SPE View on Policy Options for Securing Inertia with regard to PV + Storage

38th GC ESC Meeting - 05 June 2025

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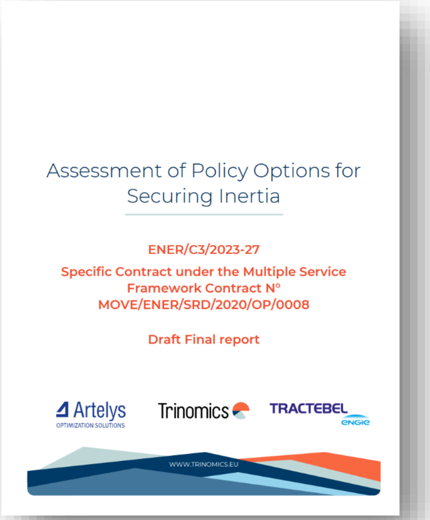
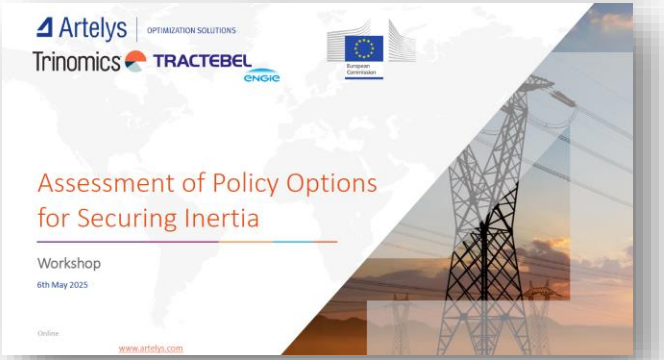
Motivation: Workshop based on Draft Report „Assessment of Policy Options for Securing Inertia“

- Report addresses inertia needs and discusses technology and policy options to secure inertia
- We strongly appreciate the investigation of the policy options and the authors considering our feedback for the final report
- The technologies taken into focus were
  - Synchronous and Induction Machines
  - Inverter Based Ressources
- Inverter-based Resources (IBR) taken into account were
  - Battery Electric Storage Systems
  - PV / Wind / HVDC / (E-)Statcom (more or less) considered to utilize ultracapacitors as additional Storage
- The Technology Readiness (TRL) of GFM IBRs has been estimated to be 7-8;
- TRL has not been distinguished among the IBR types





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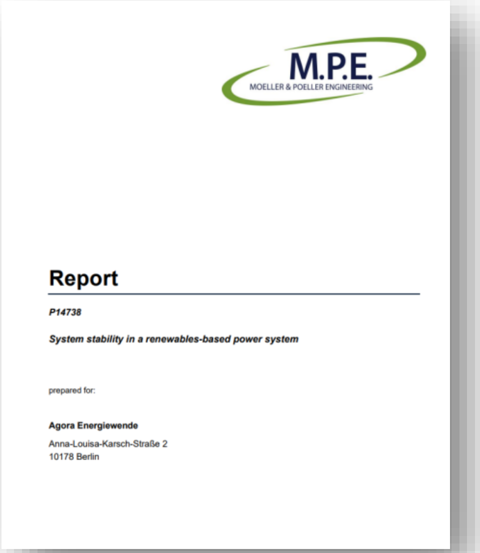
Technology Readiness Levels in the report need to be revised

- Single TRL for all GFM IBR Technologies is misleading
- TRL depends strongly on Technology of Source connected to the converter
  - GFM battery inverters: TRL 9
    - commercially available and in operation in GB
    - Deployed at utility-scale since 2018*
    - 2.2 GW+ active across multiple regions

    (see ESIG overview on GFM Projects with 47 Multi-MW BESS Projects and mentions)
  - GFM PV inverters: TRL 3–4*
    - only asymmetrical contribution to inertia w/o additional storage
    - Potentially yet unknown effects of GFM operation on losses/energy yield/ stability under realistic conditions
  - GFM Wind inverters: Intermediate (to be classified by wind industry)
- Backed by Agora Energiewende (2024 report) and ARENA frameworks.


