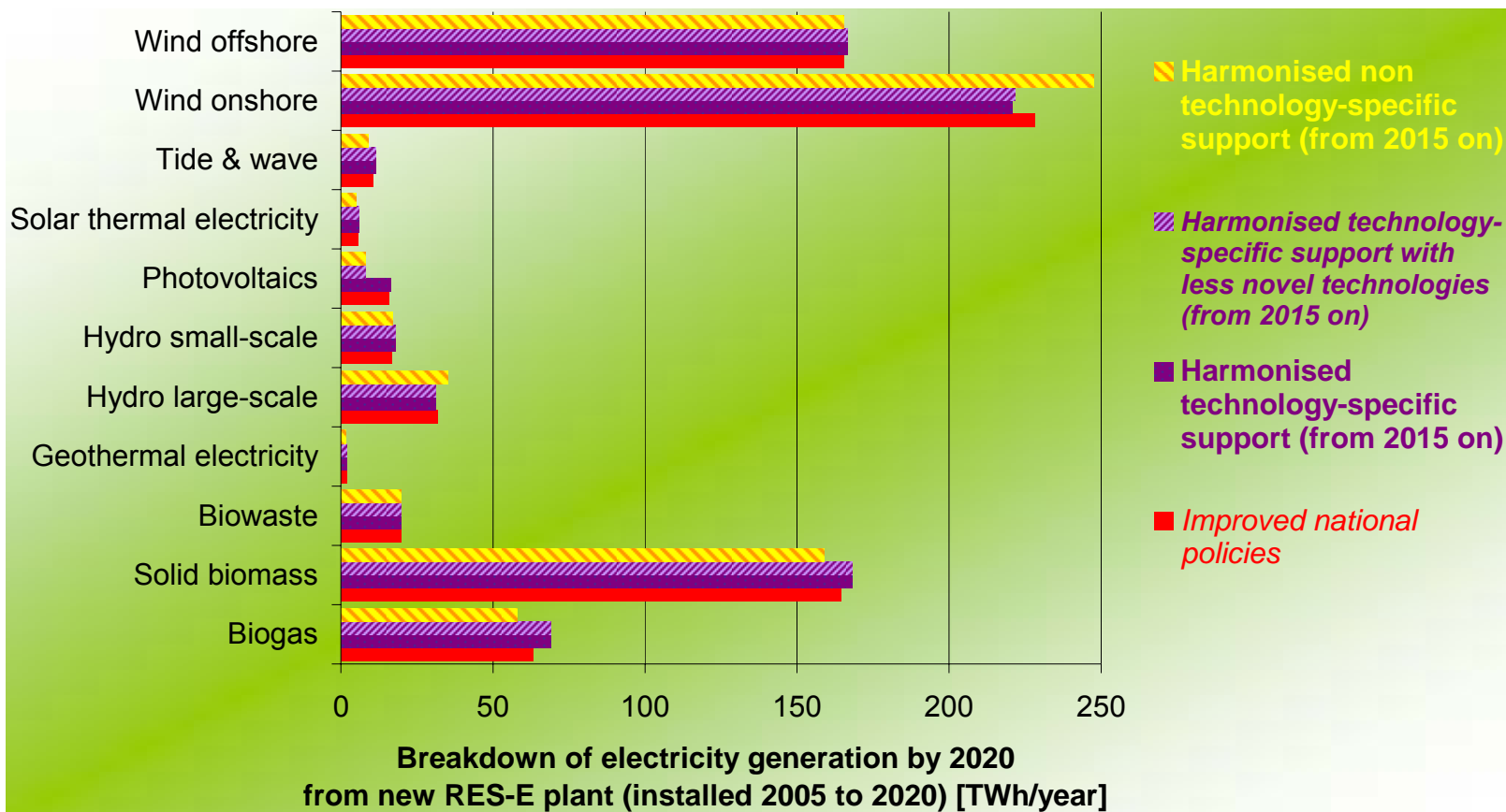
Improved national policies

versus

Harmonisation

**Breakdown of electricity generation
from new RES-E plant**
(installed in the period 2005 to 2020) on EU-25 level

**Improved national policies
versus Harmonisation**



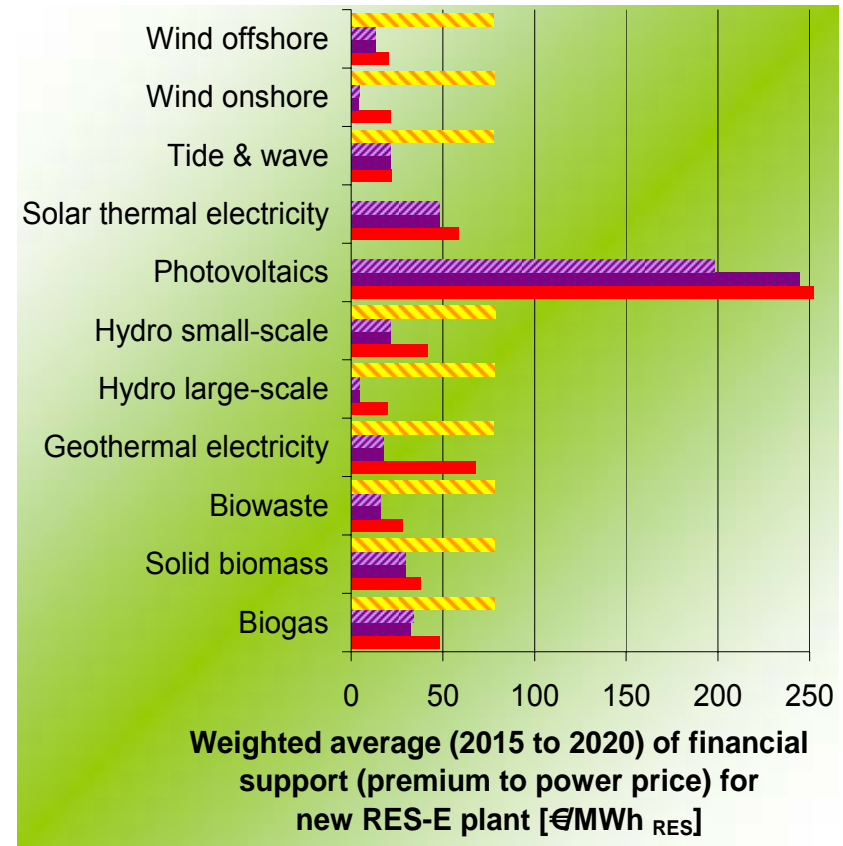
