

**EXPERIENCES OF
GREEN-X, FORRES, OPTRES....
– LESSONS LEARNED FOR
POLICY**

**Reinhard Haas, Gustav Resch, Claus Huber,
Thomas Faber**

***Energy Economics Group (EEG), Vienna University of
Technology,***

- 1. Introduction**
- 2. What is the problem / target?**
- 3. The model GREEN-X**
- 4. Results GREEN-X**
- 5. Difference in transfer costs**
- 6. Harmonisation ?**
- 7. Design criteria for effectiveness**
- 8. Conclusions**

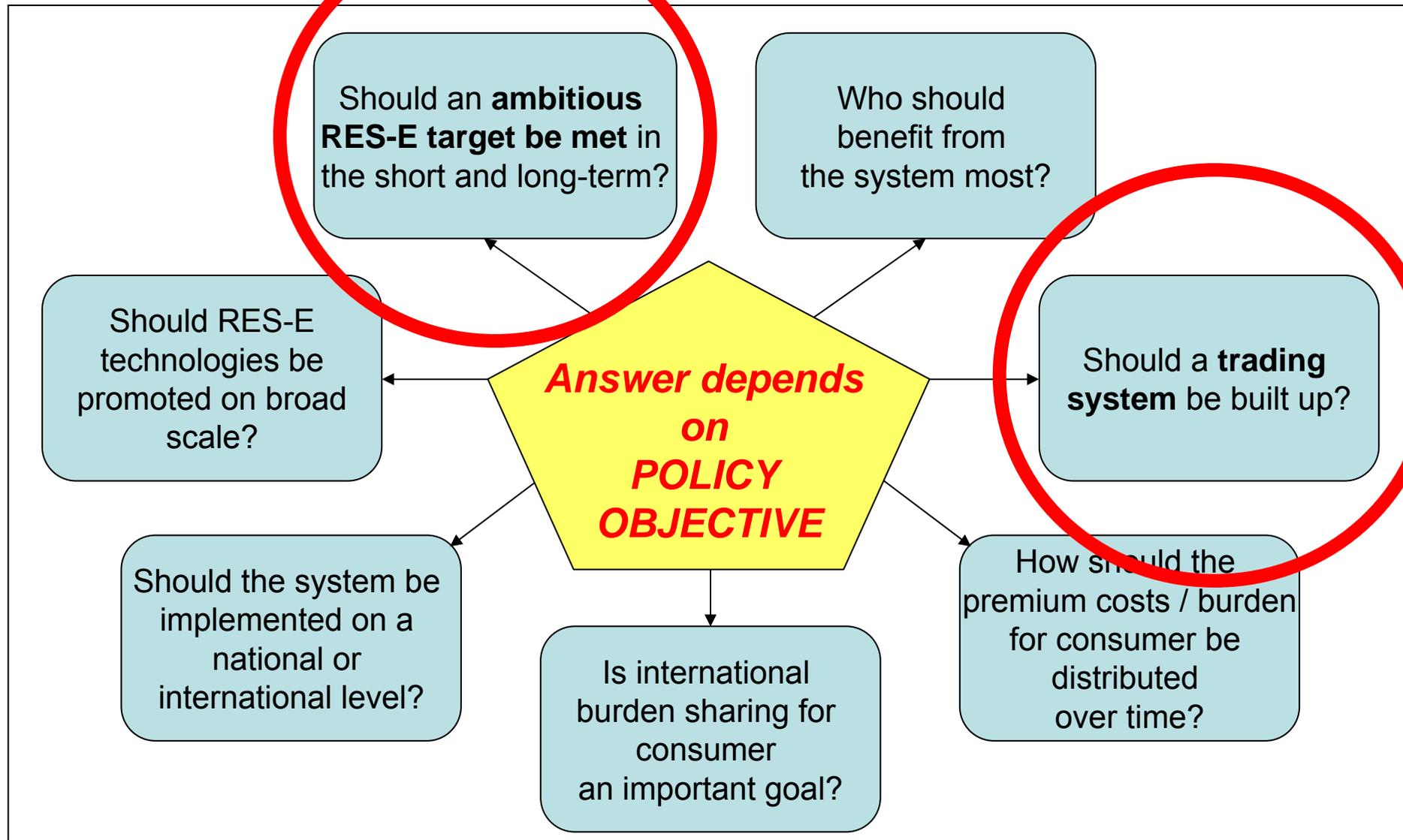
CORE MOTIVATION:

Heading towards sustainability!

**Policy targets for an
INCREASE of RES-E!**

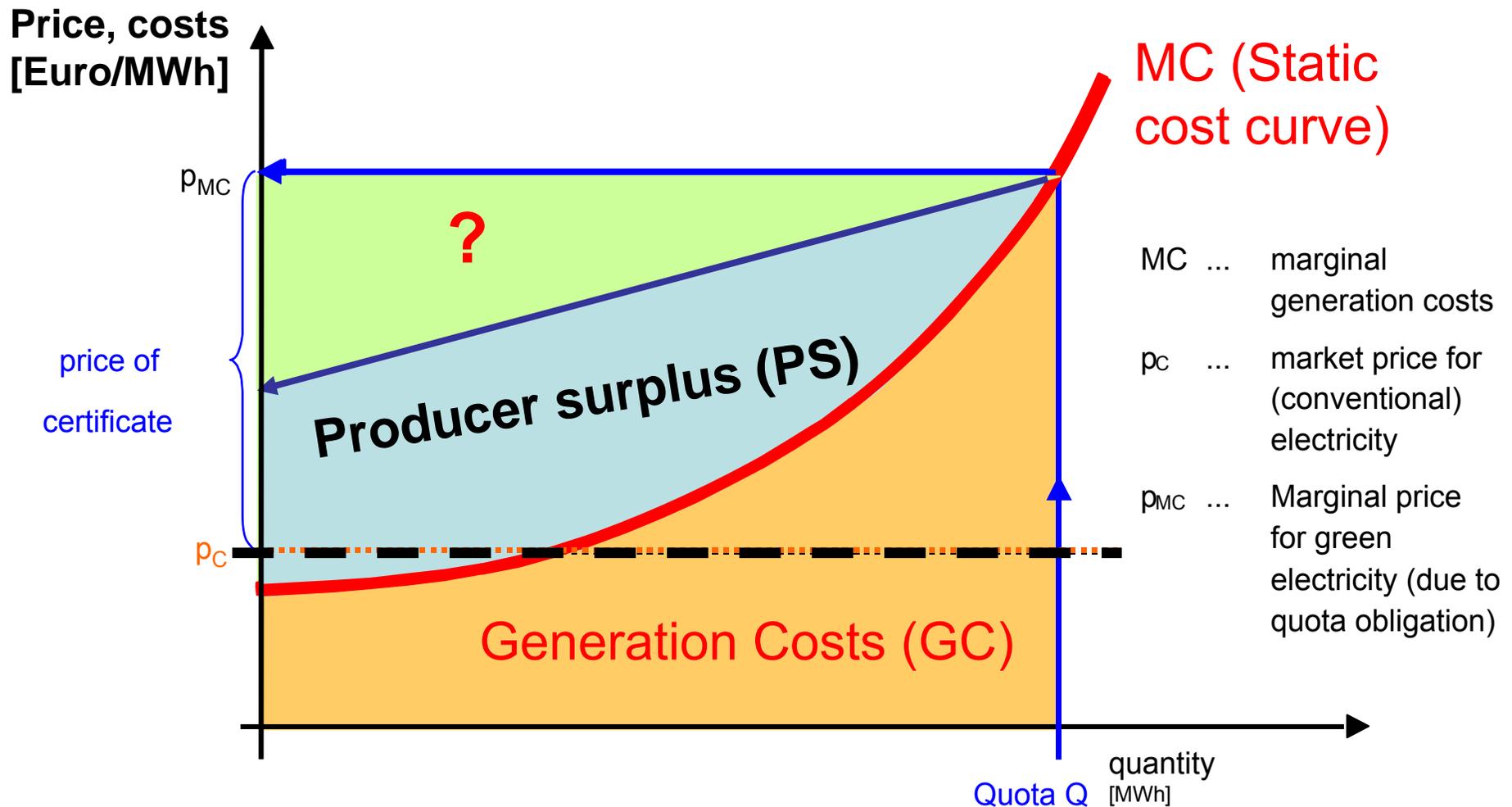
**(e.g. RES-E directive of the EC to
increase the share of RES-E)**

Which instrument fits best?



Method of approach

Minimise transfer costs for consumers = **Producer Surplus** + **Generation costs** - Revenues electricity market



