

ON THE POSSIBLE WAYS OUT OF THE POWER MARKET CONUNDRUM AFTER THE BIG PEAK FOR GAS IN EUROPE

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7th AIEE International Symposium 2022





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- Research question
- Methodology \Rightarrow NET model
- Pricing Mechanisms
- Scenario Analysis
- Conclusions

INTRODUCTION

- Energy markets have experienced an extraordinary rise in fossil fuel prices caused initially by effect of post-Covid growth path and intensified by the weaknesses of global supply chains exposed by the pandemic and even further in the first half of 2022 by the Russian invasion of Ukraine (Di Bella et al., 2022).
- The unprecedented gas price increase has influenced electricity prices, caused rising global inflation, and downsized the growth expectations of European economies (Albrizio et al. 2022).
- The discontent generated by the current crisis has led European governments to identify short-term emergency measures designed to cushion the negative effects of electricity price instability. The current situation has brought the rules of price formation in wholesale electricity markets back to the centre of the debate (Heussaff et al, 2022).

DEBATE

- Several proposals for reforming/completing European electricity markets and mitigate the impact on natural gas on electricity bills come from policy regulatory institutions and academia.
 - Policy makers:
 - "Tope" on gas temporary reform in Spain and Portugal;
 - Non-paper on policy options (European Commission, 2022);
 - REGULATION (EU) 2022/1854 for a temporary power price cap at 180 €/MWh.
 - Academia/Research centers:
 - New spot-forward power markets balance (Fabra, 2022; Meuus et al, 2022).

RESEARCH QUESTION AND GOALS

- Indicating the possible ways out of the current power market conundrum.

REMAIN System Marginal Pricing (SMP)

LEAVE Pay-as-bid (PAB)

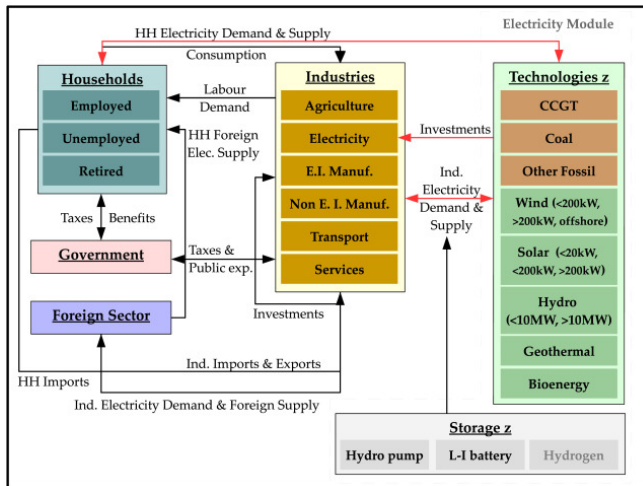
REFORM Two markets (TWOM)

- Evaluating the impact on prices and electricity bills of different pricing mechanisms, considering the uncertainty on future gas prices.
- Addressing the power market reform issue with focus on:
 - Efficiency;
 - Fairness;
 - Environmental sustainability.

NET MODEL-GENERAL FEATURES

- System-dynamics based macrosimulations (Cieplinski et al, 2021).
- Demand-led, supply constrained.
- Integrated bottom-up/top-down model.
- Endogenous technological progress (macro).
- Dynamic input-output productive structure.
- Heterogeneous (groups of) households, industries and generation technologies distributed among 6 zones.

NET MODEL - GENERAL FEATURES



NET MODEL-GENERATIONAL TECHNOLOGIES

- **Electricity Demand** is distributed between zones/months/hours based on industries' value-added and population.
- **Production costs** based on projections for investment costs, fixed and variable O&M costs, fuel prices, CO_2 emissions, hours/year, durability and load profile.
- **New capacity** is projected to fulfill expected growth in electricity demand in line with current installed capacity but constrained by profitability \Rightarrow RES Investment= f (Expected Demand, EU Renewable target, NPV, ROI, Authorization Time, Project failure due to bureaucracy).
- Simulation:from 2022 to 2030 - Calibration: Italian case.