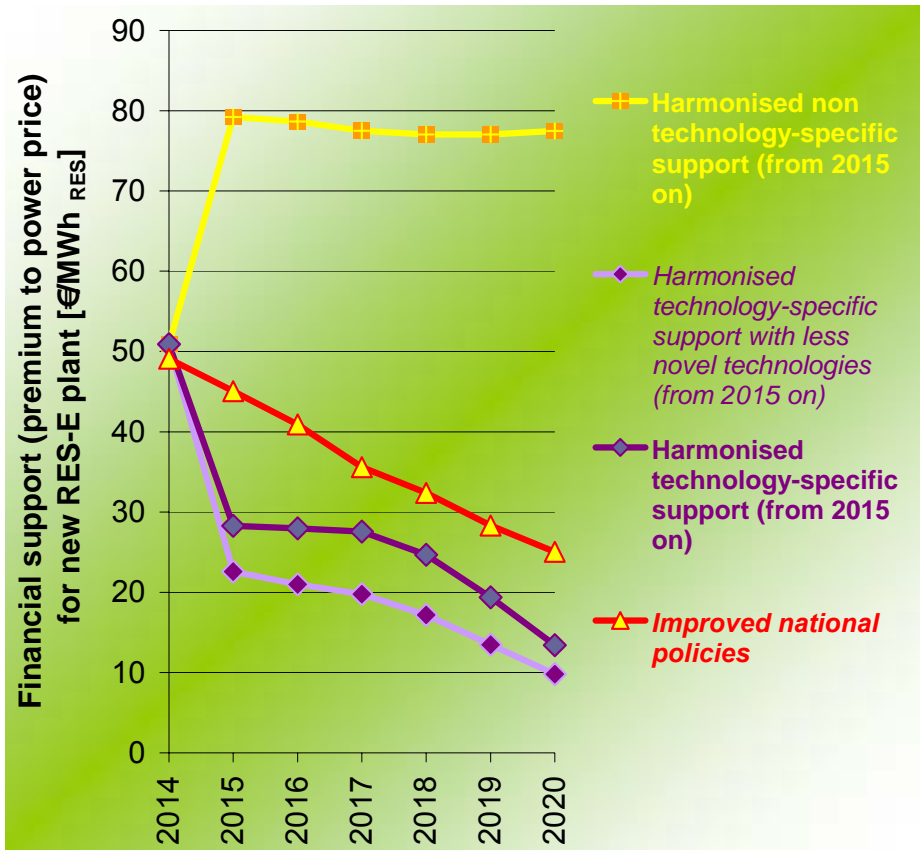
(3) Results

(Average) financial support for new RES-E plant

Unit: $\text{€}/\text{MWh}_{\text{RES}}$

... represents the average additional premium on top of the power price guaranteed (for a period of 15 years) for a new RES-E installation in a certain year...