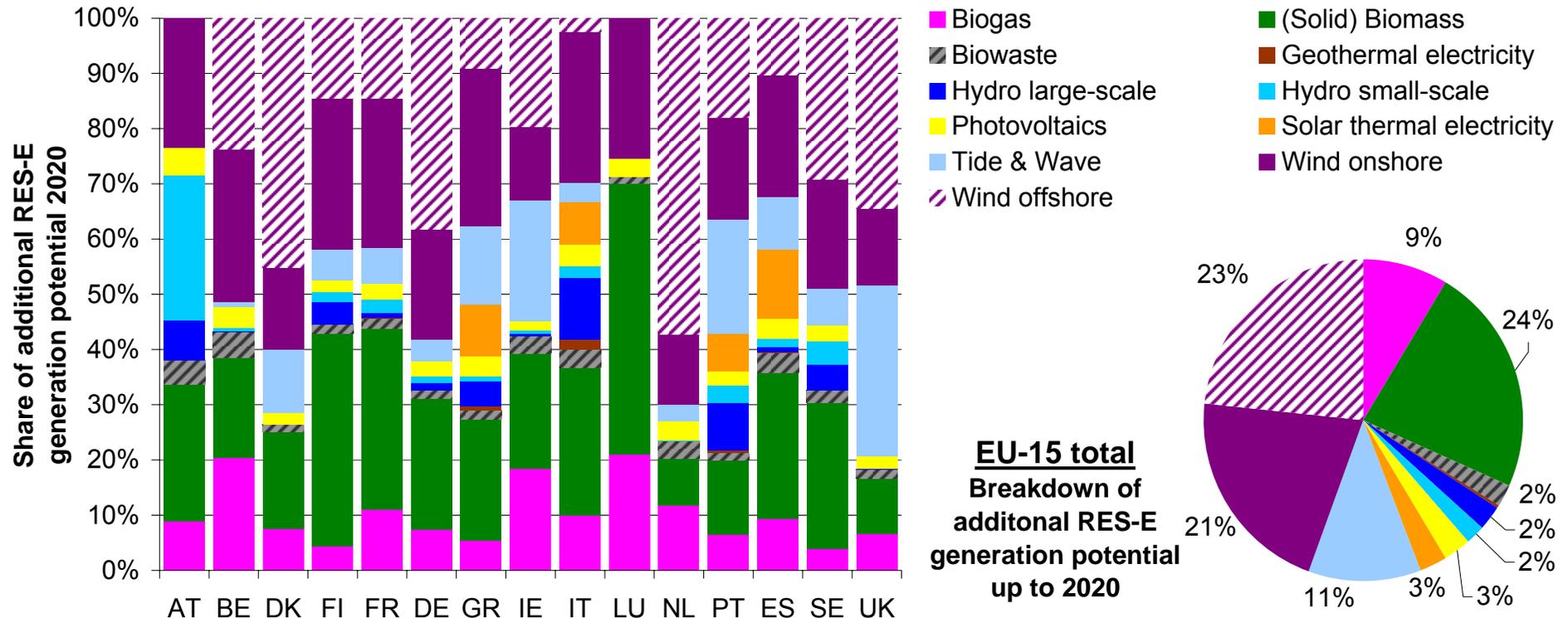
Transfer costs for consumers = Extra costs finally to be paid by the final customers

(and in every promotion scheme these costs will finally be paid by the final customers)

by technology

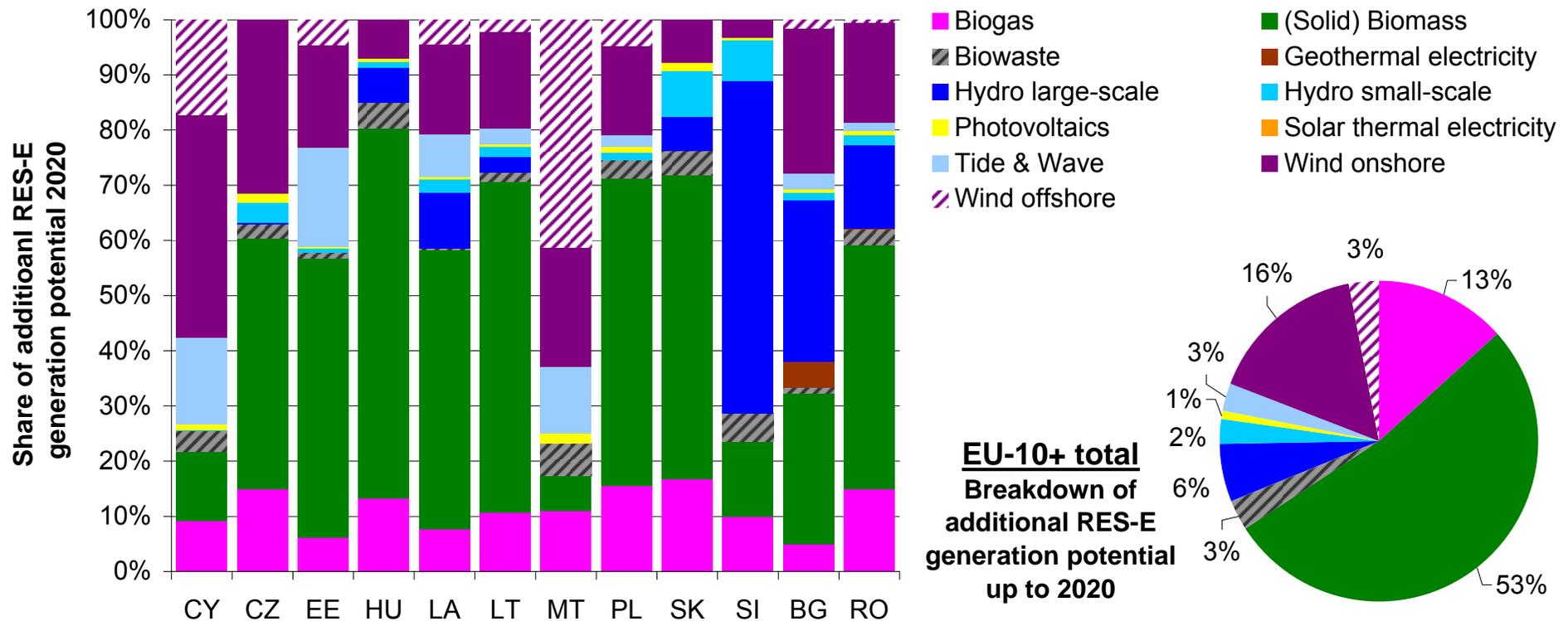
EU 15

- Promising future options: Wind energy (on- & offshore), Biomass, Biogas but also emerging new technologies: tidal stream & wave power, solar thermal electricity



EU-10+ and CC by technology

- Promising future options: Biomass, Biogas, Wind energy (on- & offshore) but also hydropower

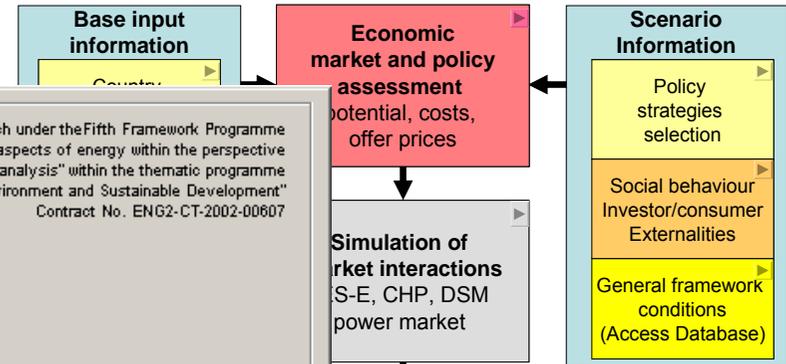


EU-Project **Green-X**

DG Research

Web: www.green-x.at

The toolbox **Green-X**



The screenshot shows the Green-X software interface. The top window displays 'Energy policy instruments - Electricity' for Germany, with options for 'Feed in tariff' (Fixed, Premium, Flat rate, Stepped rate) and 'Staged rate'. The bottom window shows 'Results - Country specific - Cross-section' for the European Union 15, listing 'General Results' and 'General Costs'.

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Green-X
Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market

Platform Win2000 SP3
Win XP SP1
Version 4.4.3

Thomas Faber, Claus Huber, Gustav Resch
Energy Economics Group
Vienna University of Technology

Share of RES-E in a dynamic European electricity market

Share of Electricity Generation	Electricity Generation new plants	Share of Electricity Generation new plants	Installed capacity	Share of installed capacity	New installed capacity
%	GWh	%	MW	%	MW
100,00	38,67	100,00	3.122,88	100,00	10,47
100,00	38,67	100,00	3.122,88	100,00	10,47
10,00	11,34	28,22	205,09	6,58	1,19
1,54	0,98	25,23	52,87	0,98	1,28
18,81	18,07	47,30	271,88	7,72	2,78
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
8,30	0,00	0,00	8,87	0,27	0,00
0,00	0,00	0,00	4,00	0,00	0,00
1,17	0,00	17,38	19,85	0,53	1,29
0,74	0,00	0,00	14,94	0,42	0,00
0,01	0,01	0,00	1,28	0,04	0,00
0,01	0,01	0,00	1,28	0,04	0,00
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
7.388,44	91,37	30,89	3.185,67	90,43	7,39
8.923,19	88,27	1.215,45	3.143,11	100,00	815,49
1.281,82	13,61	737,20	390,00	401,89	71,47

... to simulate various policy strategies for the promotion of RES-E in a dynamic framework on a national or international level

(Current: EU15, end 2005: EU27, future: EU 39???)

- The
- te

Green-X - Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market

File Select parameter Simulation Results Additional tools Window ?

