



MARKET REFORM PLAN FOR GREECE

Preliminary version for consultation

Study by E3Modelling for RAE
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July 20, 2021

Objectives of the study

- To support an application for a capacity remuneration mechanism
 - Article 20 of Regulation (EU) 2019/943
- Aims at eliminating all distortions and deficiencies that may prevent power resources to recover all costs and thus may discourage new investment
 - Remove distortions, price caps etc.
 - Introduce a shortage pricing function for balancing energy
 - Enlarge market participation to all possible power sources
 - Broaden geographical coverage of markets
- Economic viability assessment further identifies possible “missing money”
 - Financial analysis of past market functioning (costs versus revenues)
 - Identification of threats and uncertainties that may discourage investment in the future

Overview of power capacity in Greece

Current situation

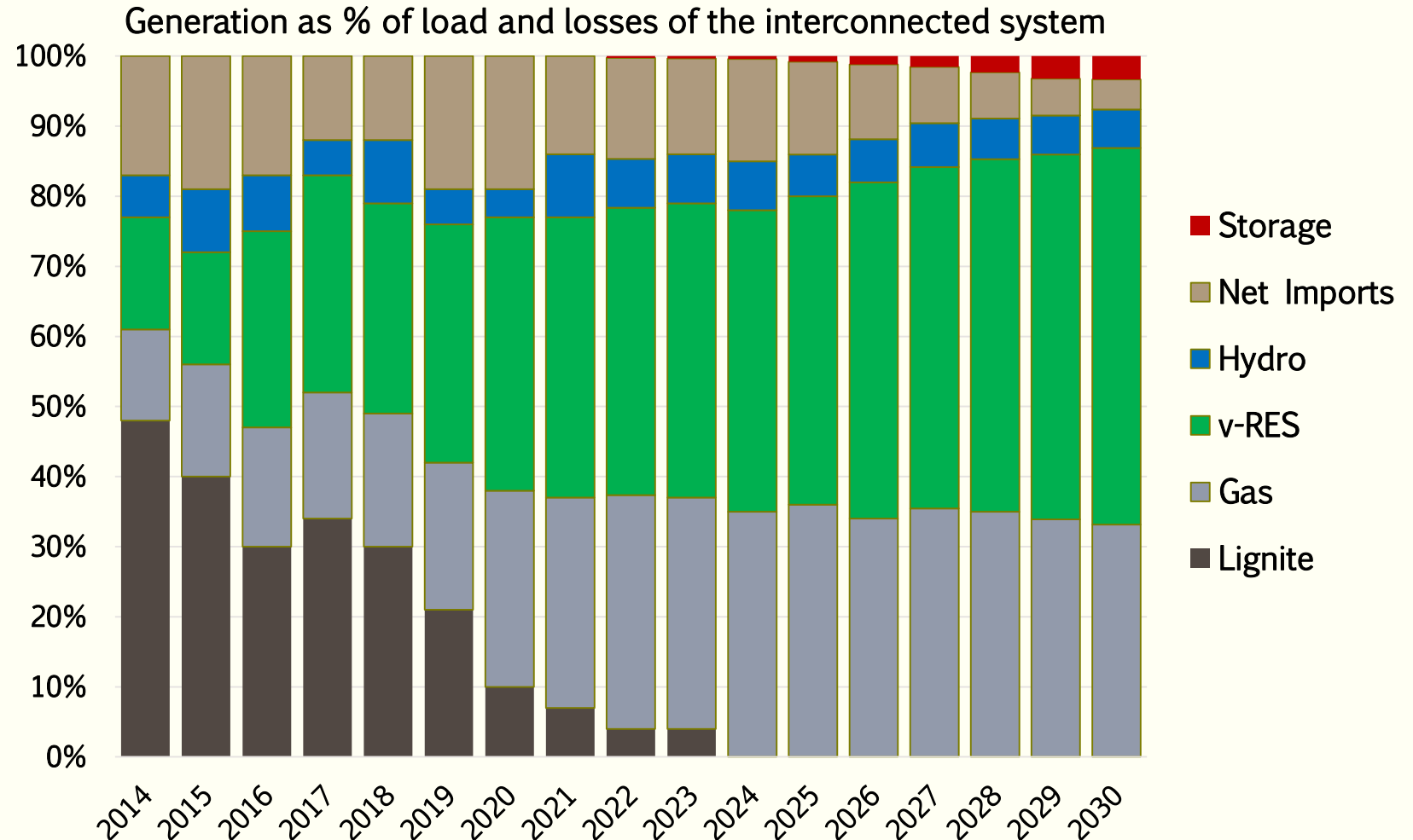
- Dispatchable
 - Lignite 2256 MW
 - Gas 5212.5 MW
 - Hydropower 3042 MW
 - Hydro pumping 699 MW
- Lignite plant retirement issue
 - PPC asks to retire the lignite plants prematurely due to economic losses
 - An IPTO adequacy study found a capacity adequacy gap if lignite plants retire before the new commissionings

