



Interactions between different support mechanisms

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Markets, Instruments and Technologies

- Physical power markets *The liberalised power market*
- Green markets *A green certificate market*
- Environmental markets *CO₂-allowance market*

Different Instruments and Technologies

*feed-in, TGC, TEA,
tendering, Kyoto-mechanisms*

RES-E, CHP and DSM ...

What do we want to achieve (Goals):

- an efficient power supply with low prices for the consumers
- to promote the development of RES
- to reduce the emissions of CO₂



Trade-offs – Interactions?

- How different markets, instruments and technologies affect each other.
 - Do we have synergetic effects?
 - Do we see barriers?
 - Can the promotion of different technologies go hand in hand?
 - Which instruments should be used at what level?



It is correct, that we by using an international :

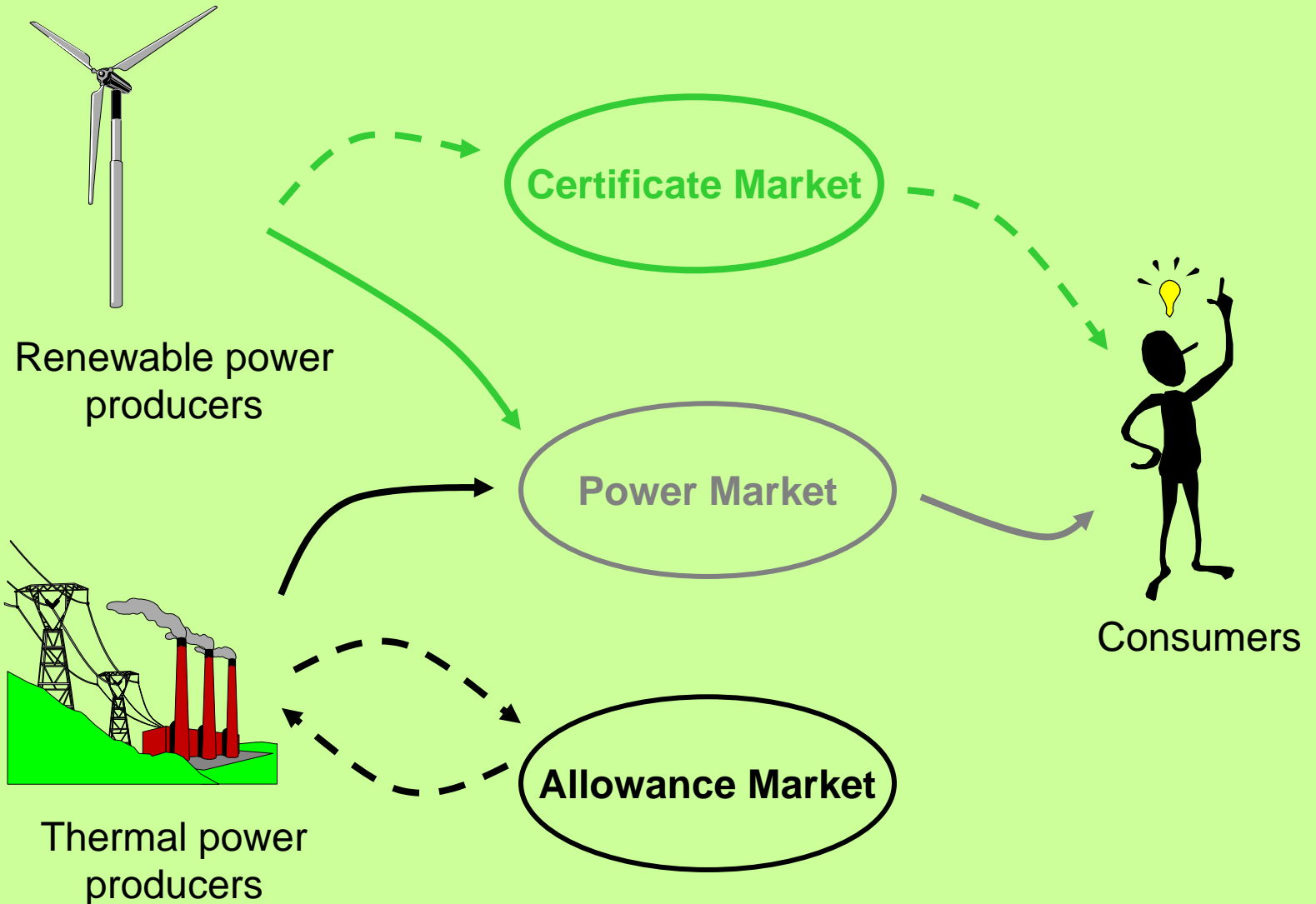
- *Power market* will get the lowest power production costs
- *Green market* will reach the target for RES-E development at the lowest generation costs
- *CO₂-trading* will achieve the CO₂-reduction targets to the lowest costs