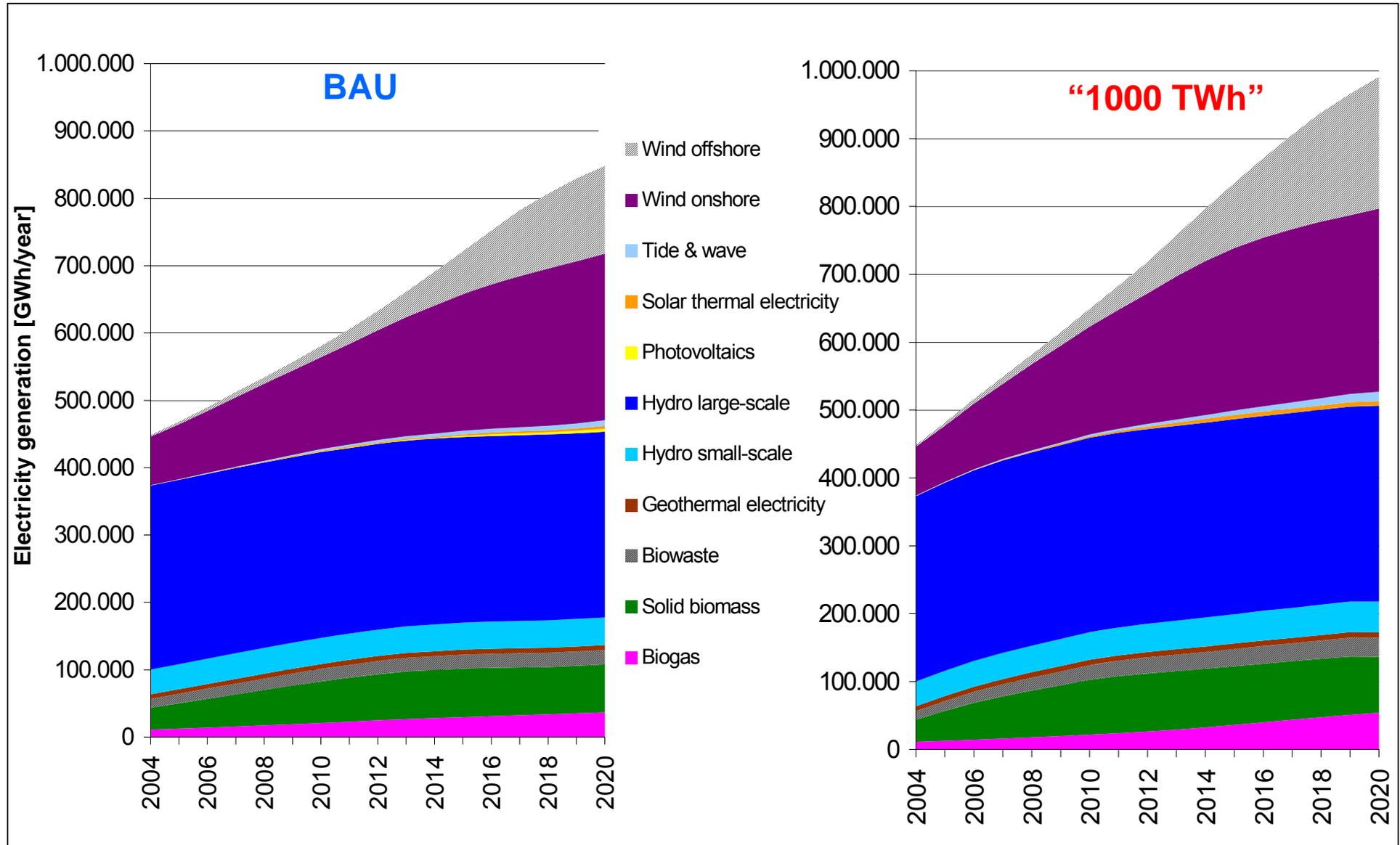
Results - Country specific - Cross-section

Select

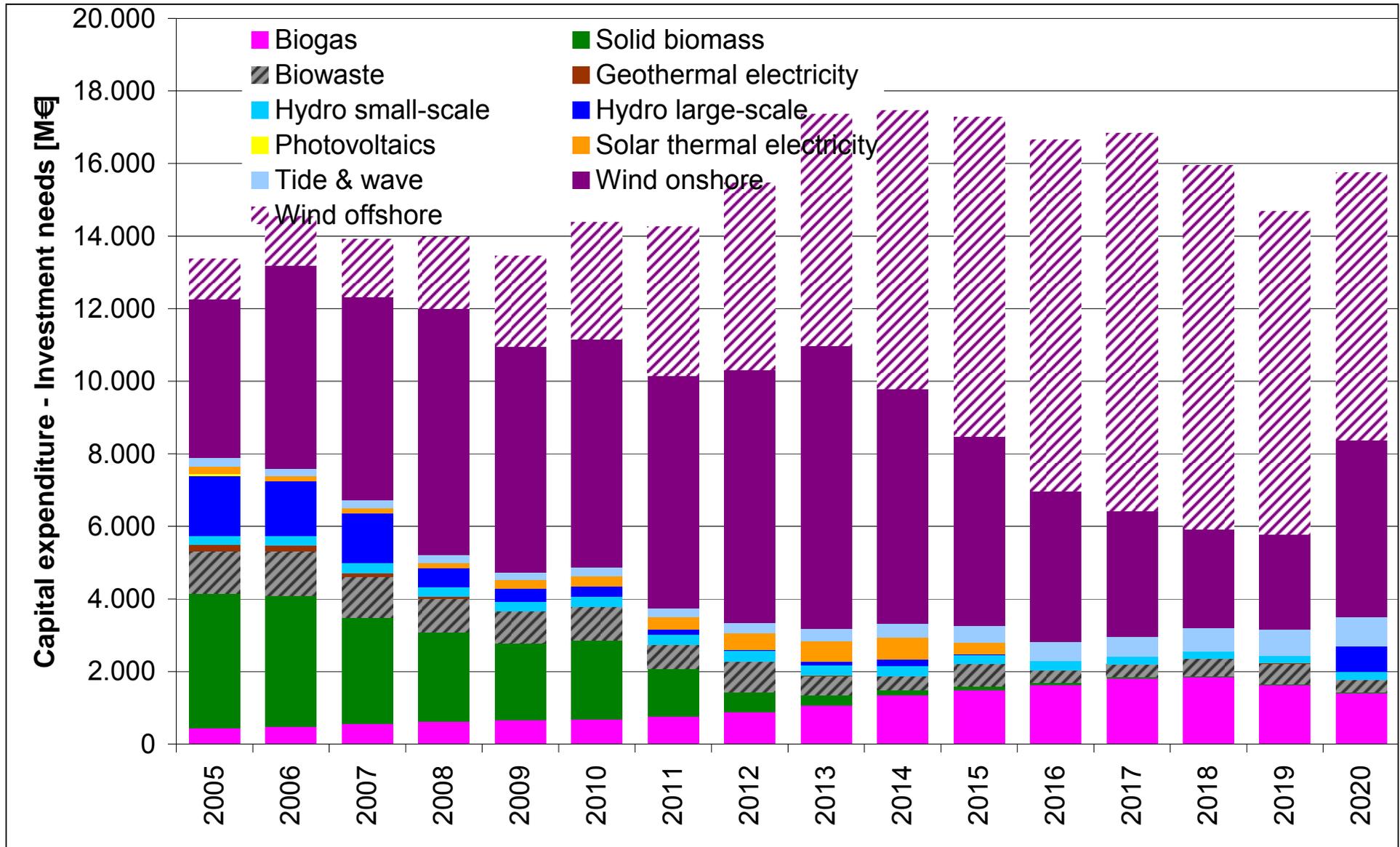
 **European Union 15**

General Results		
Total Electricity Consumption	3.106.825,00	GWh
Share of total electricity consumption	100,00	%
Total Electricity Generation	3.091.155,25	GWh
Share of total electricity consumption	99,50	%
Electricity Generation		
Total Electricity Generation	3.091.155,25	GWh
of which from renewable energy sources (RES)	607.574,44	GWh
Share of total electricity generation	19,66	%
Share of total electricity consumption	19,56	%
of which from electricity plants (ELE)	555.582,81	GWh
Share of total electricity generation	17,97	%
Share of total electricity consumption	17,88	%
of which from combined heat and power plants (CHP)	51.991,61	GWh
Share of total electricity generation	1,68	%
Share of total electricity consumption	1,67	%
Generation Costs		
Total Generation Costs due to renewable energy sources (RES)	24.836,06	Mill. Euro per year
of which due to electricity plants (ELE)	20.741,35	Mill. Euro per year
Share of total generation costs	83,51	%
of which due to combined heat and power plants (CHP)	4.094,72	Mill. Euro per year
Share of total generation costs	16,49	%
Total Costs for Society		