Capacity additions

- Plants under construction expected to be in commercial operation in 2023
 - 825 MW CCGT by Mytilinaios
 - Ptolemaida V, possibly converted to gas by 2025
 - Hydropower, 29 MW in 2025 and 160 MW in 2027
- Licensed plants with a yet uncertain investment decision
 - 2 or 3 large CCGT plants
 - Amphilochia closed loop hydro pumping
 - Batteries

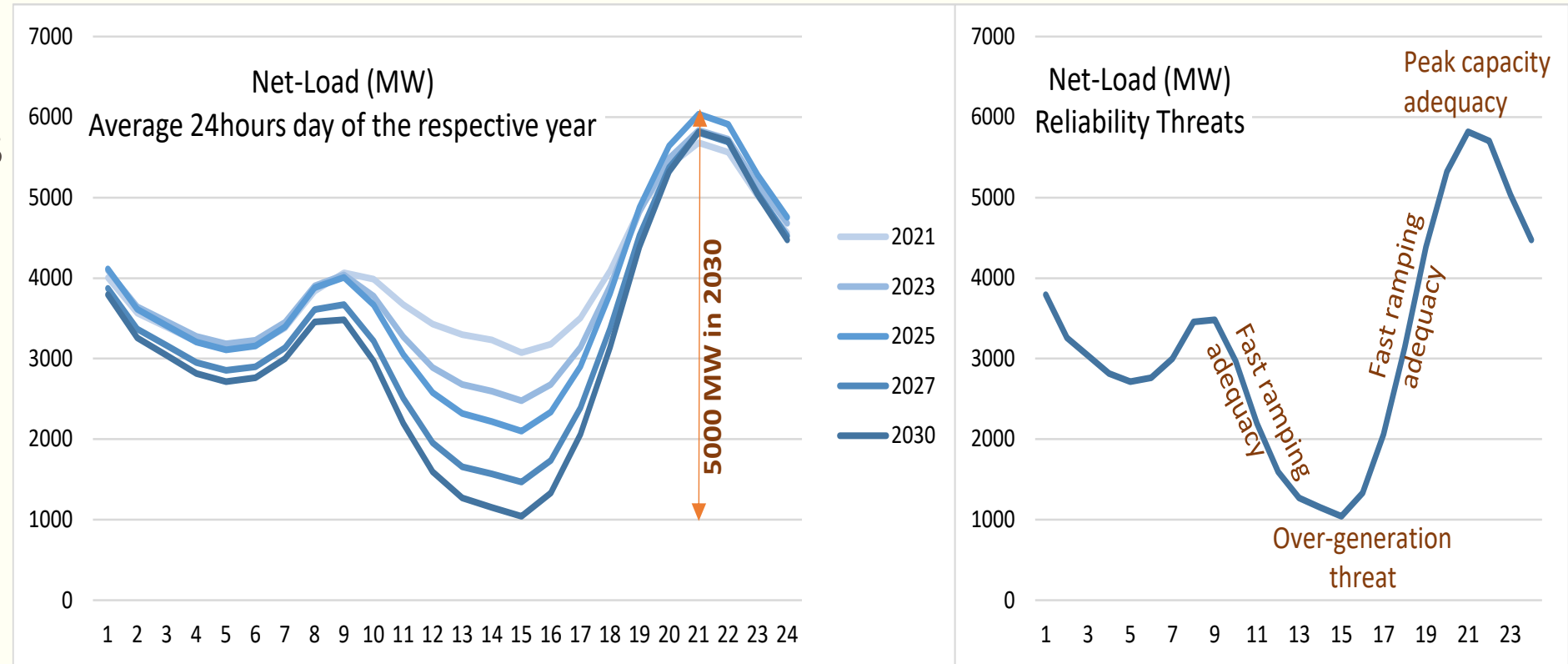
Power generation mix (past and projections)