But there will be quite a difference between the participating countries

- quite different power prices for the consumers due to different RES-targets
- very different national CO₂-reduction compared to the efforts we undertake (RES development)

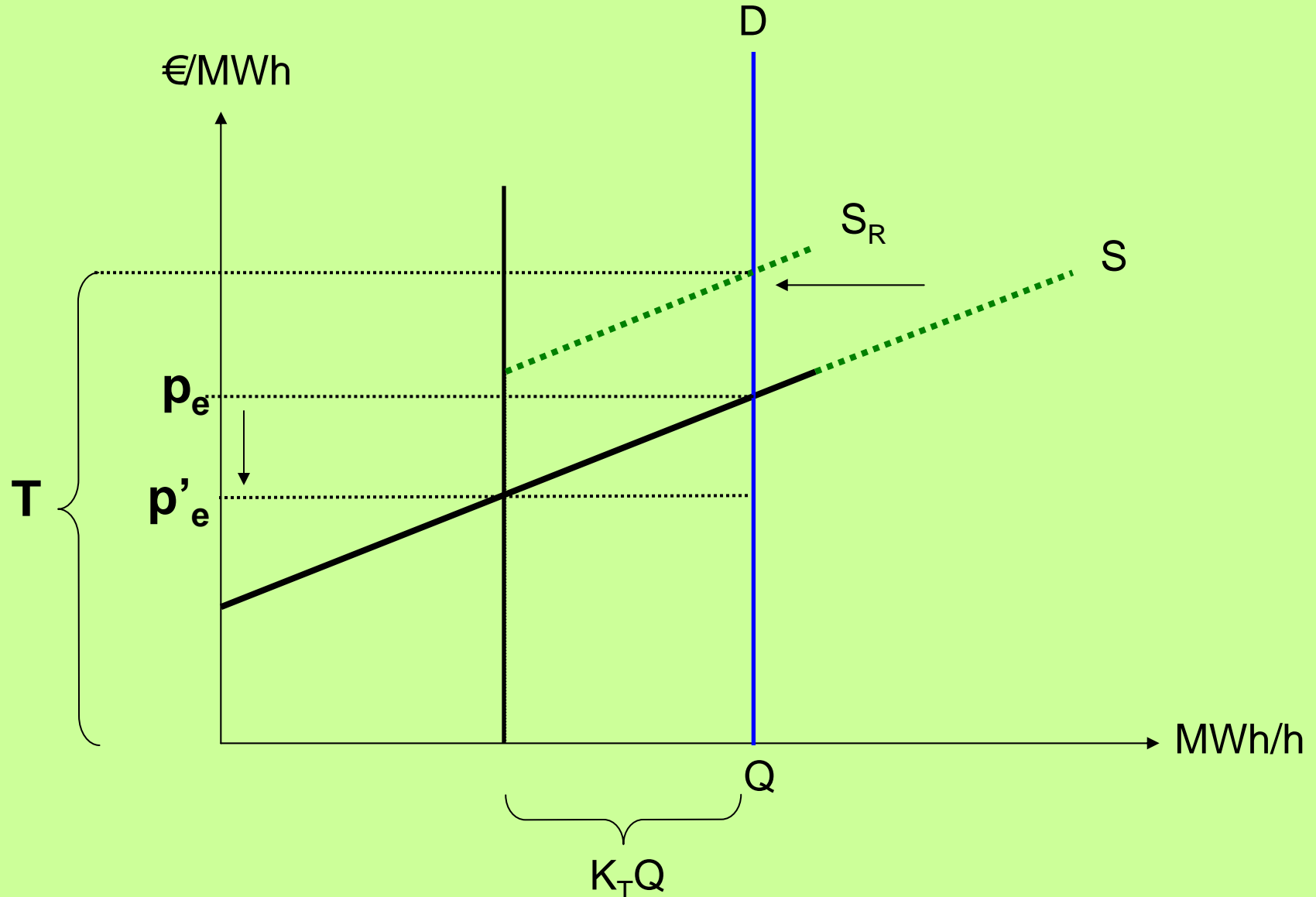


The Markets



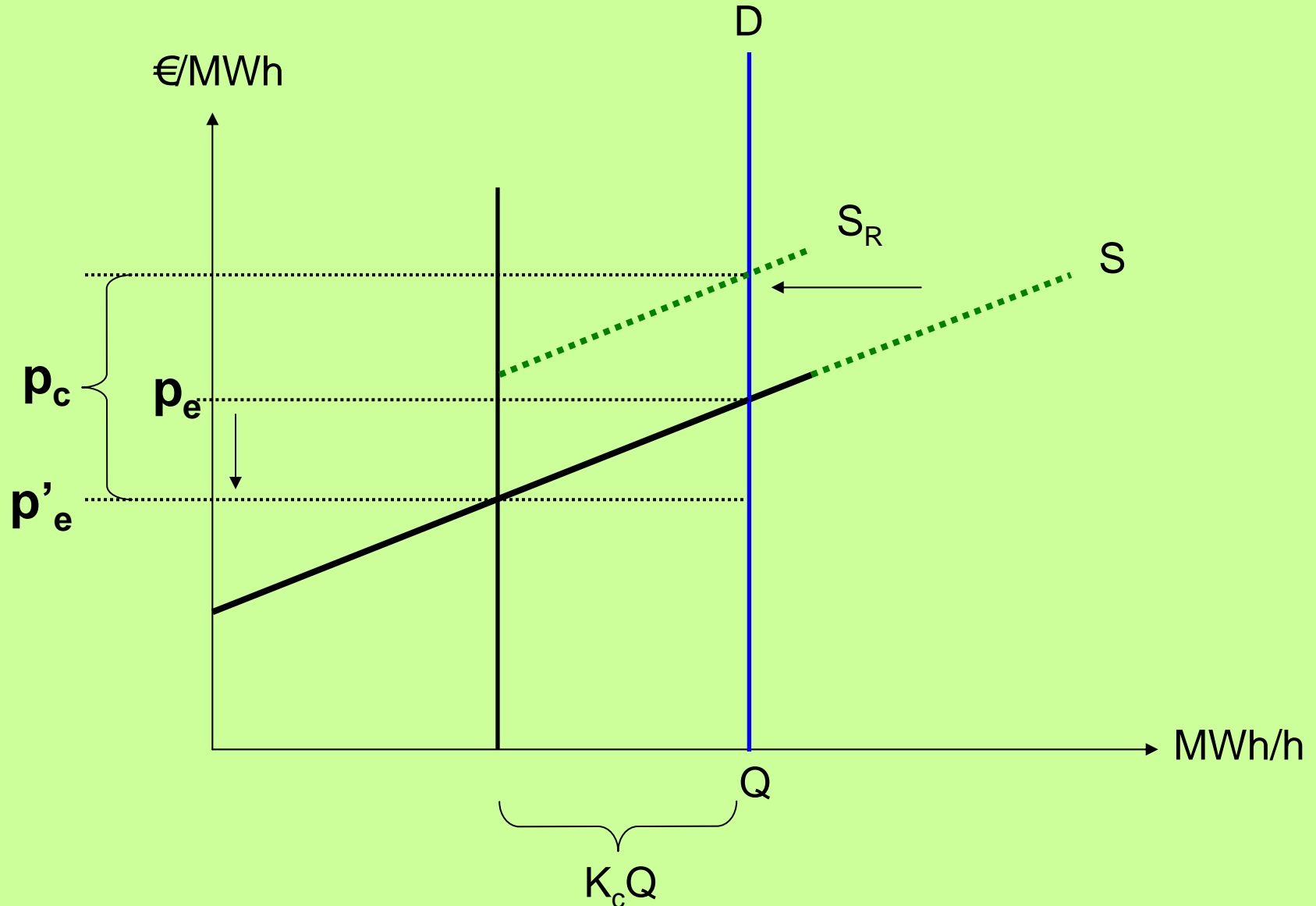


Change in prices when introducing a feed-in tariff