RES-E deployment over time EU-15

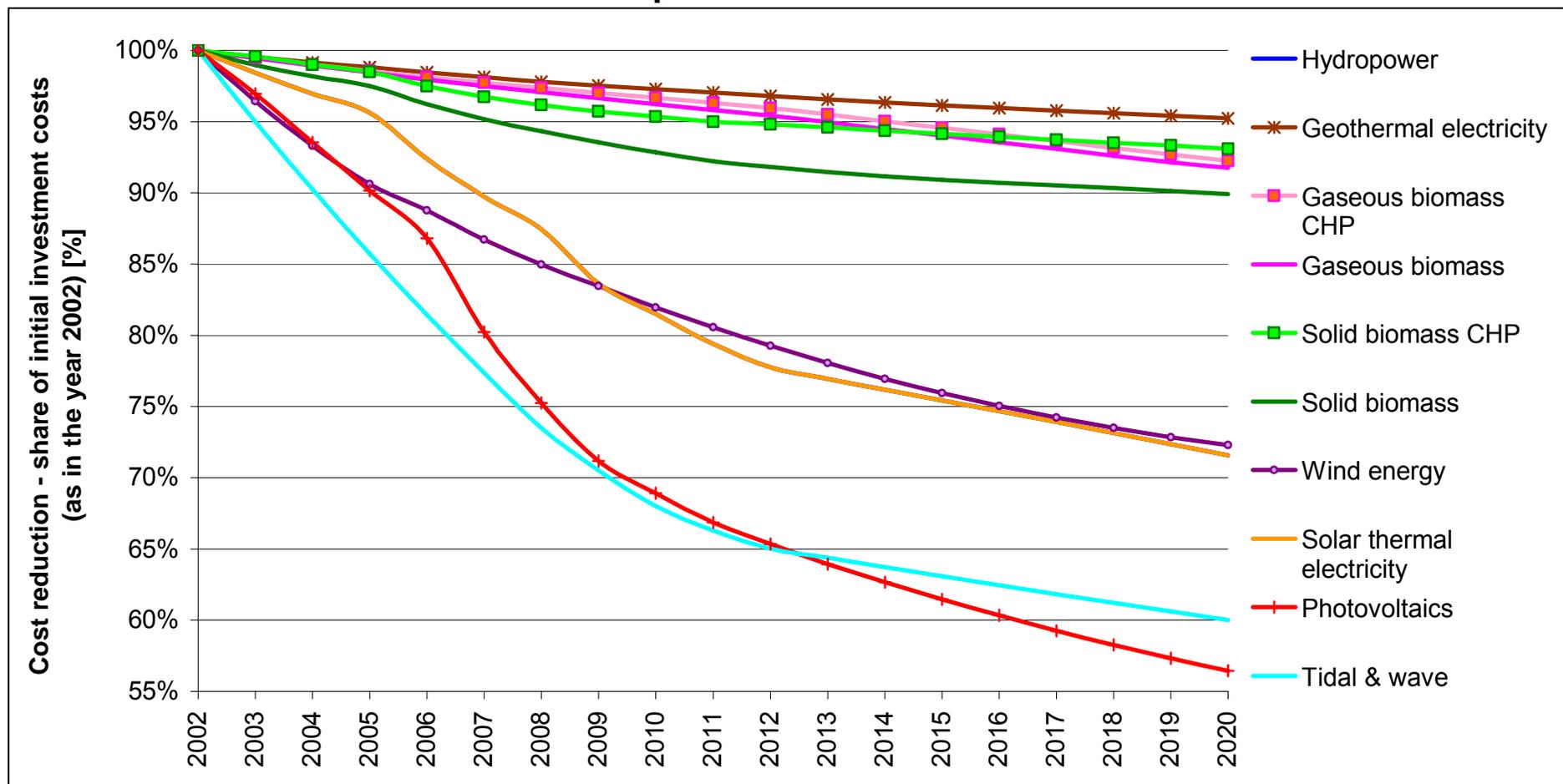


Investment needs up to 2020 **“1000 TWh”**

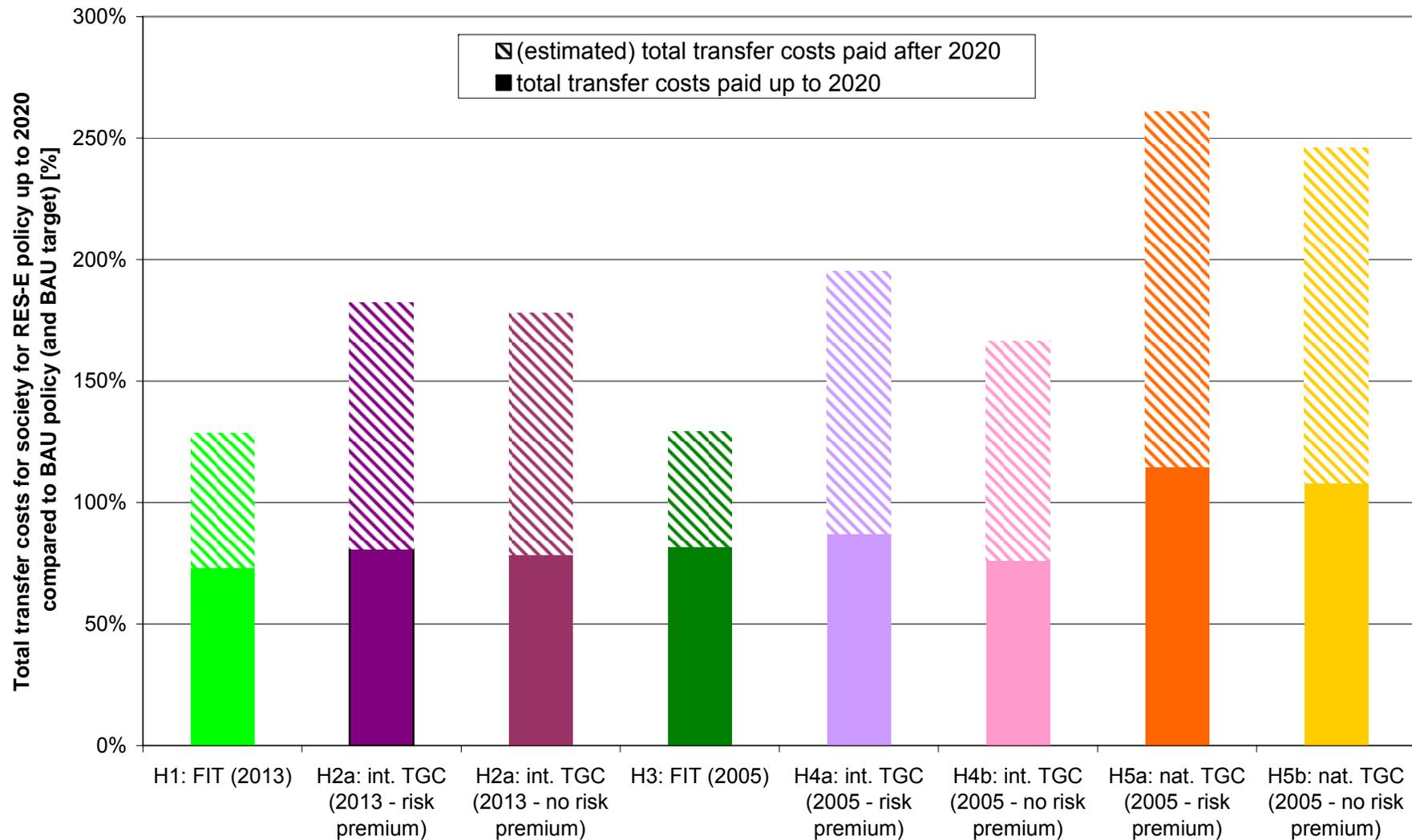


Cost reduction due to technological learning (2002-2020)

...in case of **“1000 TWh”**-development



TOTAL Transfer costs for society (1000TWh)

