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Feed-in tariff, quota obligation and tenders for renewable support: Comparison with regard to innovation, investment incentives and strategic behavior

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Introduction

- In recent years, many European countries changed their RE support scheme to tendering for feed-in premiums.
- Considerations behind that:
  - More competition among RE generators (of different or the same RE technologies);
  - Better integration of RE generators into the power market;
  - Better European integration.

But: Are tendering schemes really this advantageous?

Pricing

- For feed-in tariffs, prices are set by the government; in a perfect world, they equal LCOE (LRMC).
- In tendering schemes, prices should equal LCOE (LRMC) – if a feed-in premium is paid, ex the expected average power price.
- In quota obligation schemes, prices should equal LCOE (LRMC), but only indirectly:
  - The price is set by the probability to fall short of the quota: $p_C = p_{min} \cdot F(x_s > x_D) + p_{max} \cdot F(x_s < x_D)$;
  - Investors should invest as long as $p_C + p_E > LCOE$;
  - With each additional installation, $F(x_s < x_D)$ and hence p_C becomes lower.

Pricing

- As prices in quota obligation schemes are not fix, the investment decision is more complicated:

$$\frac{\sum_{t=1}^{T}\left(\left(p_{C,t}+p_{E,t}\right)(1+i)^{-t}\right)}{T} > \frac{\sum_{t=1}^{T}(LCOE(1+i)^{-t})}{T}$$

- This becomes a problem if LCOE decreases:
  - For a given p_C, additional investments are triggered;
  - p_C decreases;
  - Revenues for existing plants decrease;
  - If investors anticipate the decrease of LCOE, they will invest less, so that $p_C, t > LCOE$.

Pricing

- A simple numerical example:
  - Residual LCOE are initially set to 100 and decrease by 5% annually
  - $p_{min} = 0,\ p_{max} = 150;\ x_D = 30;\ i = 5\%$
  - $F = F_N(\mu = 0.5x_{inst}; \sigma = .25x_{inst}$
- Without anticipated cost degression, x_{inst} would be 49.38 ($p_C = 100$) in the first period and 90.20 ($p_C = 37.74$) in the 20th.
- With anticipated cost degression, x_{inst} would be 37.12 ($p_C = 133.66$) in the first period and 76.67 ($p_C = 49.77$) in the 20th.

Market power/Strategic behaviour

- The pricing mechanism makes quota obligation schemes prone to market power:
  - A small reduction of available certificates might result in a sharp increase of prices.
  - This sets an incentive for supplier to withhold certificates.
  - Data for the Swedish certificate market suggest that withdrawing 1% of annualy produced certificates from the market might increase the price by 5%, 2% by 13% (ignoring banked certificates).

Market power/Strategic behaviour

- For tenders, there is an incentive for strategic behaviour:
  - Most tendering schemes are designed as pay-as-bid auction;
  - For investors facing relatively low costs, the incentive is to estimate the costs of the marginal investor and then submit a bid with the same price;
  - Given uncertainty, this might lead to unwanted results: Cheap investors might overbid and loose against more expansive bids.
  - First data from German tenders suggest such a behaviour: Bids have been relatively close together and close to the feed-in tariff.
  - For Italy, prices have either been close to the reference price (if there was no competition to face) or to the minimum price (if there was competition).