Change in prices when introducing a green quota





A change in the consumer prices from 21 to 19.60 €/MWh!

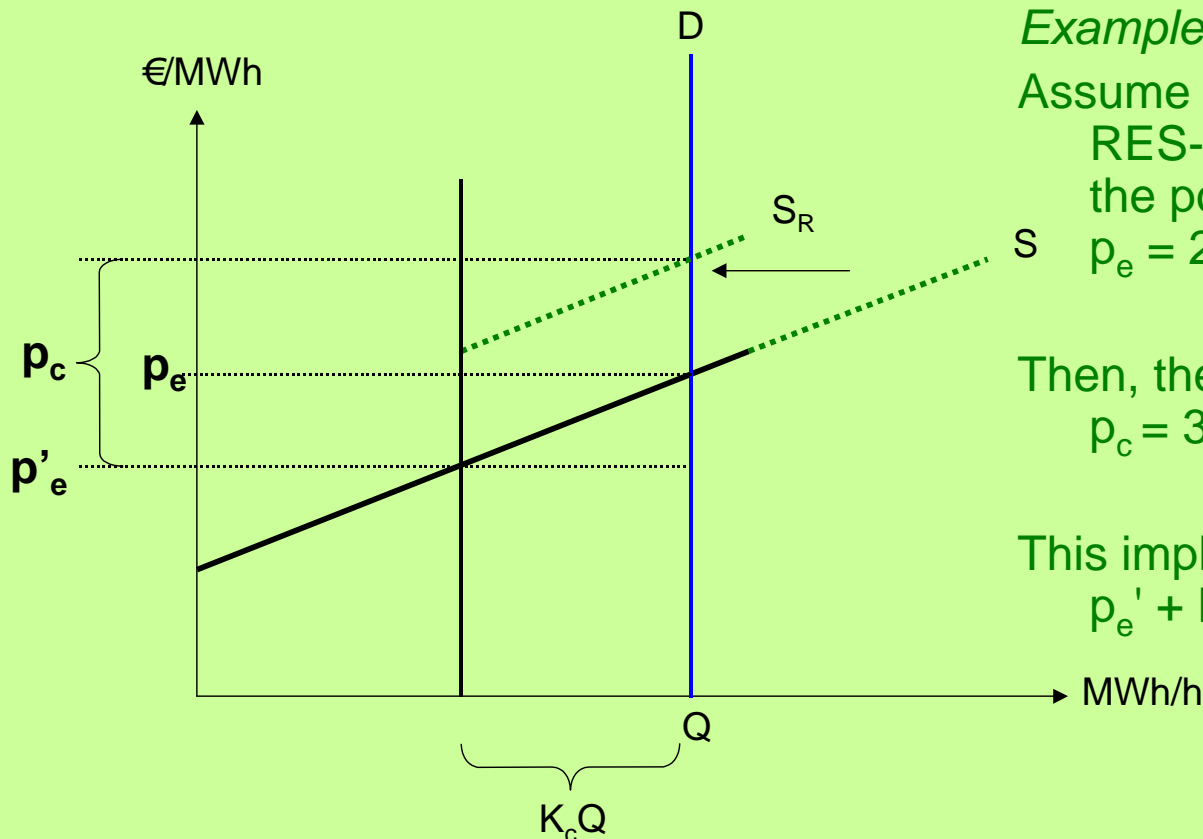
When introducing a green quota the consumer price changes from p_e to $p_e' + K_c p_c$.