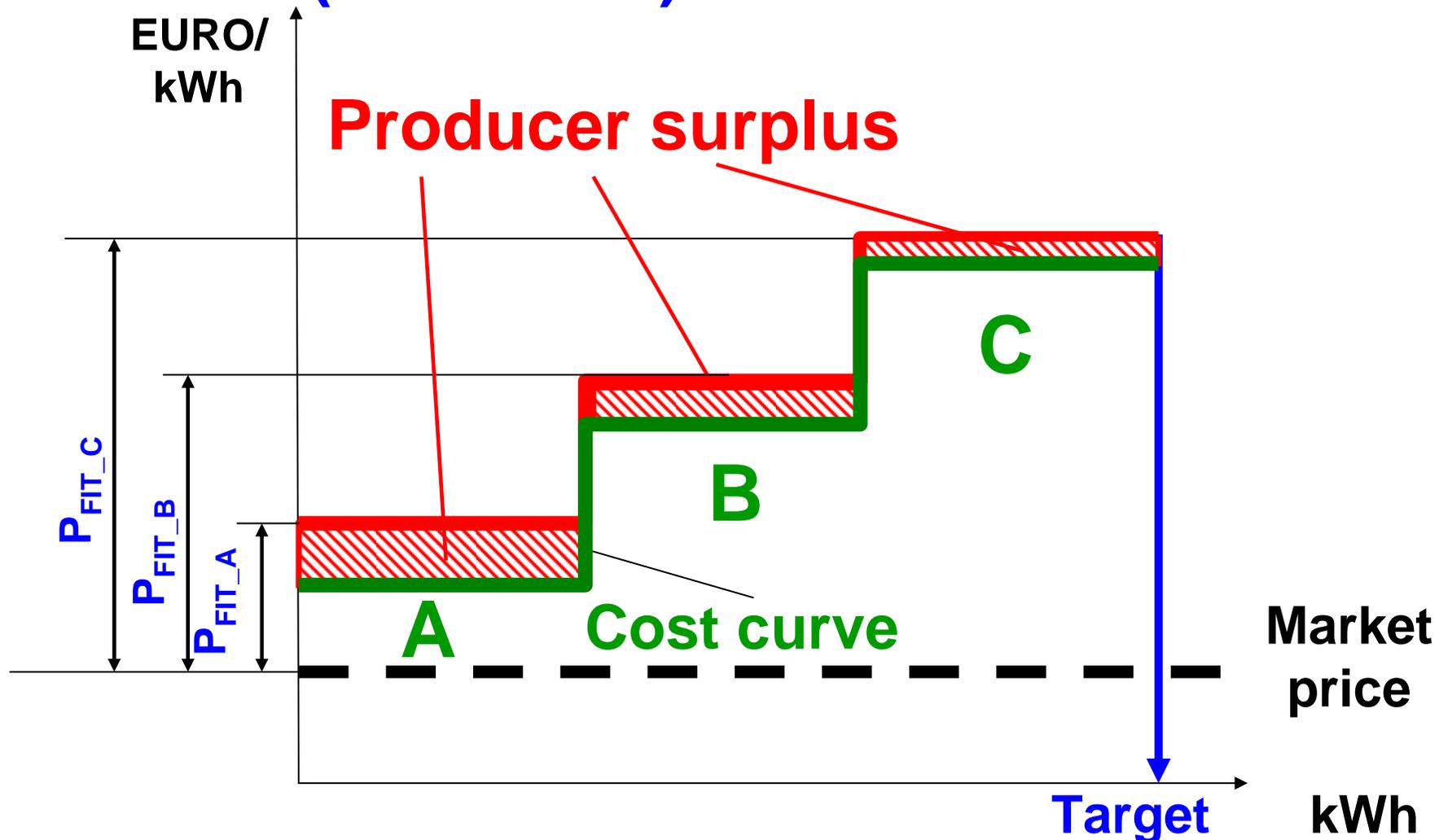


5. Differences in transfer costs –

1. Producer surplus

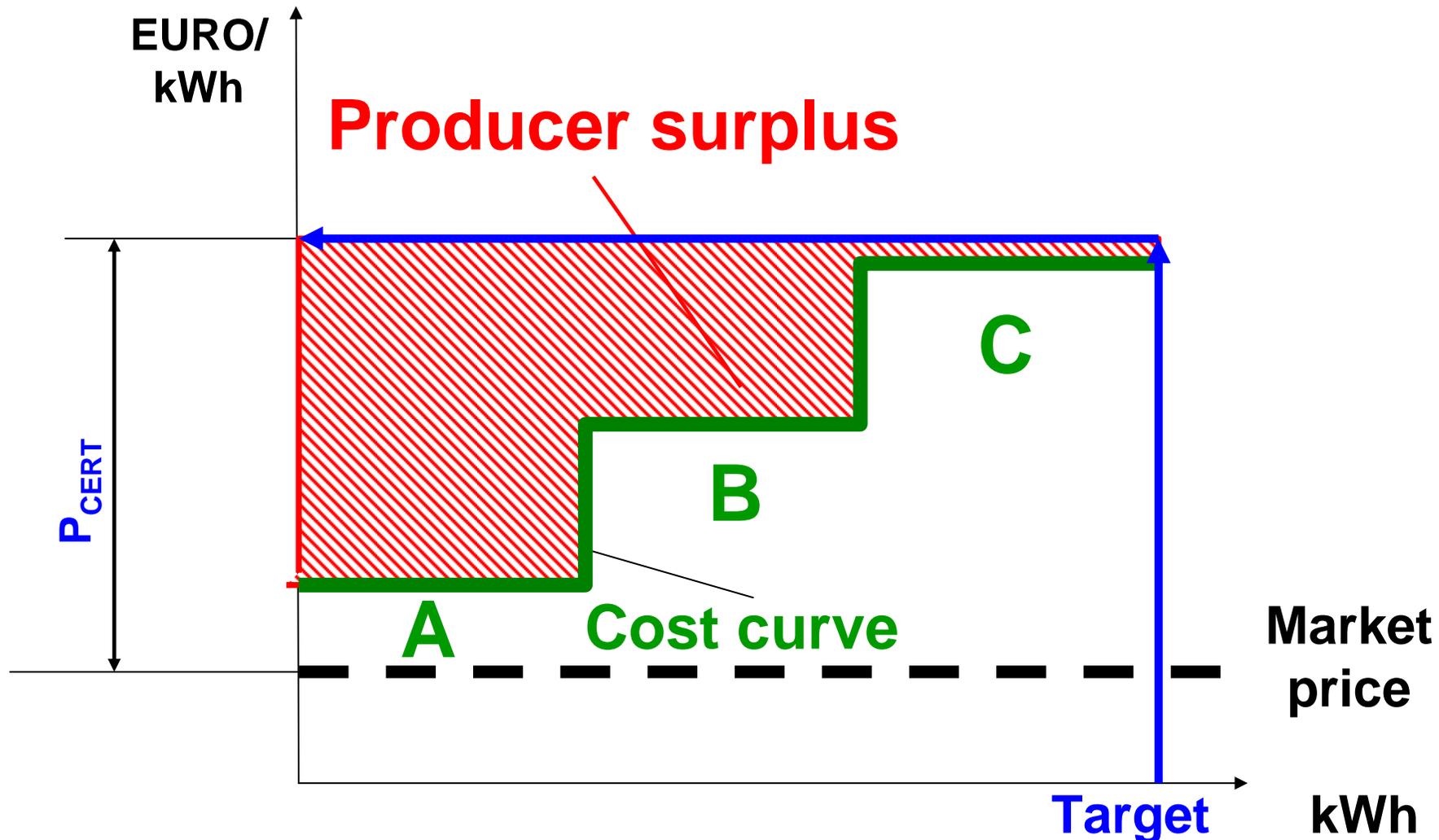
(Assumption: Same cost curves for FIT and TGC)

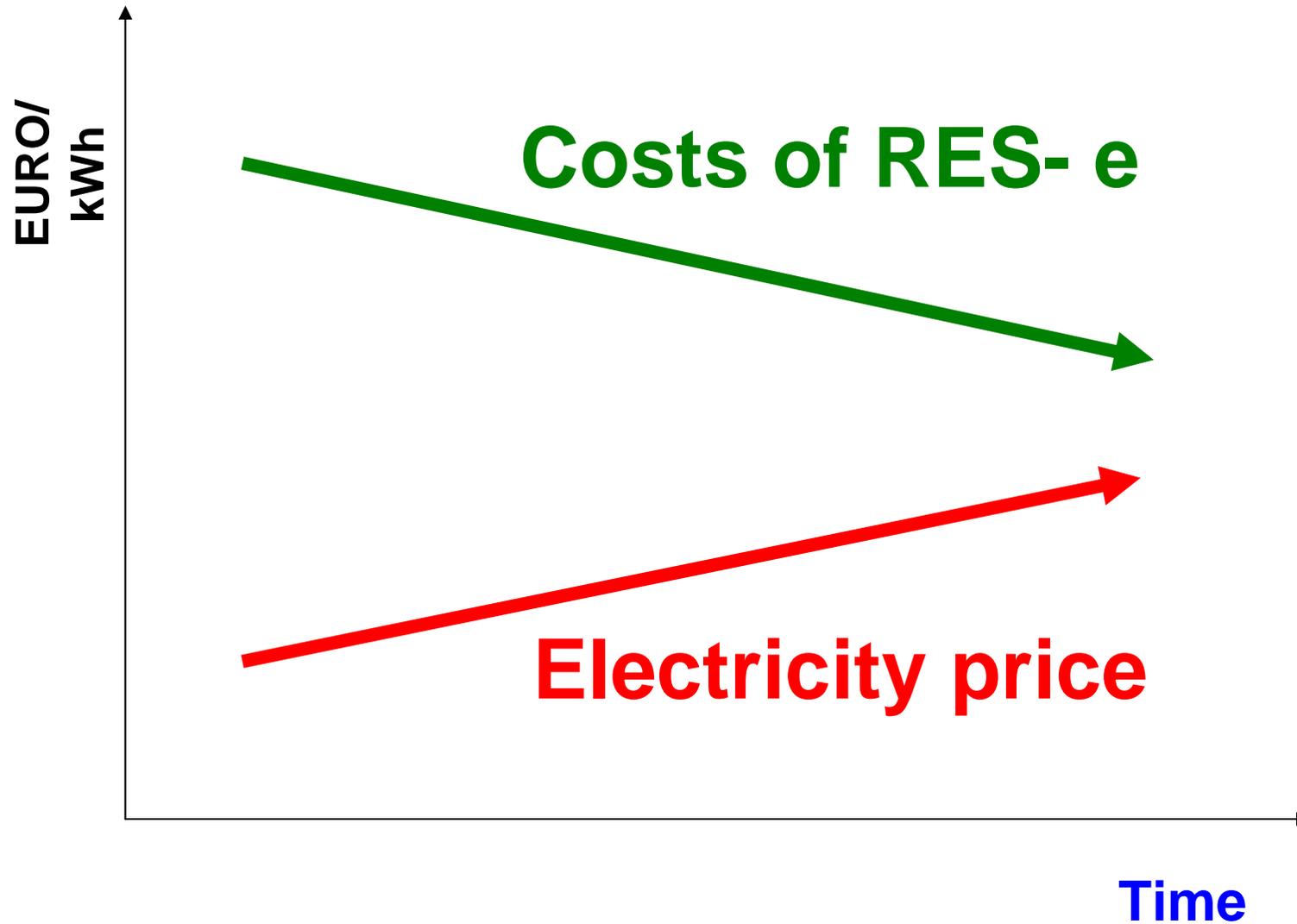
1. Producer surplus (PREMIUM) FEED-IN TARIFFS