- Estimations based on NECP's capacity plan
- The revised NECP may plan for increased v-RES
- Gas-based generation remains in the power mix at a slightly declining share, as net imports decrease due to changes in the broader region



Projection of Net-Load for an average day

- Illustration of the increase in flexibility requirements as v-RES deploy
- Scheme showing the types of generation adequacy concerns that arise in the future

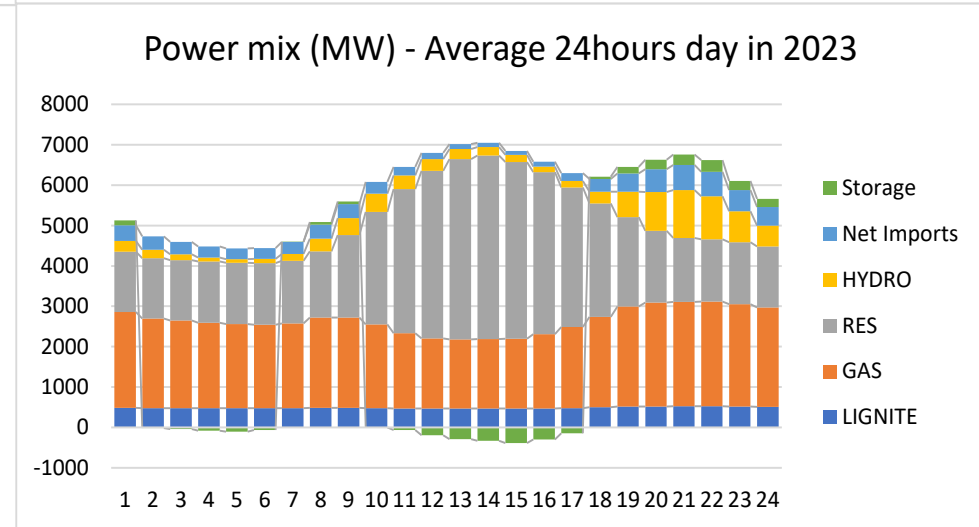