Example:

Assume a quota $K_c = 10\%$, a marginal RES-E cost of 34 €/MWh, and that the power price then change from $p_e = 21$ €/MWh to $p_e' = 18$ €/MWh.

Then, the certificate price $p_c = 34 - 18 = 16$ €/MWh.

This implies a consumer price of $p_e' + K_c p_c = 19.6$ €/MWh.





National Markets

Two Goals and Two Mechanisms

- Renewable energy goal only
 - use the **green quota**
- Emission goal only
 - use the **emission quota** when the correlation between the consumer price and the green quota is **positive**
 - use the **green quota** when the correlation between the consumer price and the green quota is **negative**
- Renewable energy and emission goal
 - use **both quotas** and set them equal to the goals when the correlation between the consumer price and the green quota is **positive**
 - use only the **green quota** (set higher than the renewable energy goal) when the correlation between the consumer price and the green quota is **negative**



International Markets

When all markets are international, we see the same effects as with national markets.

But a national change in a quota has little effect on the international prices:

Case: A small country increases its green quota

- CO₂-benefits have to be shared
- RES is implemented in all countries
- The power consumers of the small country pay the price

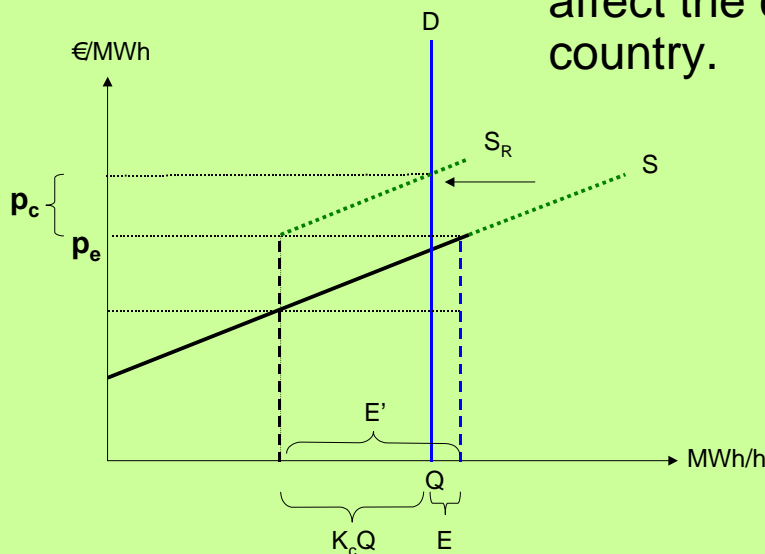
Countries with low RES targets benefits w.r.t. CO₂, RES deployment and power prices, compared to countries with high RES targets



International Markets

Differ when a small country act at int. and nat. markets simultaneously, e.g., int. power prices are independent of changes in nat. quotas

Case: Increasing the green quota at a national TGC market (with an international power market), does not affect the conventional production (emission) in that country.