Improved national policies
versus **Harmonisation**

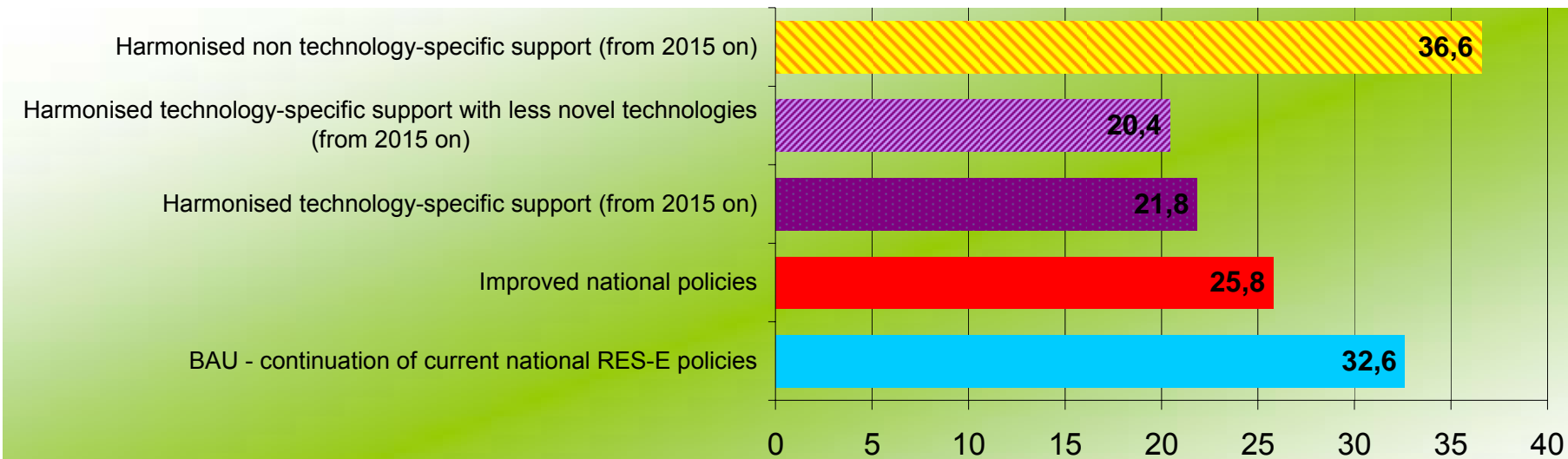


TOTAL transfer costs for consumer (due to the promotion of RES-E)

Units: M€ or % (in comparison to a reference case)

Improved national policies
versus **Harmonisation**

Total or cumulated transfer costs for consumer in 2020 summarise both the cumulated consumer burden within the investigated period 2005 to 2020 as well as the residual costs for the years after 2020. Its calculation is done as follows: The required yearly consumer expenditure in the period 2005 to 2020 as well as the estimated residual expenditures for the following years after 2020 are translated into their present value in 2005.



Cumulated* transfer cost for society due to RES policy for new RES-E plant (installed 2005 to 2020) as premium per MWh corresponding RES-E generation [€/MWh_{RES}]

*i.e. cumulated present value (2005) of yearly transfer cost

→ Expressed in specific terms, divided by their induced cumulative (15 years) RES-E generation

(4) Conclusions

General conclusion

*The **key criterion** for achieving an enhanced future deployment of RES-E in an **effective & efficient** manner, besides the continuity and long-term stability of any implemented policy, is the **technology specification** of the necessary support.*



(4) Conclusions

National policy optimisation versus Harmonisation

The results suggest that the **most significant efficiency gains** can be simply achieved through an **optimisation of national RES-E support measures**.

Further efficiency improvements at a considerably lower level are possible by an **EU wide harmonisation** of support schemes provided that a common European power market exists.

If a harmonised policy is pursued, **a technology specific support** (e.g. Feed-in tariffs, Premium systems) **is superior** to non-technology specific (e.g. common TGC-system) with respect to cost minimisation.

A **premature EU-wide harmonisation** can ...