SYSTEM MARGINAL PRICING

- The **SMP** is determined by sorting in ascending order the marginal costs of each power generation plant and selecting the highest-priced unit scheduled to meet demand.
 - Invites operators to invest in cheaper technologies through infra-marginal rent expectations
 - Discourages opportunistic behavior and encourages disclosure of generators marginal costs.
- NET \Rightarrow Hourly price is generally determined by gas-fired CCGT plants; when RES production is enough to cover hourly demand, the price will be determined by the maximum marginal costs among these generation technologies.

PAY-AS-BID

- In a **Pay-as-Bid** auction all winning producers receive what has been offered in the day-ahead marketplace (Willems and Yu, 2022).
- NET \Rightarrow The bidding prices of fossil power generation plants will be equal to their respective marginal costs (fuel cost at spot market price + O&M + carbon emission permits) plus an exogenous mark-up, while RES bidding prices will be equal to LCOEs plus an endogenous mark-up that has a direct relation with the gas price and inverse with respect to the share of renewable energy production.

TWO-MARKETS SOLUTION

- The **Two Markets** solution is based on the idea to split wholesale electricity markets for different source of power (see for instance Key and Robinson, 2017):

THERMO Fossil thermoelectric plants bid in a spot market with the SMP mechanism;

RES Renewables operate in a forward market with long-term contracts (PPA) in which the price reflects the levelised cost of electricity.

- **NET** \Rightarrow To simplify the mechanism, the existing RES plants, in addition to any other incentive, can count on a price equal to the LCOE of 2021, while new plants will receive a price equal to the LCOE of the year plus a 5% mark-up.