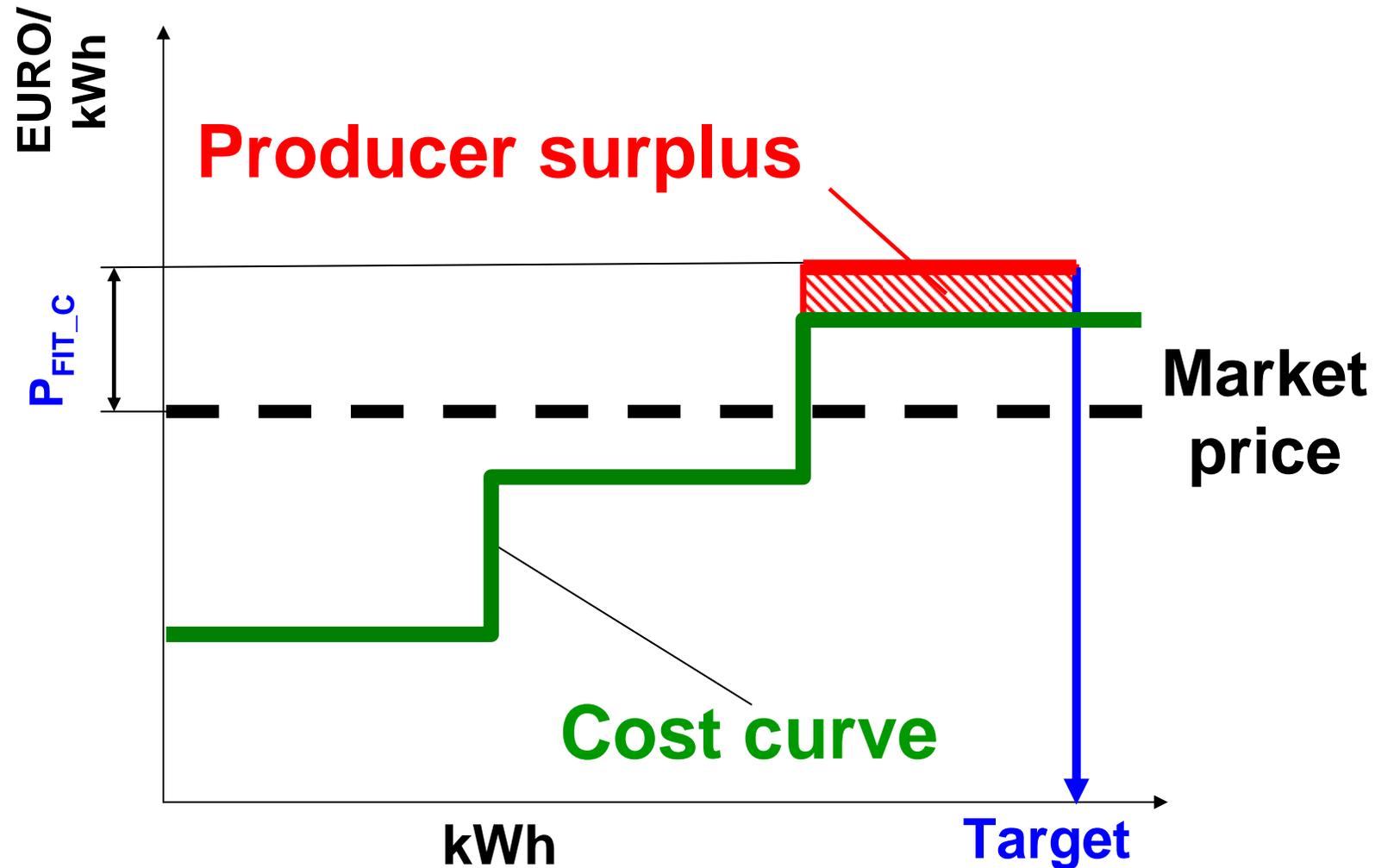
1. Producer surplus

TRADABLE GREEN CERTIFICATES

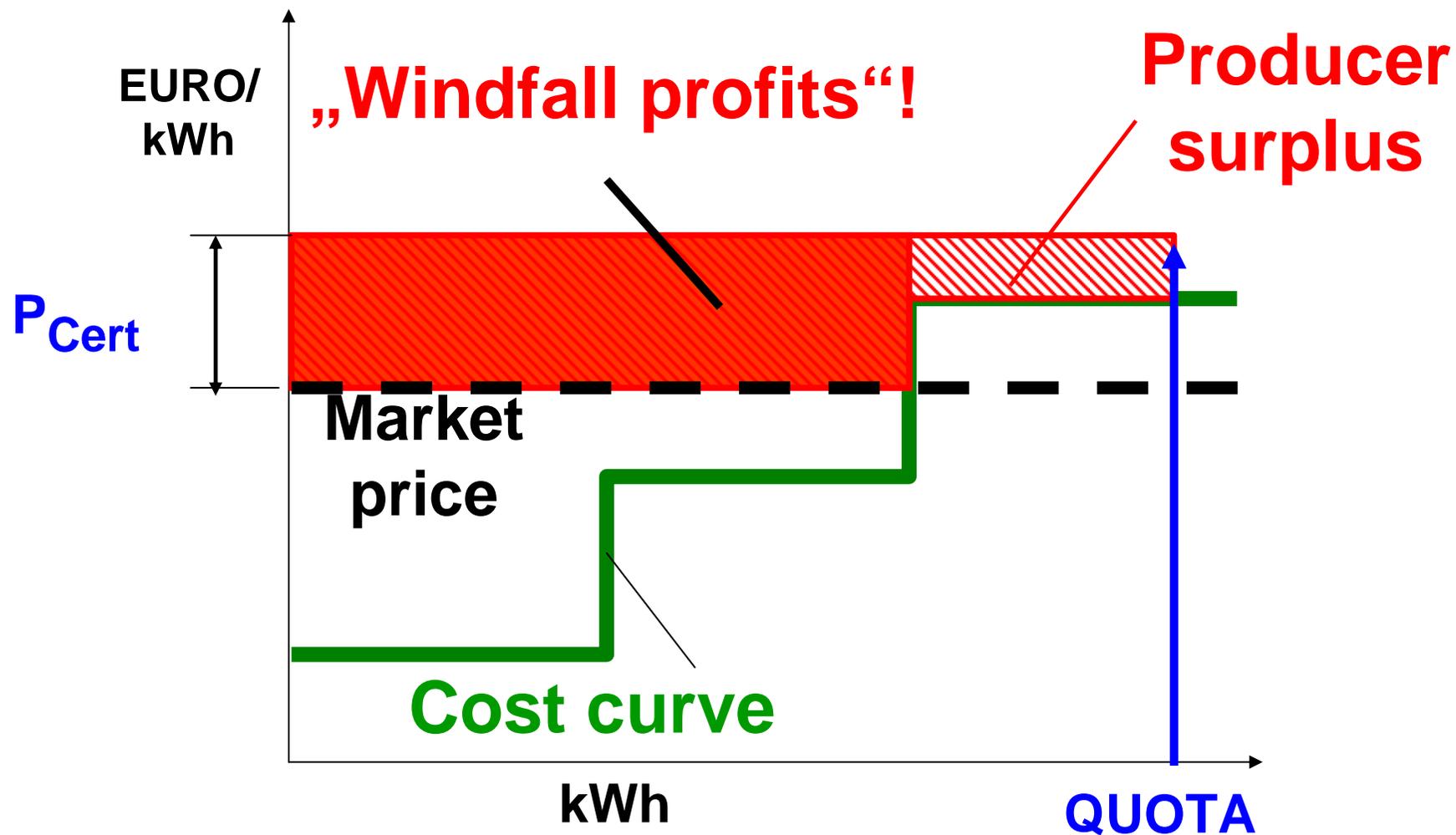




(PREMIUM) FEED-IN TARIFFS – INCREASED MARKET PRICE

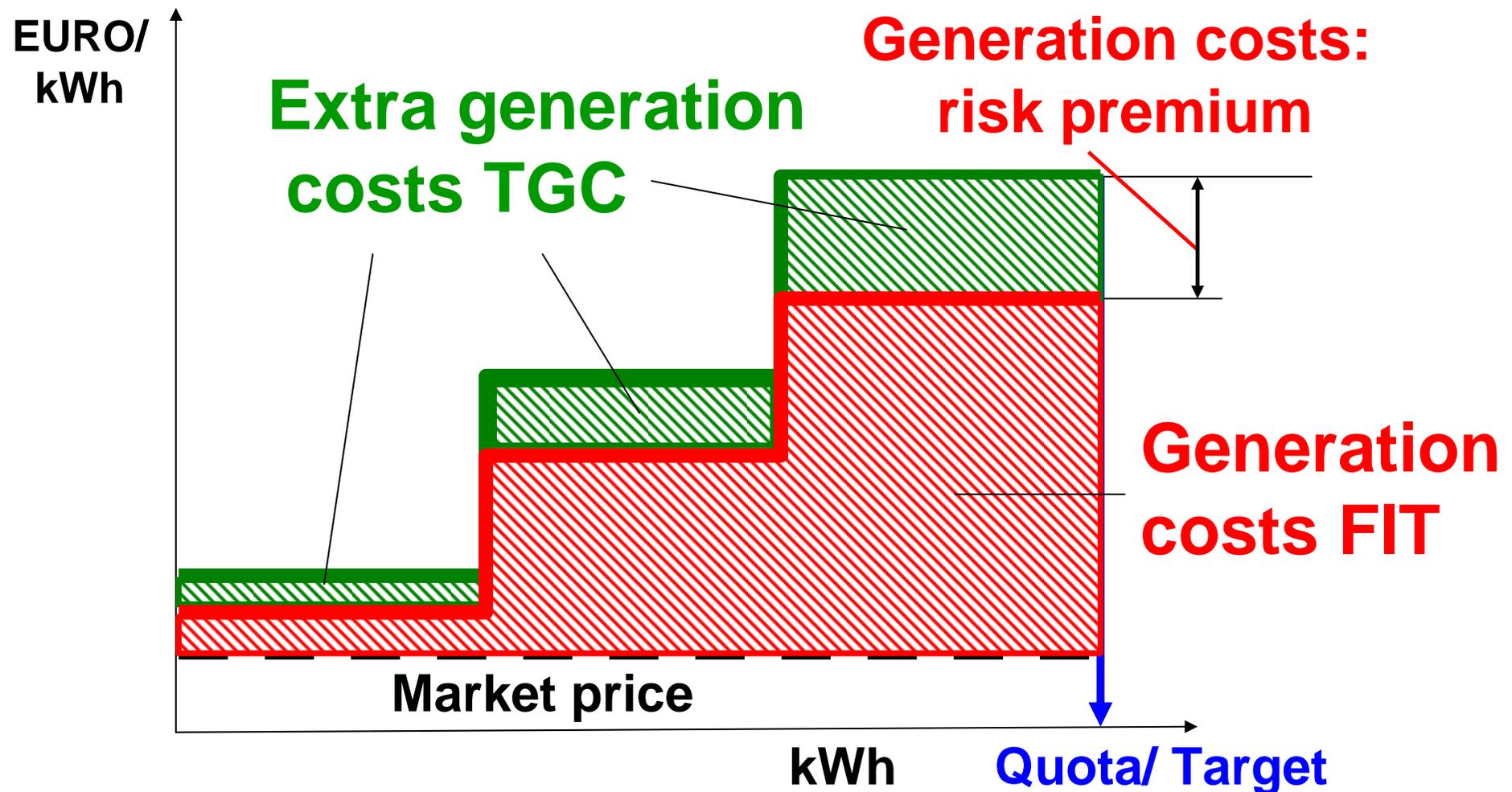


TGC-BASED QUOTAS /RPSs – INCREASED MARKET PRICE



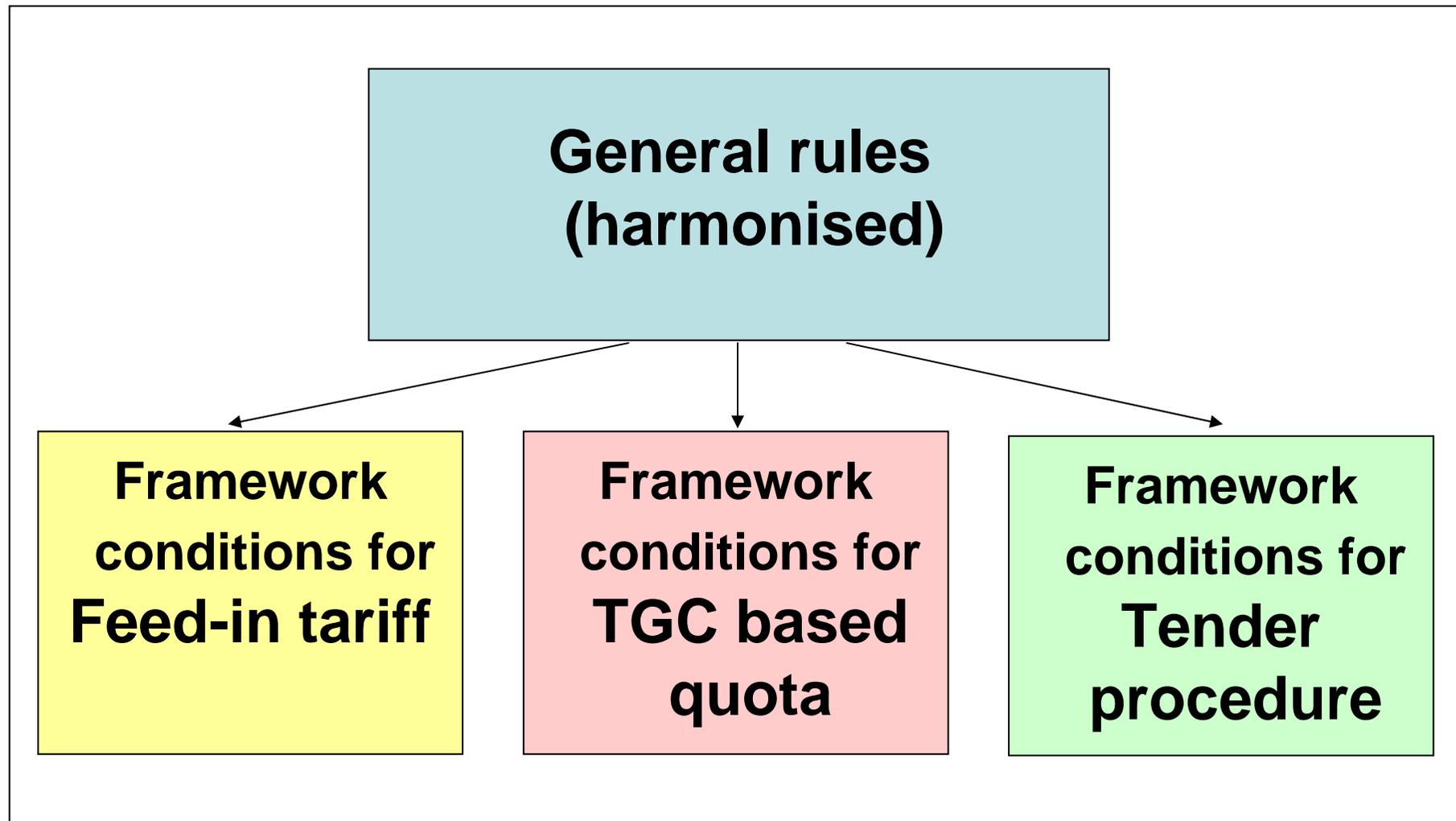
2. Cost curves

(Assumption: Same amounts of RES-e for FIT and TGC)



- **Currently: „Competition“ between promotion schemes and design features on two levels:**
 - * **Deployment of RES-e**
 - * **Public acceptance (Transfer costs...)**
- **Hopefully, the worst systems will disappear....**