- hamper the national optimisation process as well as ...
- the overcoming of non-economic barriers at Member State level and can ...
- lead to significant market distortions if power markets are not fully liberalised.

In addition, there is additional benefit from the competition of non-harmonised systems during some time as the **promotion schemes can learn mutually from each other**.

***Elements of the new proposal for
a RES directive***

- Discussion on GO trade -

► Flexibility by means of GO-trade - *Why?*

Trade of Guarantees of Origin - increasing flexibility for the fulfilment of national 2020 RES targets

- RE trade based on Guarantees of Origin (GOs) as proposed by the EC is a controversial issue.
- Ecofys, Fraunhofer ISI and Vienna University of Technology, EEG examined concepts, critical issues and design options of European GO trade in a briefing paper for the German BMU. (Klessmann et al., October 2007)

► Flexibility by means of GO-trade - *Why?*

Rationale of European GO trade

- Renewable energy potentials are distributed unevenly across Europe.
 - A trading option could help MS with low RE potential to achieve their targets at lower societal cost.
- Potentially, this could lead to lower overall costs for reaching the European 2020 targets.
 - Using standardised GOs for trade and disclosure may avoid double counting and double selling of RE.

► Flexibility by means of GO-trade - *design options*

General design options under discussion

► *Mandatory* or voluntary trade?

► Trade by Member States or *private parties*?

► Restriction of trade?

-Restriction to a certain percentage (of the target)?

-Restriction of import or also *export*?

-GO trade of RES-E, or also *RES-H*?

► Further specifications?

► *Assessment: Case study ...*

... **Unrestricted GO-trade by private parties**

Critical issues of GO trade are discussed for the case of mandatory, unrestricted trade by private parties, i.e.

- Member States are not allowed to block or restrict trade
- RES-E producers can choose to sell their RES-E domestically or to governments and utilities in other MS
- RES-E producers can participate in the support scheme of another MS, if they have not received support in their own country
- No further specification

Note: This is the most extreme case; alternative trade designs may limit critical effects.

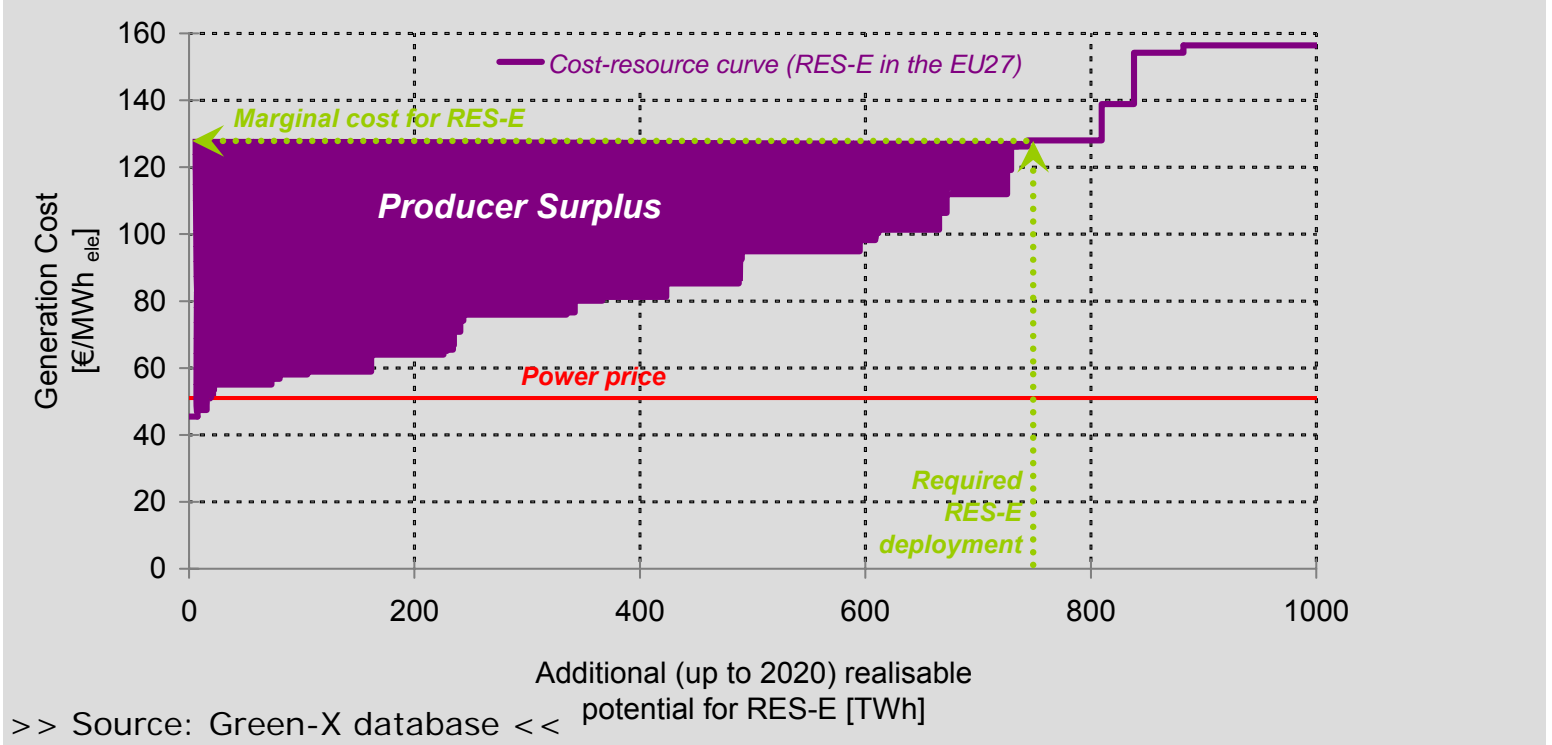
► **Critical issue: *Time frame for trade***

