Report 2022

Task 50

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Hybrid Power Plants

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The primary goal of Task 50 is to accelerate the development and deployment of hybrid power plants.

The Task's objectives include tracking the state of the art, mapping barriers to adoption, creating a roadmap based on existing research, and developing reference hybrid plants. By achieving these objectives, the Task expects to yield significant results in five work packages (WPs):

1. WP1: Hybrid Power Plant Definition: The Task aims to define a comprehensive taxonomy for hybrid power plants. Several draft versions of the definition have been proposed, emphasising the combination of two or more electricity generation and/or storage technologies connected behind the same point

of interconnection to produce electricity.

2. WP2: Design of Reference Plants: The Task currently discusses reference designs for hybrid power plants, including three different variations, one incorporating hydrogen. These reference designs will serve as benchmarks for future developments and deployments.

3. WP3: Controls and Optimisation: The Task focuses on developing control algorithms and optimisation techniques for hybrid power plants. Preliminary dispatch use cases have been designed and will undergo further vetting.

4. WP4: Electrical Design, Market, and Grid Services: The Task aims to review grid and market ancillary services to develop an open-source model. This model will assist in designing the electrical components of hybrid power plants while considering market requirements and grid services.

Progress and Achievements

Technical Results

The report provides details on the technical findings of each work package:

1. WP1 Hybrid Power Plant Definition: The Task has proposed several draft definitions, with the latest version (1.3, see Figure 1) encompassing a wide range of technologies that accommodate specific end-use needs, such as electricity, hydrogen and ammonia production, steel production, grid balancing services, and alternative fuels production.

2. WP2 Reference Power Plant: Initial survey results about objective functions to be pursued as part of the reference designs.

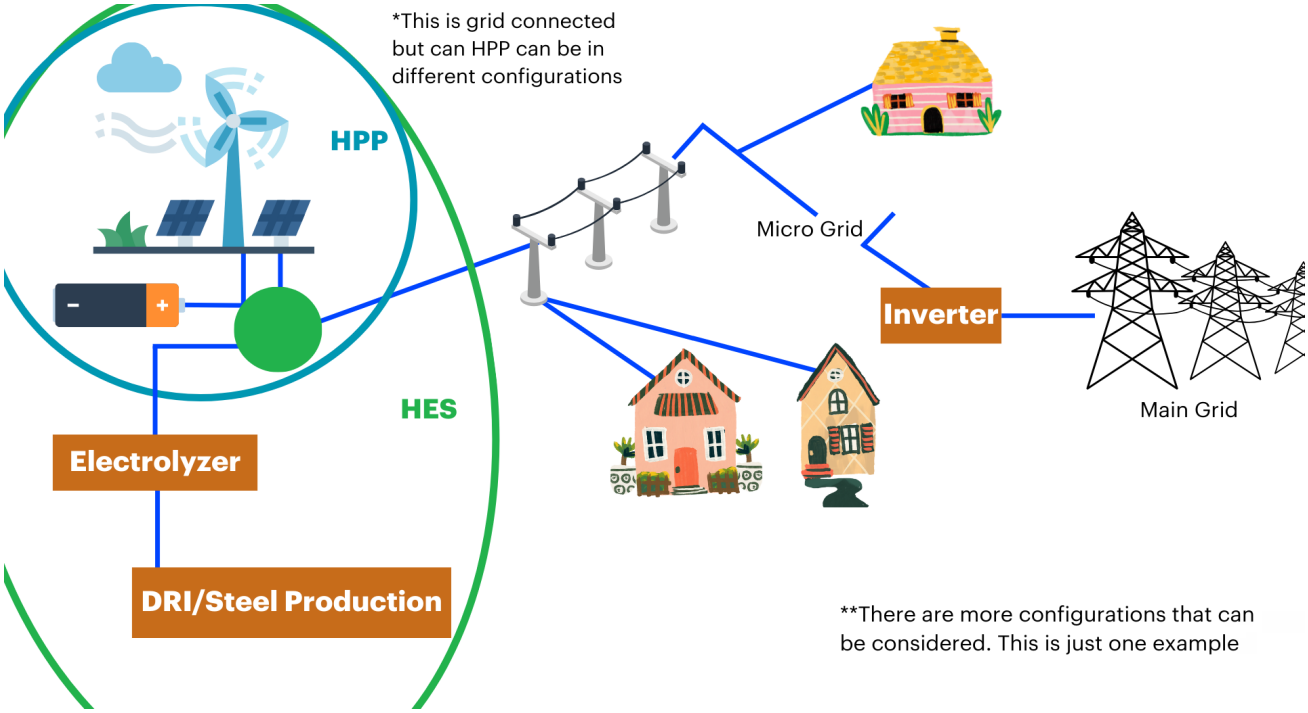

Figure 1: Working taxonomy for hybrid power plants, hybrid energy systems, and microgrids demonstrated pictorially. *Credit: Matthew Kotarbinski, WP1.*