How can a harmonised approach look like?

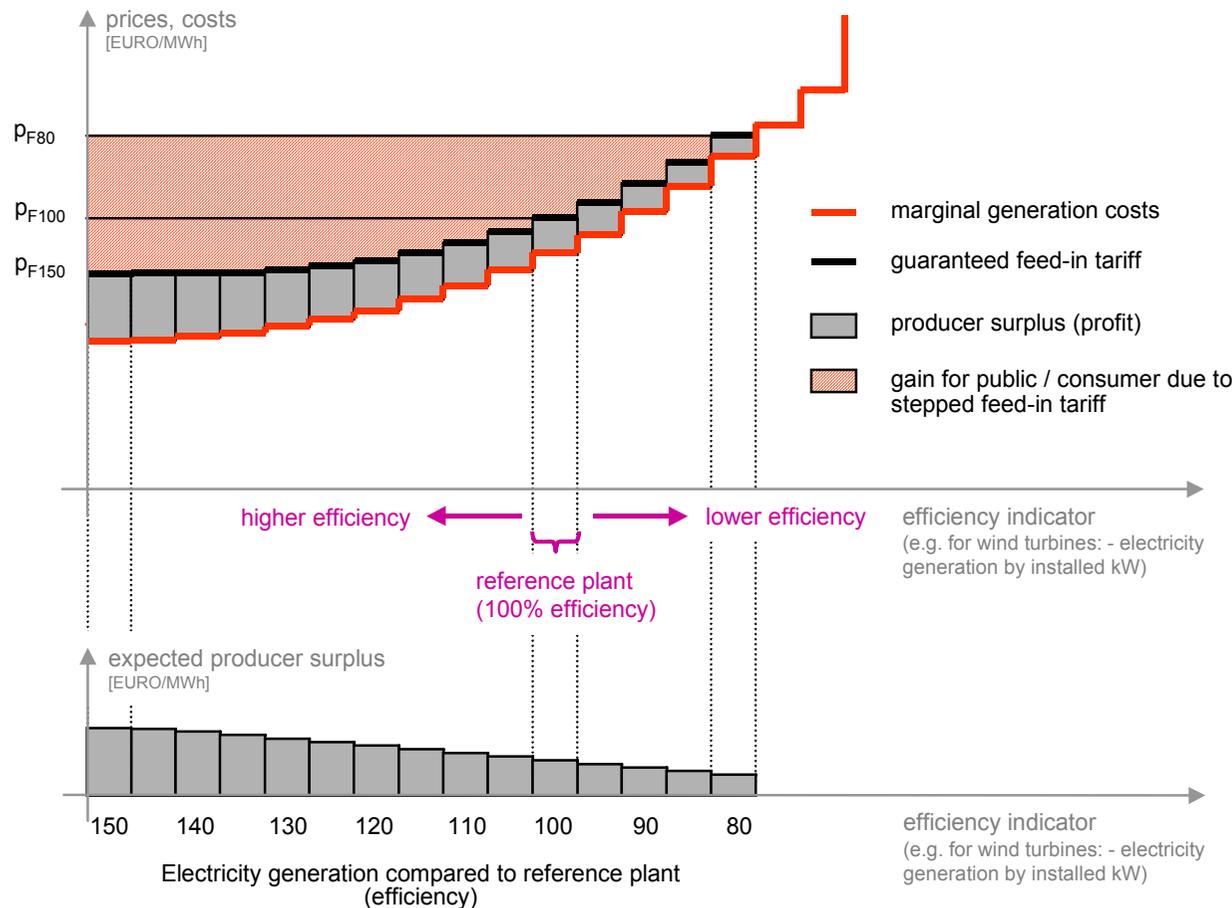


- High investor confidence (stable planning horizon, predictability, creditability);
- Pursue a continuous RES-E policy (no stop-and-go nature);
- Existing capacities and new capacities should not be mixed;
- Financial support given by any instrument should be restricted to the same time frame (e.g. 13 years);
- Encourage competition among the manufacturers;
- Remove non economic barriers
- Compatibility with other policies (climate policy, agricultural policy, demand-side measures);