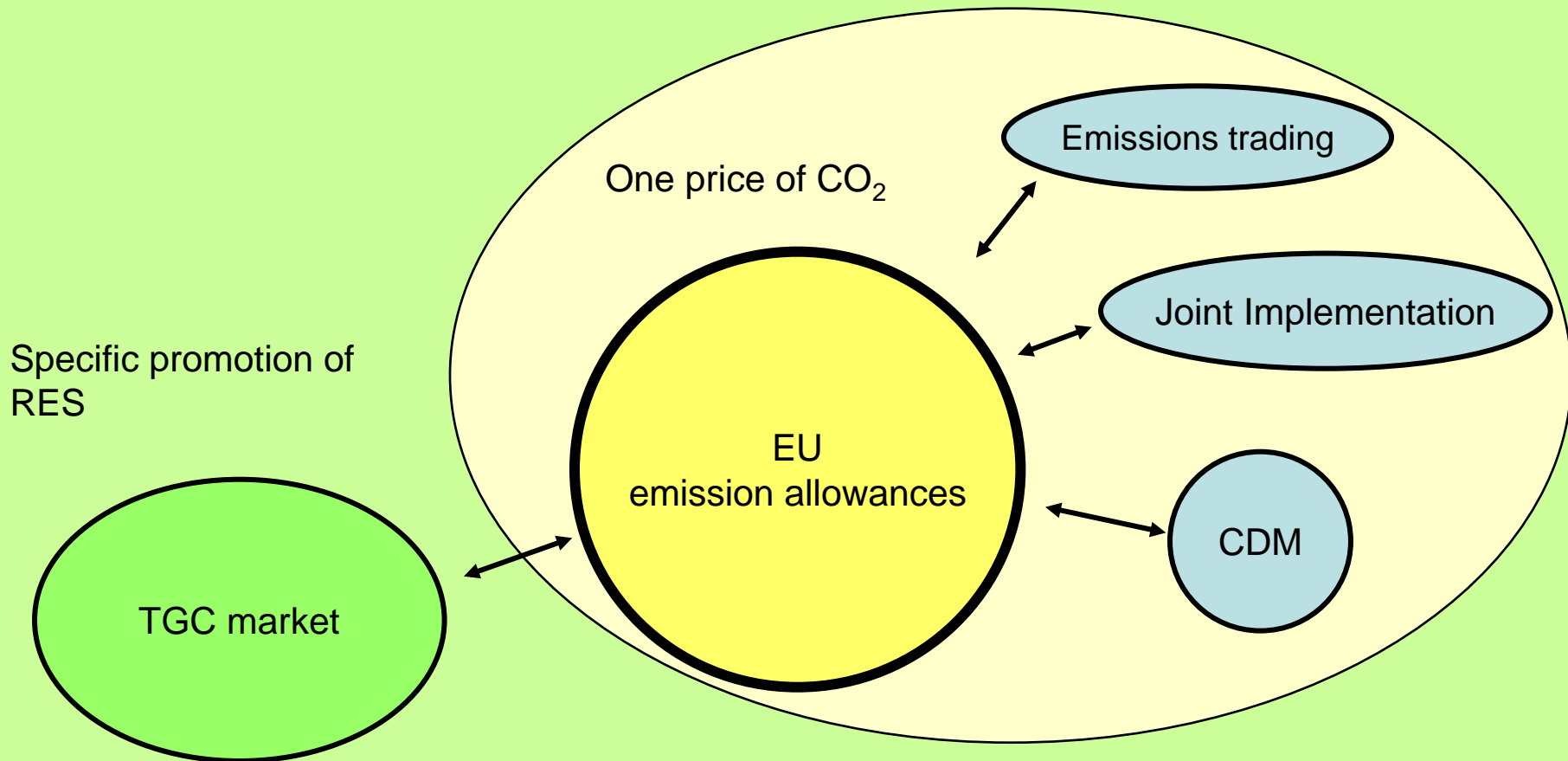


It increases the export of power.

A TGC system cannot be used to reach emission goal



International CO₂ Markets

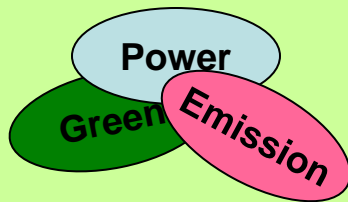




Conclusions

Synergies exist

Problem when the different markets do not cover the same area.



Limited synergy – An instrument might only help reaching one goal

Different quotas imply different burden sharing

Call for common markets and actions