„Cherry-picking” between support schemes

- If producers can choose the support system which pays the highest support every year, they undermine the long term concept of most European support systems.
 - Problem for target compliance: RES-E production of the same plant could count to the target of one MS in one year and another MS in the next year.

→ **Long term arrangement needed**

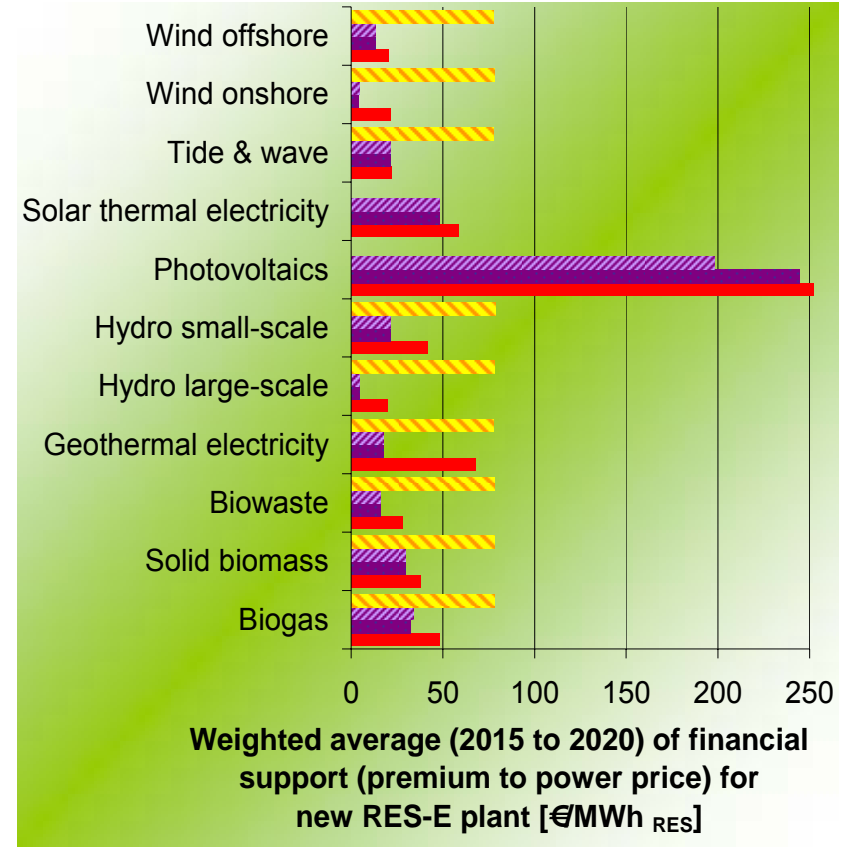
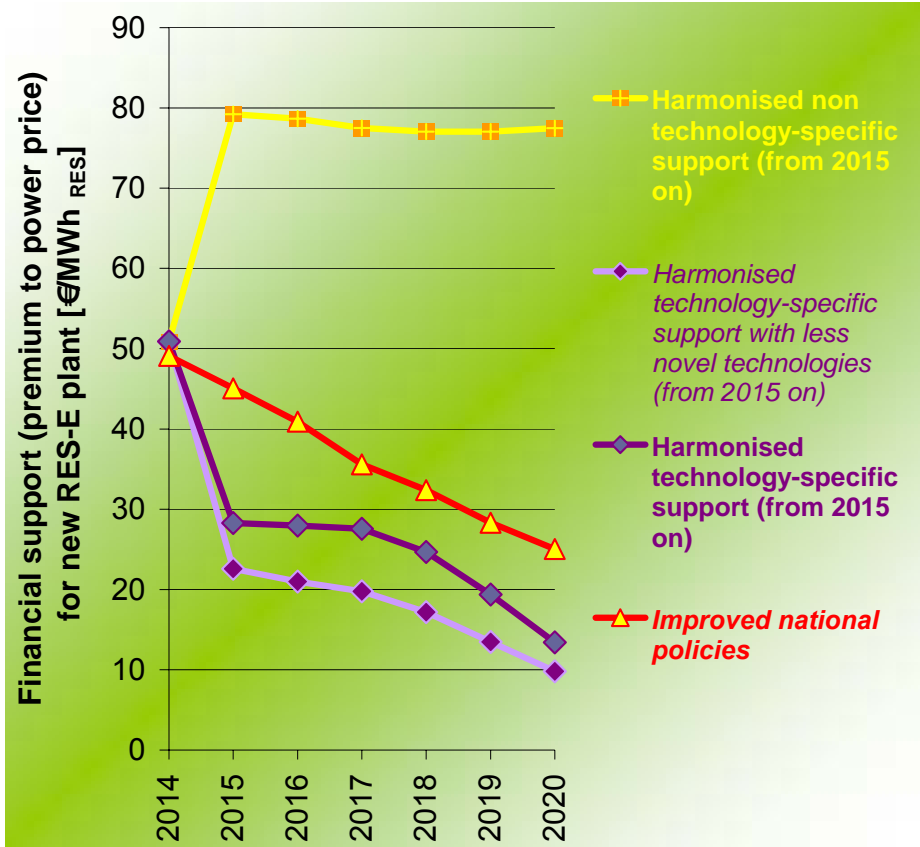
► Critical issue: Technology unspecific support (GO trade)