M.P.E.
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Report

P14738

System stability in a renewables-based power system

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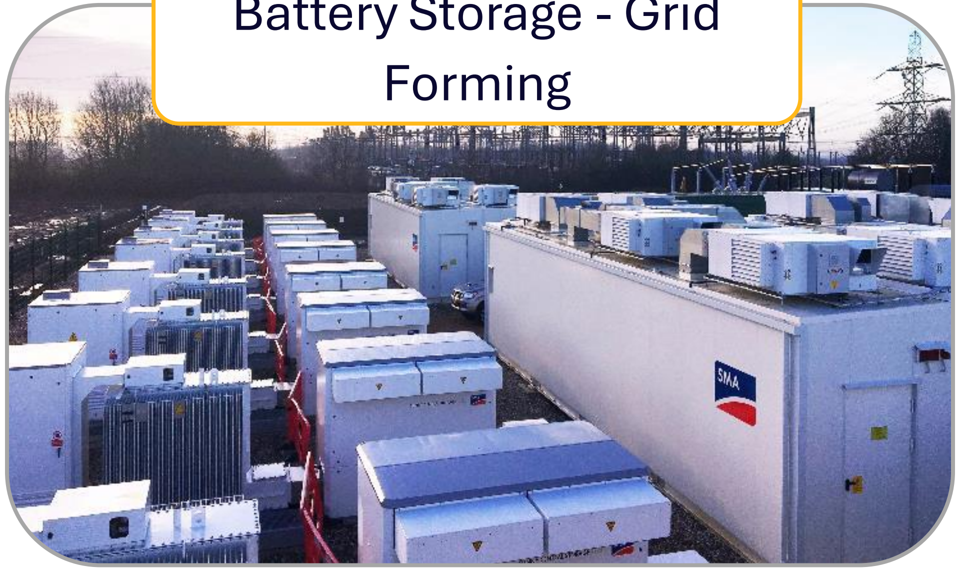
*not necessarily according to latest specifications discussed

Realistic consideration of TRL is crucial for Stability Frameworks

- Appropriately designed **Market based** approaches allow
  - to (cost-)effectively utilize High-GFM-TRL technologies fast to provide secure Inertia
  - to let Low-GFM-TRL technologies develop and gather experience
- Non-technology-specific **connection requirements** may
  - lead to stability issues due to limited operational experience with Low-GFM-TRL specific characteristics (e.g. asymmetric inertia) and thus insufficient specifications
  - or result in market failure if overly stringent requirements are imposed since requirements can't be met by some Low-GFM-TRL technologies
- Side note beyond Inertia and GFM capabilities:
  - TRL of GFL-„PV-only's" capabilities to contribute to voltage and (Low-Inertia-) frequency stability is already high
  - The utilization of those capabilities throughout Europe could be improved

High-TRL-approach: Grid Forming Battery + Grid Supporting PV

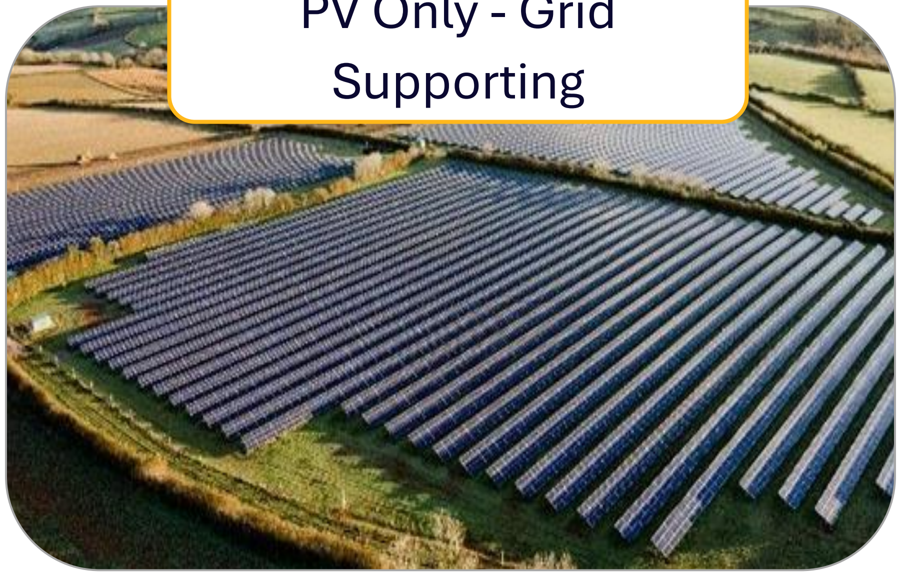
Battery Storage - Grid Forming



Focus: Flexibility and System Services

- Voltage Source behaviour and Inertia with secured Power and Energy Reserve
- Enhanced Power/Frequency Balancing