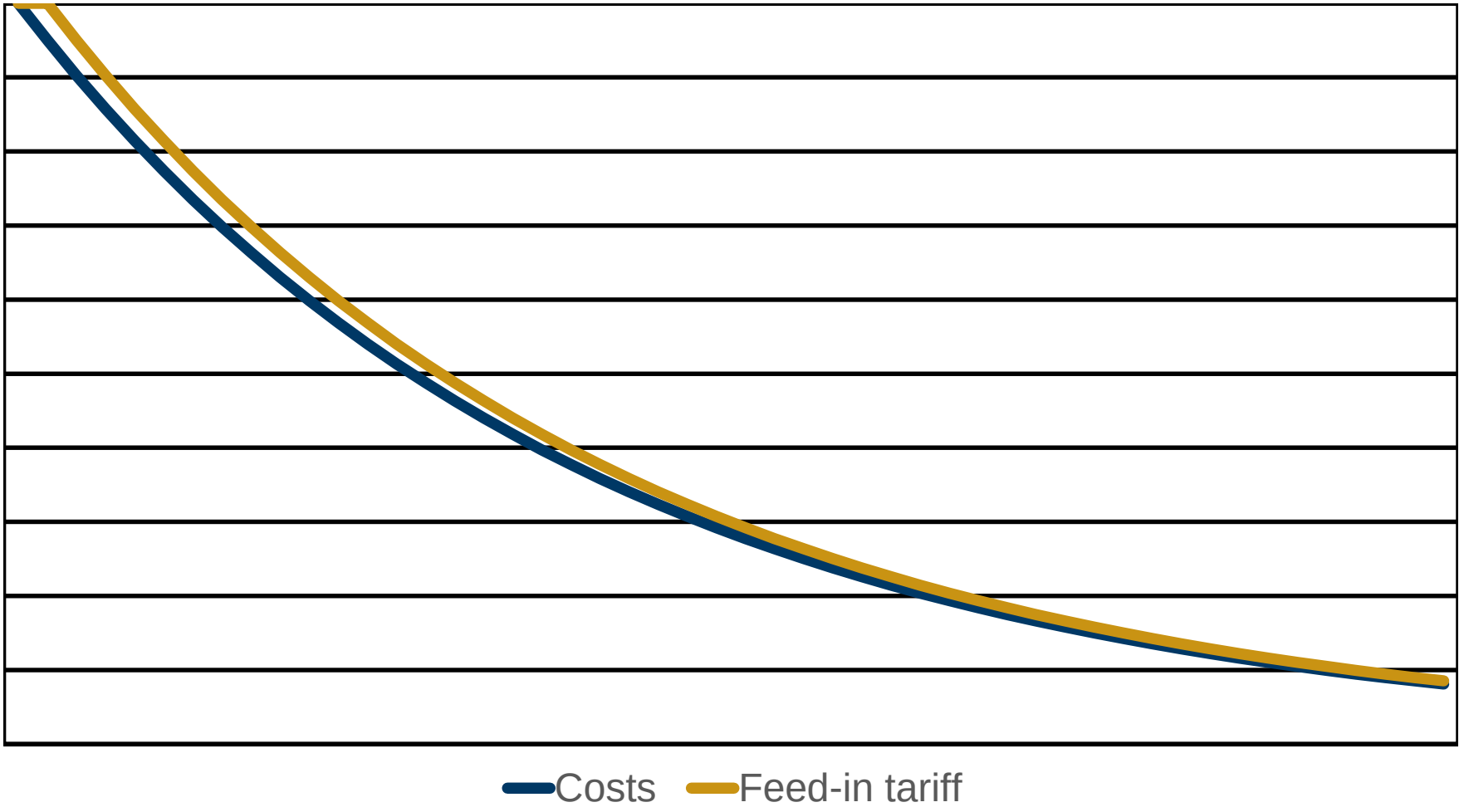
Market power/Strategic behaviour

- Another incentive in tendering schemes seems to be solved nowadays:
  - In first tenders in the 1990ies, it seemed that some conventional producers bid low prices without installing the capacity – just to hinder the entrance of renewables.
  - The first rounds of the Italian tendering schemes have seen relatively low realisation in time.
  - Buts: Fines are higher today.

Innovation

- Feed-in tariffs give a high security for investments in new technologies:
  - Prices are fixed for an investment period.
  - Non-commissioning or delays in commissioning have no consequences (except lost planning costs).
- But:
  - Incentives for enhance existing technologies are low.
  - Prices lag behind decreasing costs, generating windfall profits and increasing system costs.