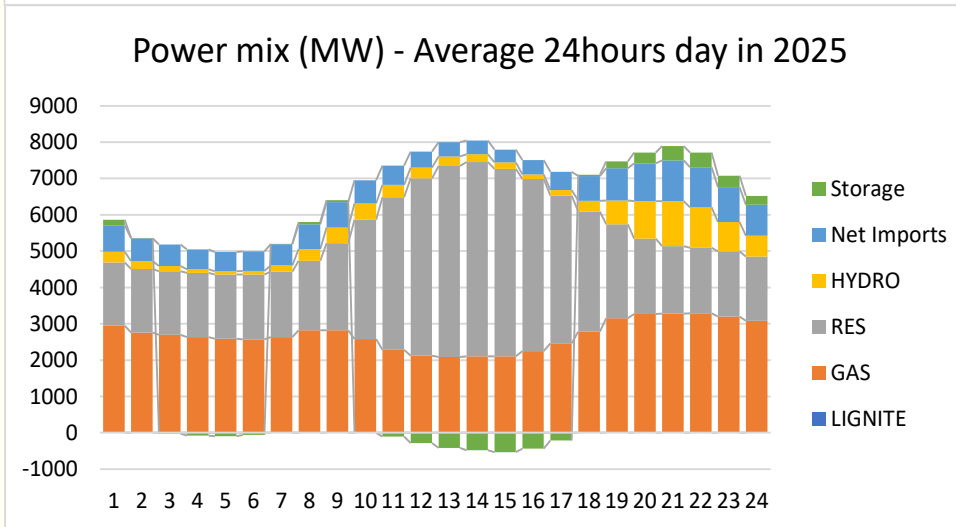
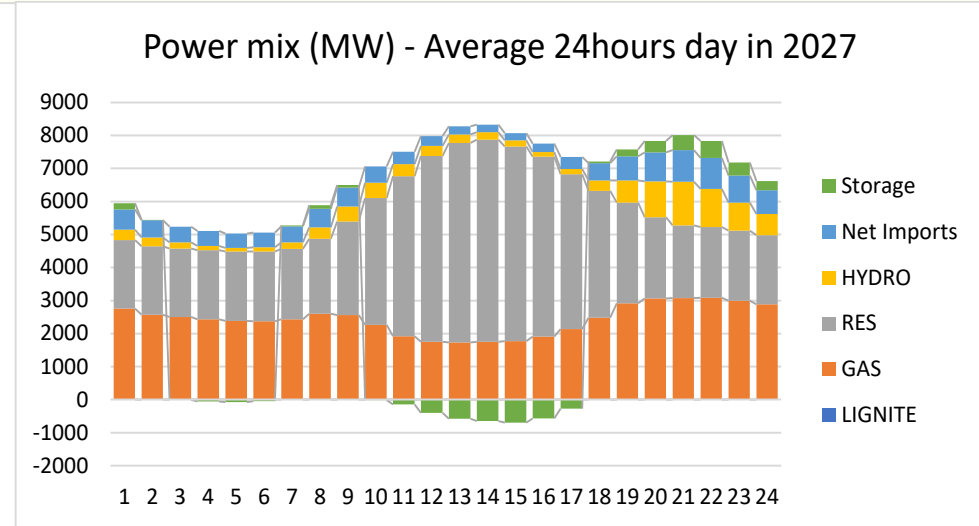
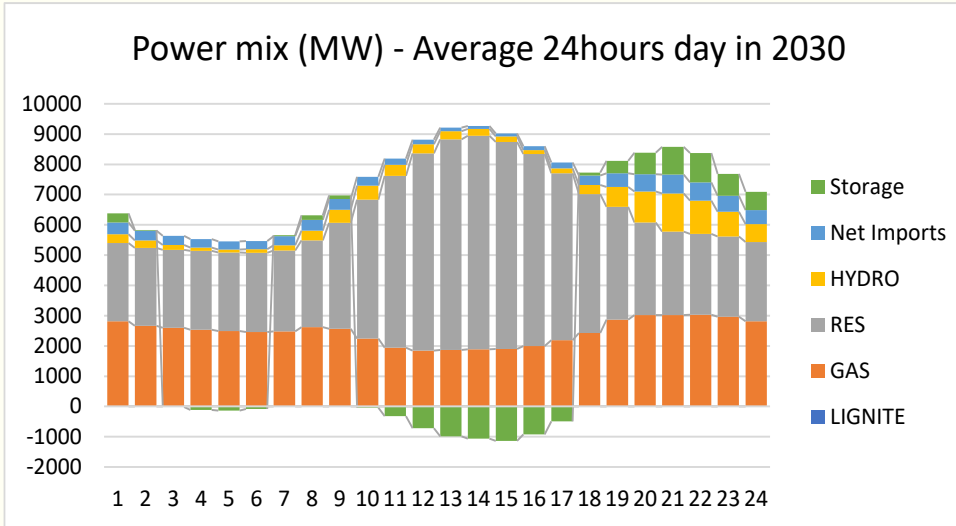


Indicative projection of the average daily pattern

The expected development of solar energy has considerable impacts on the average daily pattern in the future

The projections illustrate the importance of storage and demand response for smoothing the typical load curve in the future

Gas power plants provide both energy and reserves, and operate in a cyclical pattern