PV Only - Grid Supporting

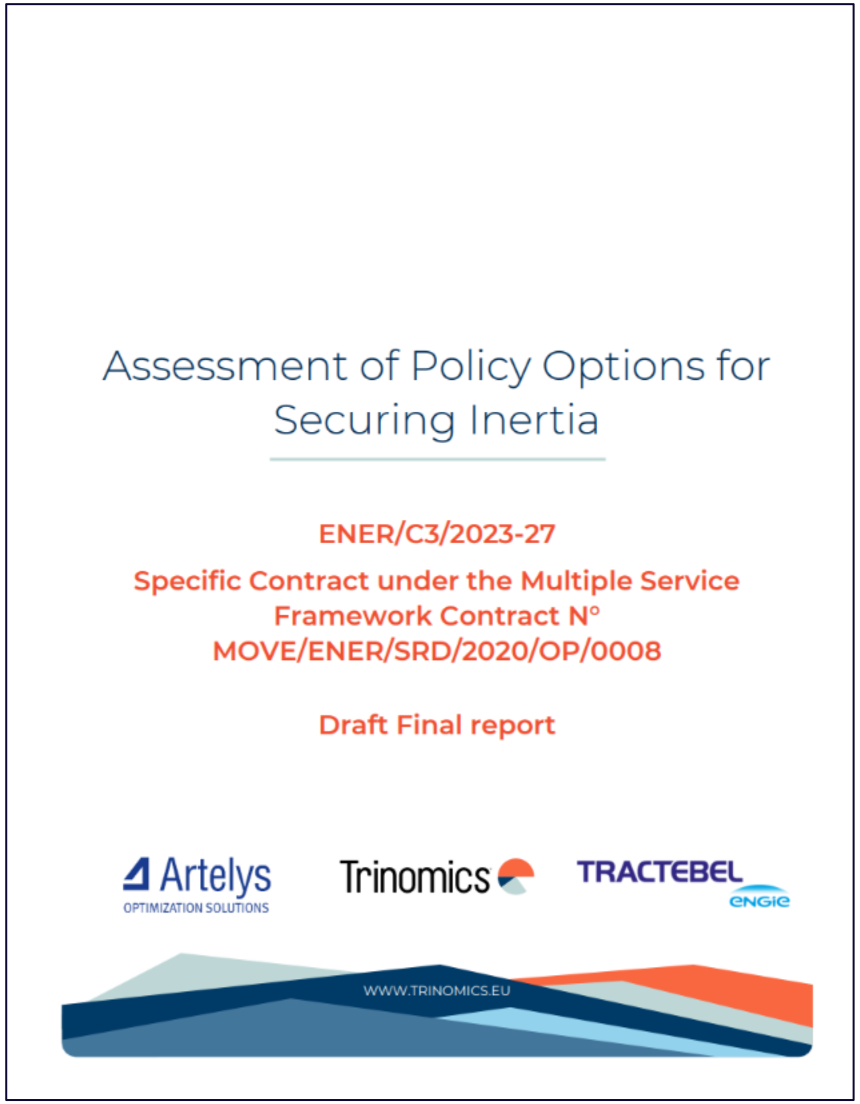


Focus: Efficient Electricity Generation

- Voltage Control + Power Oscillation Damping
- High Robustness (Voltage-, Frequency- and ROCOF-) Ride- Through capabilities
- Fast frequency response (e.g. LFSM) for low inertia frequency stability

Our Recommendations on the Inertia report

1. Engage industry stakeholders to improve the accuracy of TRL evaluations for battery technologies.
   - Recognize the TRL 9 status of commercially operating grid-forming batteries, including those deployed e.g. in GB
2. Distinguish TRLs across grid-forming IBR technologies to reflect
   - their varying maturity and clarify their specific contributions to inertia and system services
   - and the effect of different TRL on the recommendation of Policy Options
3. Apply technology-agnostic TRL frameworks, such as ARENA's, to ensure objective and unbiased assessment.


Assessment of Policy Options for Securing Inertia

ENER/C3/2023-27

Specific Contract under the Multiple Service Framework Contract N° MOVE/ENER/SRD/2020/OP/0008

Draft Final report

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Solar Role in Grid Stability

The solar industry supports grid integration through advanced storage grid stability / grid forming systems and control systems.

- **Case 1 - France (Corsica, La Réunion):** Akuo Energy uses solar PV + Li-ion batteries (since 2014) for bi-directional frequency response and night peak load shifting.

- **Case 2 - St. Eustatius:** Since 2017, operates without synchronous machines using grid-forming batteries and solar PV.

- **Case 3 - Great Britain:** 100+ MW grid-forming batteries (2025) will provide inertia, short-circuit power, and market-based ancillary services. → Zenobē commences construction of its Kilmarnock South battery project, in drive to maximise renewables and reduce the cost of wasted wind - Zenobē