Innovation

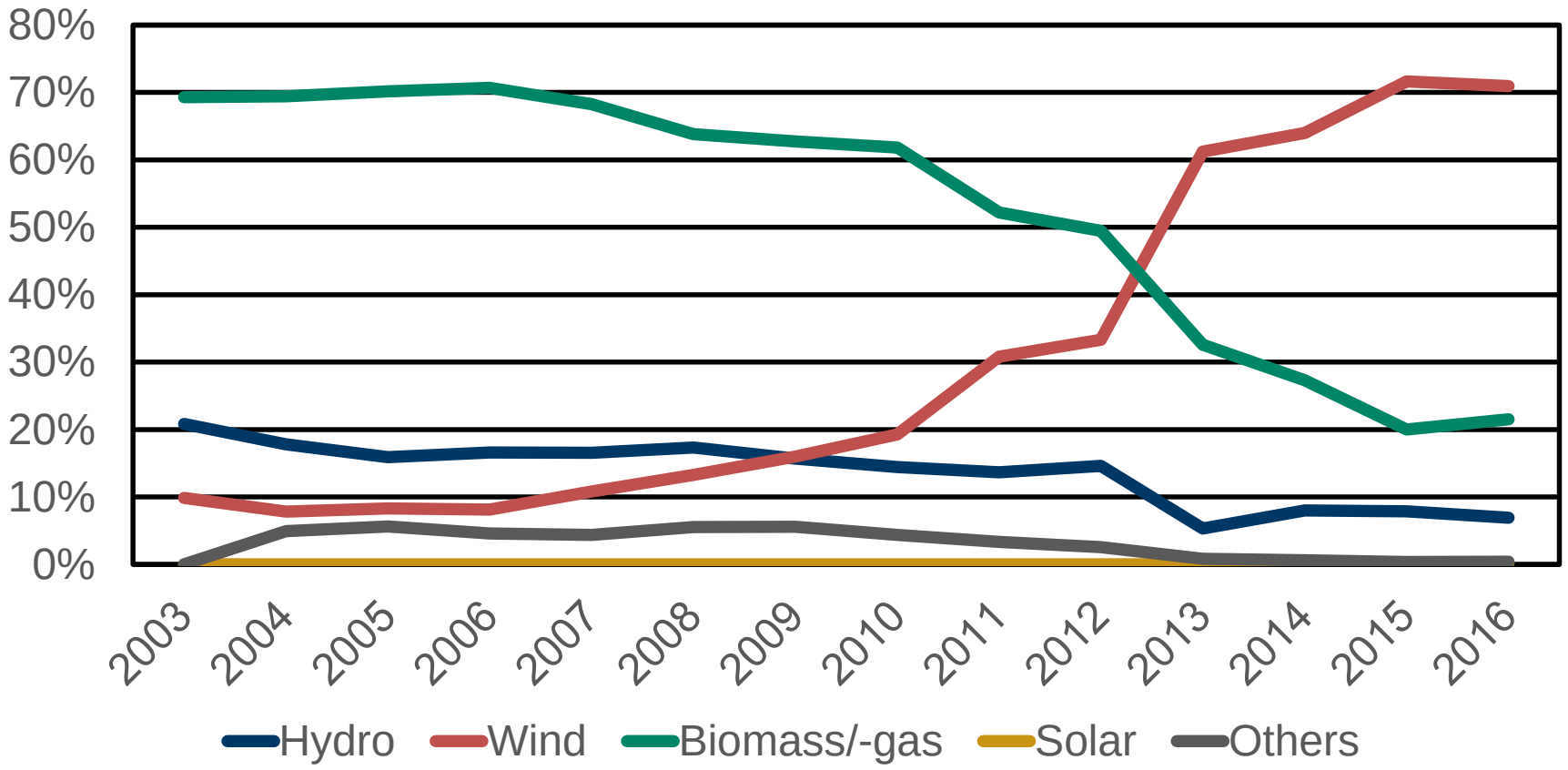


Innovation

- Quota obligation schemes punish the pioneer:
  - If costs of a newly introduced technology decrease, prices will fall, and the pioneer will face losses.
  - If investors are risk-avers, they will avoid to pioneer - and this means that new technologies are not applied.
- Quota obligation schemes favour the cheapest, established technologies:
  - New technologies might not be introduced as they are to costly in their initial phase.
  - This can mean that a technology that might be cheaper than the existing one after cost degression might not be introduced to the market.
  - Setting up bands does arise new problems: If costs decrease sharply and converge to the costs of established technologies, bands should be removed – what is difficult to enforce.