Overview of retail market competition

Indicative market shares in 2020

	PPC	Suppliers with IPP	Suppliers without IPP
Households (Low Voltage)	79%	12%	10%
Services and Industry Low Voltage	66%	18%	16%
Services and Industry Medium Voltage	39%	37%	24%
Industry (High Voltage)	96%	4%	0%
Total	70%	17%	13%

Measures to increase competition

- RAE's market monitoring and surveillance tool expected to fully operate by end 2021
- The cost fundamentals change, due to ETS, while at the same time competition to incorporate RES in bilateral contracting will emerge
- The RES-PPA trading enabling measures, accompanied with a support of energy-intensive industry, will modify market shares in high voltage market segment
- In the short-term, the anti-trust remedy will apply
- No issues regarding the social tariffs and universal service schemes

Forward electricity market

Assessment

- Poor market liquidity both for bilateral contracts with physical delivery and hedging financial instruments
- Market participants have used forward market futures through the EEX

Measures

- To explore lifting of the 20% cap on physical contracts
- Improvement of software and standard products for financial hedging instruments
- The forthcoming RES-PPAs essentially are forward contracts
- The anti-trust remedy may also increase forward market operations

Day Ahead Market

Assessment

- Sufficient liquidity
- Successful market coupling
- Although block orders are available, the majority uses simple bidding
- Accommodating anticipation of reserves in the DAM bidding is not facilitated

Measures

- To explore application of complex bidding
- To explore portfolio bidding, instead of unit-specific bidding
- To consider revisions to allow market participants to accommodate commitments in the context of possible day-ahead tendering for capacity reserves

Intra-Day Trading

Assessment

- Poor liquidity at present
- Limited participation
- Lack of regional coupling

Measures

- Regional intra-day auctions (CRIDAs)
- Participation in the single intraday coupling project based on the XBID platform
- Participation of traders conditional on agreeing the capacity calculation rules and procedures for the non-EU cross borders.
- The establishment of full balancing responsibility of RES will add liquidity to the ID market
- Continuous trading is the ultimate goal

Balancing Market

Assessment

- The plant commitments for energy and reserve resulting from the central scheduling (ISP) presents substantial discrepancies from the merit order resulting from the DAM
- Re-dispatching to accommodate system constraints (Peloponnese limits and over-voltage occurrences) has significant cost implications
- The cost of reserve procurement has been logical, but the cost of balancing energy has been high so far.
- The participation of additional balancing resources is pending.

Measures

- Flagging of re-dispatching and amendments to avoid influence of re-dispatching on market prices for balancing energy. Upon successful implementation, removal of the current bidding limitations.
- Under consideration, to perform capacity reserve tendering at day-ahead and facilitate pre-emption of capacity reserve commitments in the DAM. Combine with enhancement of a nomination platform.
- Concrete steps to allow participation of demand response and storage in all stages including in the balancing market
- Study of shortage pricing alternatives
- Integration in balancing resource sharing platforms

Financial analysis of the target model markets in the first 6 months

Summary of net results

	Lignite	Gas	Hydro	Total
Revenues minus fuel variable and fixed O&M costs, '000€	-81,497	147,762	214,552	280,818
Revenues minus total costs, including CAPEX, '000€	-139,927	-27,736	19,132	-148,531
DAM and IDM (€/MWh)	54.2	65.9	47.4	60.0
BM (€/MWh)	12.0	17.2	40.8	19.8
Total costs (€/MWh)	104.5	86.1	80.6	89.6

Assessment

- The economic losses of the lignite fleet justify the measure of Strategic Reserve
- Despite the rather exceptional revenues from the balancing markets, a missing money problem persists for the gas plants



SUMMARY OF MARKET REFORM ACTIONS AND THEIR TIME SCHEDULE

Market reform action list (Part A. Actions for the Wholesale Markets)