► A uniform European GO price for all RES-E would be set by the marginal price of the most expensive technology sold.

→ high producer surplus („windfall profits”) for low cost RES-E options

► Critical issue: **Technology unspecific support (GO trade)**



→ High public transfer cost may arise (high consumer expenditures)

► Critical issue? **Economic efficiency**

+: higher cost-effectiveness from the static viewpoint with regard to generation cost ... static least cost allocation of RES-E potentials all over Europe!

[2020: -3 ... 9 billion € (EU27)]

-: decreased dynamic efficiency!

... delayed deployment of innovative RES-E options

→ only at higher cost applicable when needed in the long-run!

-: decreased efficiency with regard to public cost (i.e. transfer cost for consumer) ... high producer profits may lead to a dramatic increase of consumer expenditures

[2020: ... up to +30 billion € (EU25)]

▶ Critical issue: „**Cross-border subsidies**“
 ... *"sell-out" of low-cost RE potentials*

- ▶ Net exporting countries would lose their low-cost RE potential. Their cost for achieving their RE target would increase.
- ▶ The cost for net importing countries would decrease.

→ Net exporting countries would **cross-subsidize** net importing countries.

But: **benefits** for their local industries, GHG reduction,
 less air pollutant

In addition: The generated electricity still needs to be **integrated** into the power system of the exporting country (grid connection, reinforcement etc.) → integration cost, interconnectors needed?

► Concluding remarks

GO-trade at company / private level ...

- Only voluntary trade!
- Trade restriction (Import / Export) are necessary!
- Technology-specification of support is highly recommended, but difficult to realise!

In general ...

- (Unrestricted) private trade = hidden harmonisation!
 → A public debate on pro's and con's as well as with regard to the choice of support instrument (TGC/GO vs. Premium-FITs) is needed!
- Remove of non-economic barriers for an accelerated RE deployment is necessary in order to assure the achieving of the 20% target at low public cost!
- GO-trade at Member State level is preferential → offers increased flexibility and contributes to a low cost solution!



Forthcoming events: Regional workshops ...

Ljubljana, 11 April 2008

*London, 25 April 2008 ... Focus: joint efforts to promote
offshore wind in the North Sea?*

Rome, May 2008

Germany, June 2008

Final conference ... Brussels, November 2008

*Thanks for your
attention!*

In case of questions / remarks ...

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