EFFECTS ON POWER SPOT PRICE

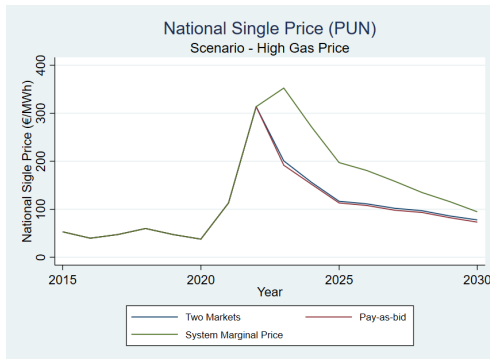


FIGURE: National Single Price - *High Gas Price Scenario*

EFFECTS ON POWER SPOT PRICE

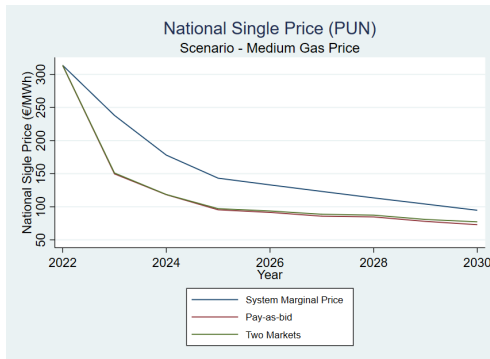


FIGURE: National Single Price - *Medium Gas Price Scenario*

EFFECTS ON POWER SPOT PRICE

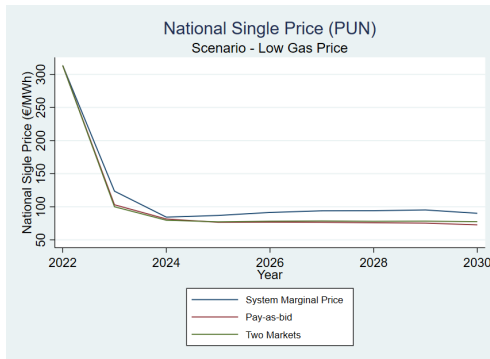


FIGURE: National Single Price - Low Gas Price Scenario

EFFECTS ON ELECTRICITY SUPPLY COST

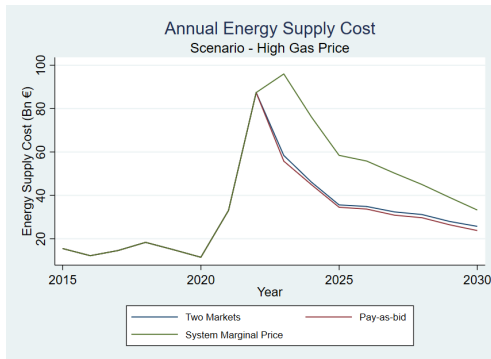


FIGURE: Supply Cost - *High Gas Price Scenario*

EFFECTS ON ELECTRICITY SUPPLY COST

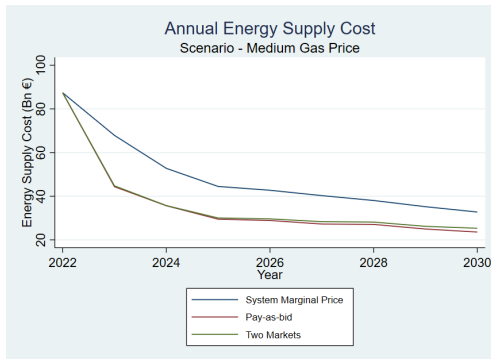


FIGURE: Supply Cost - *Medium Gas Price Scenario*

EFFECTS ON ELECTRICITY SUPPLY COST

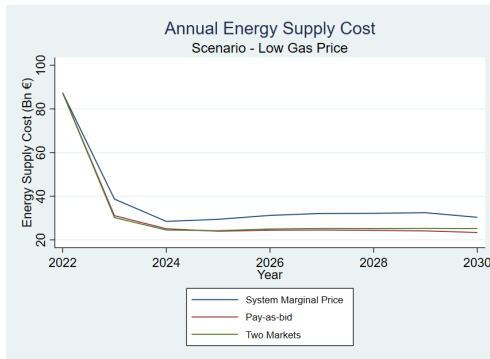


FIGURE: Supply Cost - *Low Gas Price Scenario*

EFFECTS ON PROGRESS TOWARDS DECARBONISATION TARGETS

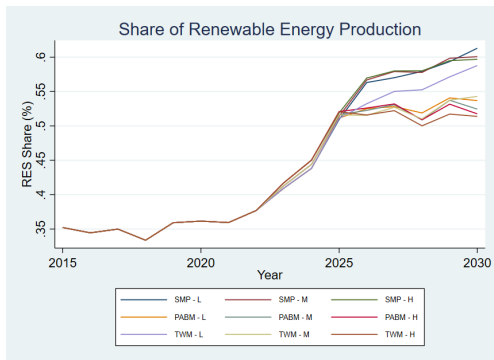


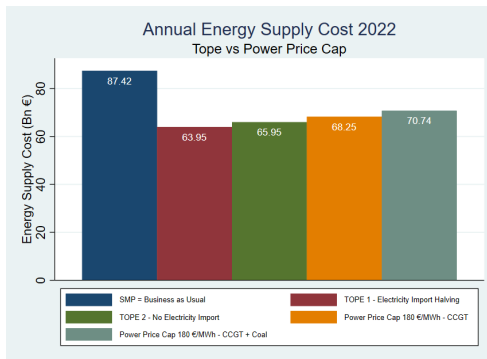
FIGURE: RES Share

POLICY CONCLUSIONS AND SUGGESTIONS

- Pay-as-bid and Two-Markets options reduce the price of energy in a scenario with high gas price.
- However, both pricing mechanisms do not allow European targets to be met by penalizing investment in RES capacity. Main weaknesses:
 - PAB** Cannibalization risk when renewables cover an increasing part of electricity demand;
 - TWOM** Fixed mark-up might induce investments in expensive technologies.
- Furthermore, preliminary results show that PAB and TWOM options do not spur investments in storage technologies (not included in this presentation).
- There is no evidence to suggest a reform on the price formation mechanism...

POLICY CONCLUSIONS AND SUGGESTIONS

- Short-term measures to cushion the negative effects of electricity price instability on the economy (e.g. Price Cap or Tope).



POLICY CONCLUSIONS AND SUGGESTIONS

- Short-term measure to cushion the negative effects of electricity price instability on the economy (e.g. Price Cap or Tope) ⇒ delayed action by EU.
- Give consumers access to cheap renewables with Contracts for Difference (CfDs) and Power Purchase Agreements (PPAs).
- Streamlining the bureaucracy and speed up authorization time.

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Thank you for the attention!
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