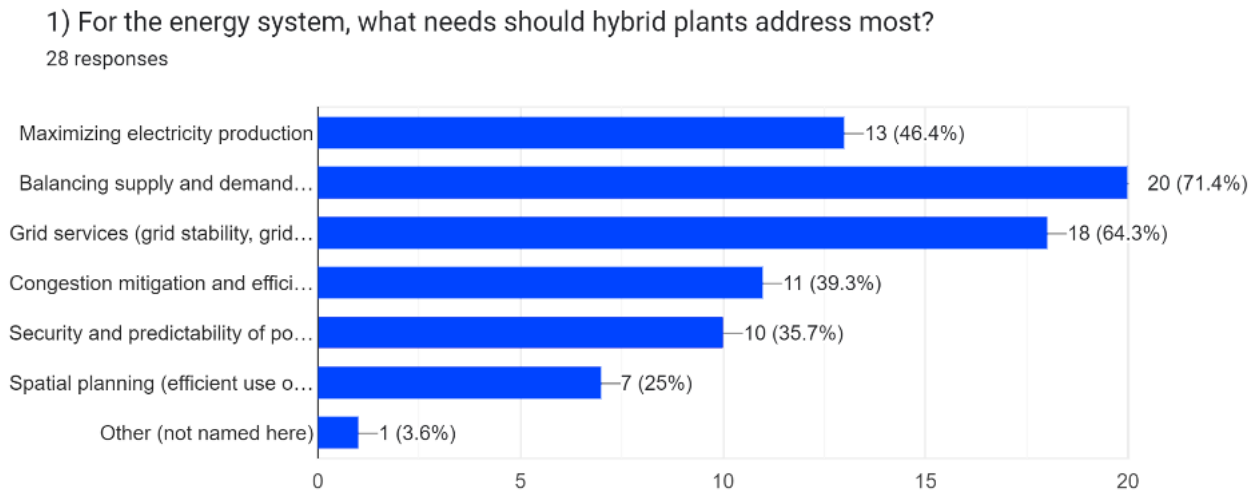

Figure 2: Illustrates the wide range of objectives for hybrid power plants and the group's priorities.

Deliverables

The report highlights the ongoing progress of various deliverables within each work package:

1. WP1 Hybrids Taxonomy: The Task is currently working on a draft publication that aims to establish a global consensus on hybrid taxonomy.

2. WP2 Design of Reference Plants: The Task is discussing and finalising reference designs for hybrid power plants, with a total of three variations under consideration, one of which incorporates hydrogen. These reference designs will be made available as open-source and online resources.

3. WP3 Controls and Optimisation: Preliminary dispatch cases have been designed and will be reviewed to refine the control algorithms and optimisation techniques for hybrid power plants.

4. WP4 Electrical Design, Market, and Grid Services: A review of grid and market ancillary services is underway to develop an open-source model that considers market requirements and grid services for hybrid power plants.

Highlight(s)

We had a joint meeting with Task 44 on Wind Farm Flow Controls at the Wind Energy Science Conference in Glasgow, UK, in May 2022.

Figure 3: In-person bi-annual Task 50 meeting in Glasgow, UK, at the Wind Energy Science Conference. *Credit: Matthew Kotarbinski.*

Outcomes and Significance

The results and activities of Task 50 bring significant benefits to participants, industry stakeholders, and society as a whole. By collaborating and sharing knowledge within the Task, participants gain valuable insights and expertise that can drive their own research, development, and business strategies in the field of hybrid power plants. The Task's outcomes, such as the comprehensive taxonomy, reference designs, control algorithms, and optimisation techniques, serve as practical tools and guidelines for industry stakeholders. These resources help them streamline the design, implementation, and operation of hybrid power plants, improving efficiency, cost-effectiveness, and performance.

Industry stakeholders, including renewable energy developers, power system operators, equipment manufacturers, and investors, can leverage the results of Task 50 to make informed decisions and investments. The clear definition and taxonomy of hybrid power plants enable stakeholders to identify suitable project opportunities, select appropriate technologies, and optimise system configurations. The reference designs provide benchmarks for industry best practices, facilitating standardised approaches and fostering technological advancements. The developed control algorithms and optimisation techniques enhance system operation and grid integration, leading to increased flexibility, stability, and reliability of hybrid power plants. The dissemination efforts of Task 50, including in-person meetings, virtual workshops, and open-source resources, foster collaboration, knowledge sharing, and capacity building among participants and key stakeholders.

Next Steps

The next steps include continued work on work packages 1-4. The first significant deliverable is expected to be a definition of the taxonomy of hybrid plants that will inform the other work packages, including defining collaborative reference designs, control algorithms, and electrical design.

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