1. Distinction of Balancing Energy and Energy due to Re-dispatching → early 2022
2. Distinct portfolio-based reserves market establishment → to explore
3. Participation of Demand Response in the wholesale markets → early 2022
4. Participation of storage in the wholesale markets → end 2022
5. Participation of dispatchable RES units and RES portfolios as BSPs in the Balancing Market → early 2022
6. Launch of Complementary Regional Intraday Auctions (CRIDAs) → 2021
7. Participation of Traders in the Intraday market - Launch of Intraday PTR Auctions for non-EU bidding zone borders → 2022, conditional
8. Launch of Continuous Intraday Coupling → 2022
9. Resumption of the possibility of BSPs to submit Balancing Energy bids with negative prices → end 2021 linked to A1
10. Participation of RES units in the Electricity Markets having full balancing responsibilities → early 2022
11. Activation of scarcity pricing mechanism → to explore
12. Exploration (pros/cons) portfolio-based bidding in DAM and IDM and nomination platforms → to explore
13. Exploration of self-scheduling and central dispatch → to explore
14. Participation in the EU balancing platforms (MARI/PICASSO) → 2024
15. 70% target (margin available for cross-zonal trade) → mid or end 2022
16. TSO-DSO Coordination Platform → 2024

Market reform action list (Part B. Interconnections and grid reinforcement)

1. Cross-border interconnection projects
 1. New interconnection Greece-Bulgaria → 2022
 2. Italy (pre-feasibility studies)
 3. North Macedonia (feasibility study)
 4. Turkey (pre-feasibility study)
 5. Albania (very preliminary)
2. Southeast Electricity Network Coordination Centre (SEleNe CC)
3. Islands interconnection projects
 1. Crete Phase 1 → operational
 2. Crete Phase 2 → mid 2023
 3. Skiathos → end 2022
 4. Cyclades Phase D → 2024
 5. Dodecanese → 2028
 6. North East Aegean islands → before 2030
4. Reinforcement of transmission system
 1. Completion of the 400 kV backbone Peloponnese → high priority
 2. Compensation and stability enhancement → Q1 2022
 3. Rouf EHV S/S
 4. Argypoli EHV S/S
 5. Filippi-Santa
 6. Nevrokopi etc.
 7. Kerkyra
 8. Halkidiki
 9. Katerini and others
 10. South Ionian loop
 11. Various others

Market reform action list (Parts C, D, E and F)

C. Retail Market Competition

1. Market Monitoring and Surveillance Mechanism → 2021
2. Antitrust case - energy release by PPC → end 2021
3. RES-PPA and support of energy intensive industry → 2021-2022

D. Liquidity of Forward Market

1. Software extension and enhancement → 2021-2022
2. Customized products for hedging DAM and Balancing transactions → end 2021
3. Antitrust case - energy release by PPC → end 2021
4. RES-PPA and support of energy intensive industry → 2021-2022

E. Investment support

1. Support of RES (separate action)
2. Support of Storage (Resilience and Recovery Plan)
3. Interruptibility scheme (phased out in Sept.)
4. Strategic Reserve → 2022 and 3Q 2023
5. Capacity Remuneration Mechanism with Reliability Options and flexibility enhancements → end 2023 onwards

F. Price limits and other restrictions - lifting

1. Lifting of 20% cap on physical contracts of vertically integrated suppliers → explore
2. Complex bids in DAM → explore
3. After continuous ID trading -9,999 EUR/MWH to +9,999 EUR/MWH
4. Negative balancing energy offers allowed → end 2021
5. Balancing energy offers up to +9,999 EUR/MWH after CRIDAs
6. Balancing energy offers -99,999 EUR/MWH to +99,999 EUR/MWH after MARI/PICASSO

Conclusions and next steps

- The current market deficiencies and distortions are small – no major issue identified
- The current version of the market reform plan is comprehensive and well elaborated
- It is important to follow the tight time schedule but the implementation is challenging – essentially a huge reform has to complete end 2022.
- There is optimism about acceptance of the Plan by the EU institutions
- Next steps
 - The new capacity adequacy report by the IPTO, which is close to completion, will be submitted
 - The European Commission will put the market reform plan in international consultation
 - Afterwards, the European Commission will issue an assessment of the Market Reform Plan, the Capacity Adequacy Report and the Economic Viability Assessment
 - Depending on this assessment, the Greek State will submit the final notifications for the Strategic Reserve and the Capacity Remuneration Mechanism.