7. DESIGN CRITERIA FOR EFFECTIVE INSTRUMENTS

SUCCESS CRITERIA FOR FIT's

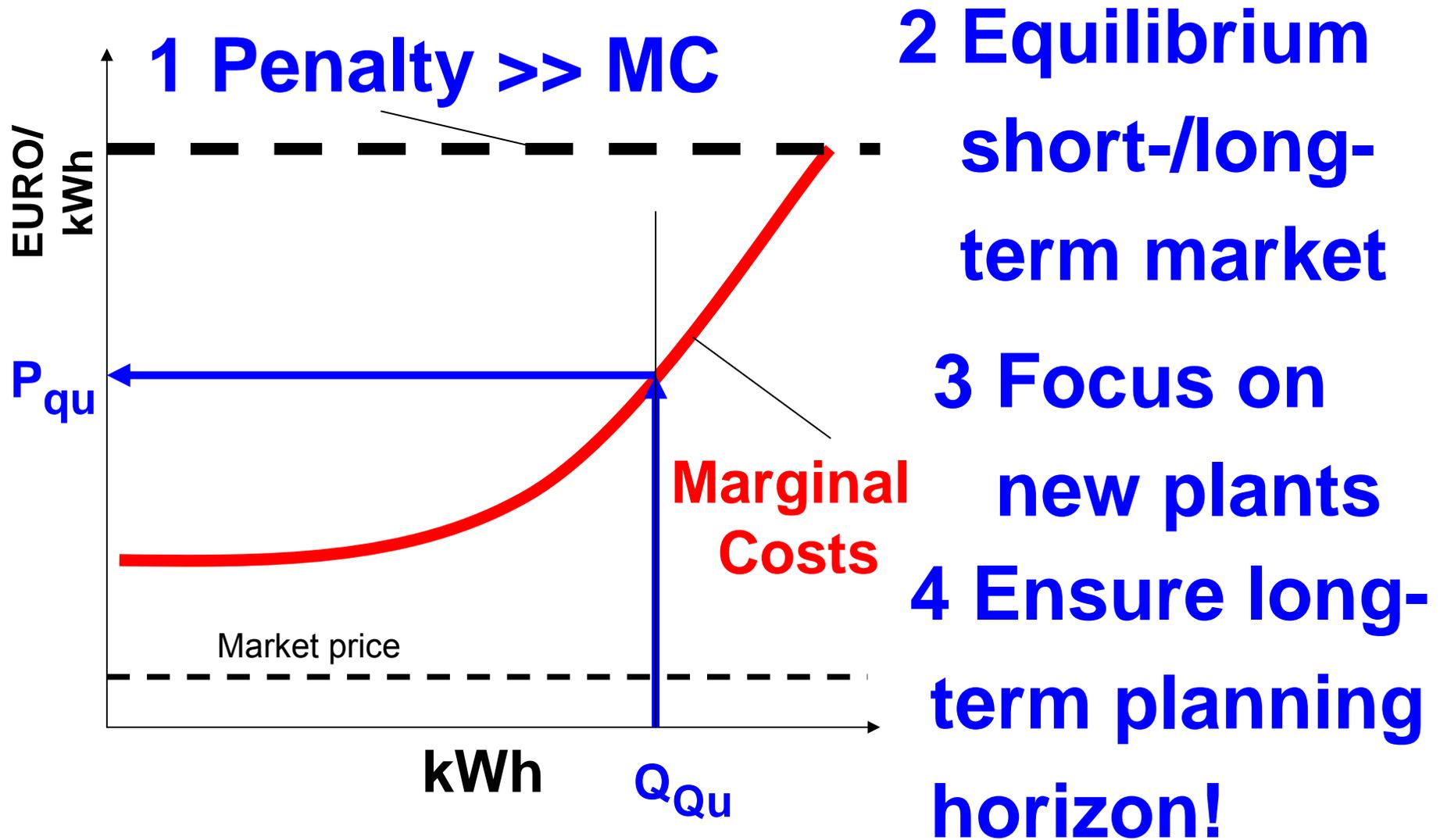
1 Use a tough stepped premium FIT



2 Decrease over time

3 Limited time frame

SUCCESS CRITERIA FOR QUOTA-BASED TGC's



MAJOR PITFALLS FOR QUOTA-BASED TGC's

1 Market is too small:

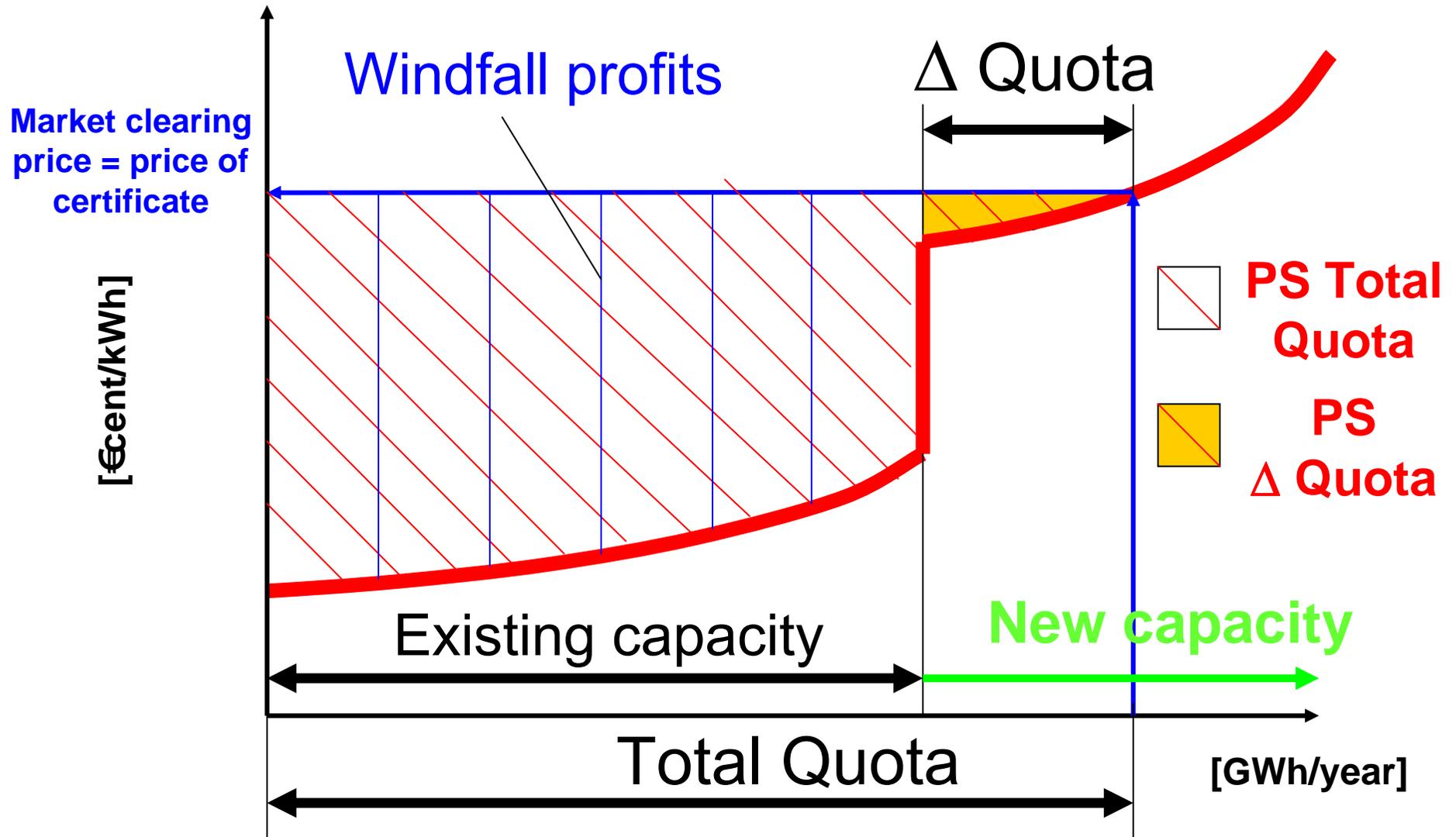
**e.g. in a small country for one technology with very limited potential
-> Non-Liquid because every single plant is known**

2 Creation of an artificial market:

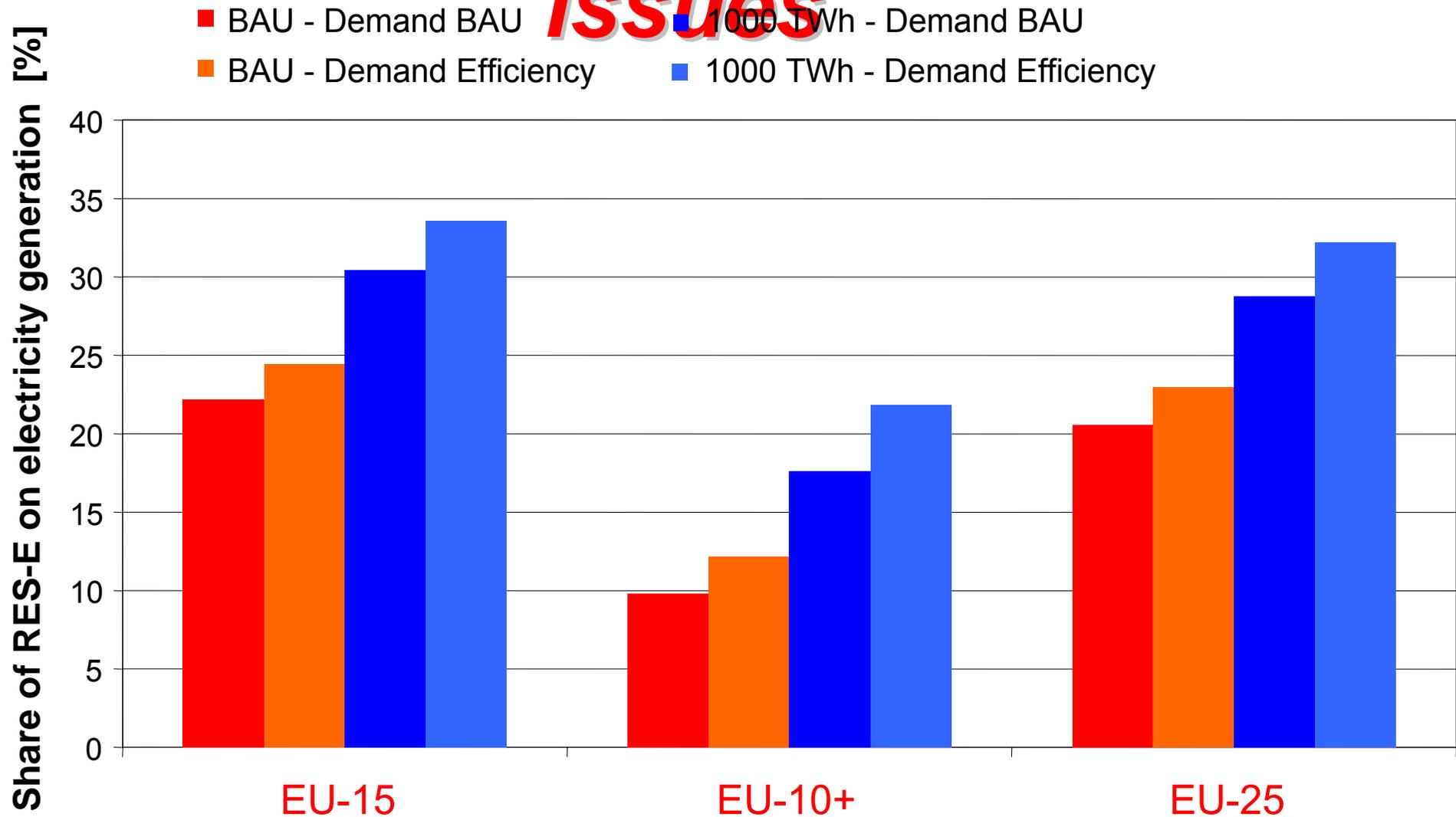
To many parameters are regulated

3 Penalty is too low

QUOTA: EXISTING VS NEW CAPACITY



issues



Demand Scenarios according to EU Energy Outlook 2030 (DG TREN 2003)

8. CONCLUSIONS:

Design of instruments

- **The careful design of a strategy is by far the most important success criteria!**
- **There should be a clear focus on NEW capacities!**
- **To ensure significant RES-E deployment in the long-term, it is essential to promote a broad portfolio of different technologies**
- **Encourage competition among manufacturers**
- **Consider „learning“ for price-based strategies**
- **Ensure credibility of the system! Avoid „stop-and-go approaches**

8. CONCLUSIONS:

Design of instruments

- **FIT: rather diversified structure of investors**
- **Why should competition in the TGC market work if it does not in the conventional electricity market?**
- **In addition, it is hard to imagine that a European-wide TGC market will work disconnected from the large incumbent generators**
- **Utilities/generators are in favour of TGC because they can make much more money and can easier control the market**
- **A well-designed (dynamic) FIT system provides a certain deployment of RES-e fastest and at lowest costs for society**