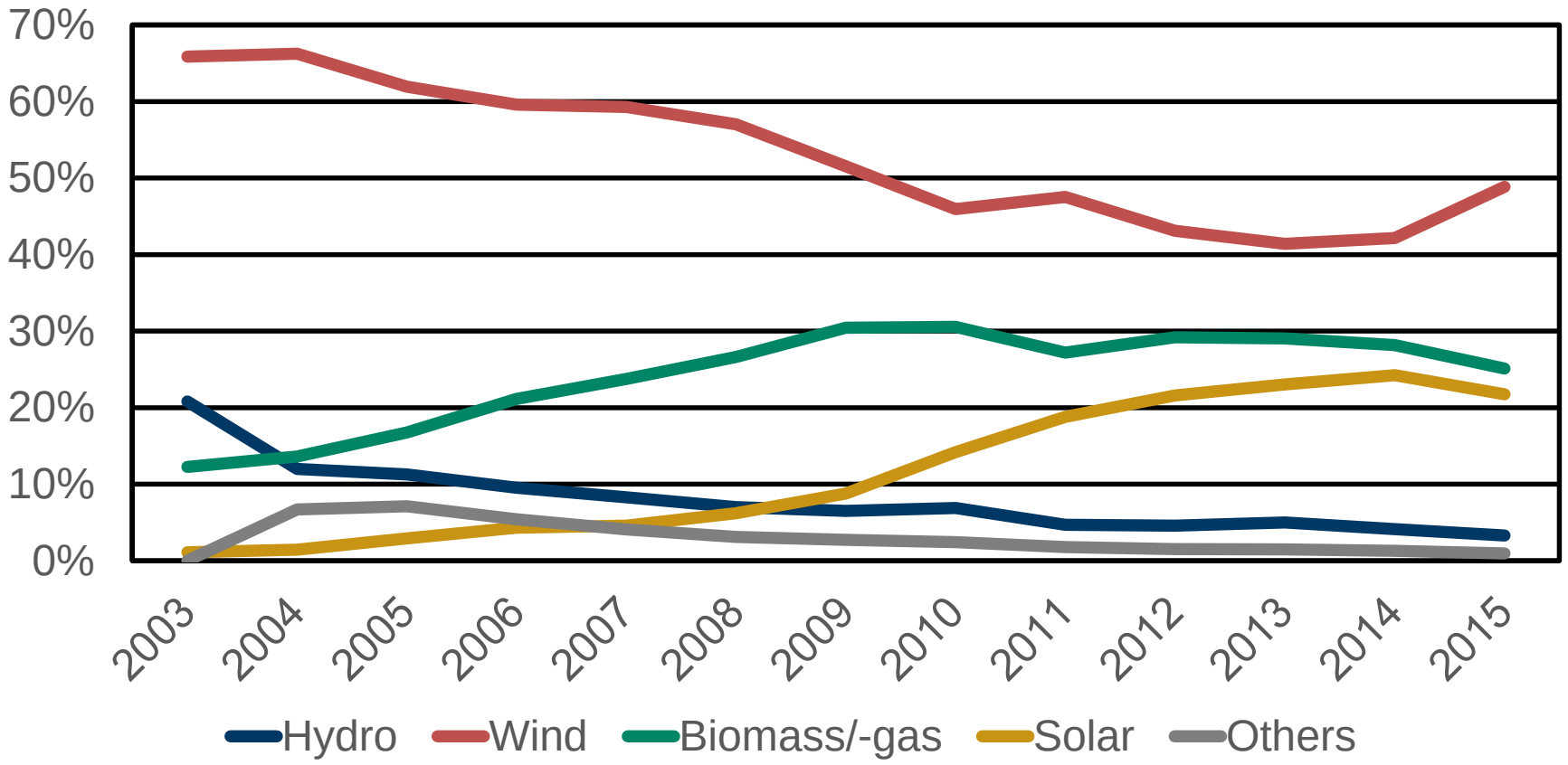
Innovation

Technology mix of the Swedish quota obligation scheme



Innovation

Technology mix of the German feed-in tariff



Innovation

- Tenders combine advantages of feed-in tariffs and quota obligations:
  - If cost decreases, prices decrease as well.
  - But: Pioneers are not punished: They receive the price of their respective tender.
  - New technologies might be introduced through a specific tender for it, while established technologies might be tendered together.
- But: So far, the Italian tendering scheme has only seen competition for (onshore) wind power.
- For all other technologies, only few projects took part in the auction.

Innovation

- A crucial point for innovation in tenders is commissioning: If there are delays, a fine must be paid.
- This is a problem for novel technologies, when investors cannot be sure that all technical issues will be solved in time.
- The same problem might arise if approval procedures are long and/or not reliable.

Investment incentives

- Tenders (as tenders for a premium) and quota obligations both expose producers to the electricity market.
- This gives them incentives to optimise their installation:
  - Choice of location: Installations might be located in regions where the price is higher.
  - Choice of technology: Installations might be optimised to produce in hours of higher prices.
  - Both aspects can reduce system cost.
- Under feed-in tariffs, the only incentive is to produce as much electricity as possible.

Conclusions

- To introduce new technologies to the market – or to start introducing renewables at all –, feed-in tariffs seem to be the best option:
  - They grant investors a high certainty about revenues;
  - Investors are not negatively affected by delays and technical problems of there project (regarding revenues from RE subsidies).
- Once a technology is successfully introduced, the suggestion is to move to tendering schemes:
  - Prices are now subject to competition, cost degression should lead to lower subsidies.
  - Investors should now know about the “normal” duration of installing their technology.

Conclusions

- Quota obligations are problematic as
  - They are prone to execution of market power.
  - Investors face high uncertainty about future prices if there is cost degression.

- For tendering schemes, there are open questions:
  - Are the time limits for commissioning the plants adequate, regarding approval and construction times? Are the fines adequate?
  - Is pay-as-bid the adequate auction mechanism?
  - Should there be one auction for all technologies or specific auctions? Or might there be a model where bands are reserved for specific technologies, but unused capacity might be used for other technologies?
  - How to enhance cross-border trade?