Presentations of the outcomes of the interactive sessions

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(1) How can the industry develop a clear definition of low-carbon ready solutions to support the decarbonisation of thermal assets?

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1. Description of the problem root causes

- The actual challenge at hand to come to realistic low carbon goals is complex and potentially the full perspective is not well understood by all stakeholders.
- Many parties involved in the process – Lack of leadership and coordination (End-users, governments, technology developers, banks, manufacturers, insurance, etc.)

(1) How can the industry develop a clear definition of low-carbon ready solutions to support the decarbonisation of thermal assets?

2. What solutions did your groups brainstorm?

- It is believed a position paper from the ETN side would be most beneficial to evaluate where we are and re-evaluate the way forward in light of the developments in the US, GER and the UK.
- Break down this complex problem into smaller challenges that can be addressed. Formulate different categories of readiness with specific timelines and the investments needed (considering technology availability, business models, stable policies, etc.)

(1) How can the industry develop a clear definition of low-carbon ready solutions to support the decarbonisation of thermal assets?

3. How can ETN Global Network bring these solutions to life?

- A position paper to develop the categories of readiness - timeline for the position paper – May 2025 – TurboExpo.
- Definition of reference cases and boundary conditions.
- Review of business models in which investment can developed.

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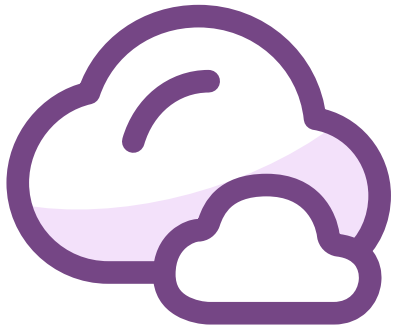

How can ETN Global Network bring these solutions to life (1/6)?

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(2) What safety measures and modification are needed to retrofit existing power plants to be H2 ready by 2030?

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1. Description of the problem root causes

- Uncertainty on the scenario (which fuel? Is co-firing?)
- Lack of specific training/education/experience throughout the value chain
- Existing plants are not designed/compatible to be retrofitted with H2 or retrofitting might not be approved by OEMs

(2) What safety measures and modification are needed to retrofit existing power plants to be H2 ready by 2030?

2. What solutions did your groups brainstorm?

- Uniform regulation in terms of safety measures in different areas and for different fuels
- Transfer knowledge from other sectors (e.g. chemical industry)
- Involvement of all stakeholders / risk sharing (user, OEMs, service provider, legislator…)

(2) What safety measures and modification are needed to retrofit existing power plants to be H2 ready by 2030?

3. How can ETN Global Network bring these solutions to life?

- Develop an ETN industrial standard for safety measures and alternative fuel readiness
- Identify and connect to sectors with relevant experience/benchmarks
- Facilitate collaboration and experience sharing amongst stakeholders (pilot plants/projects, industrial funded project, specific task forces)

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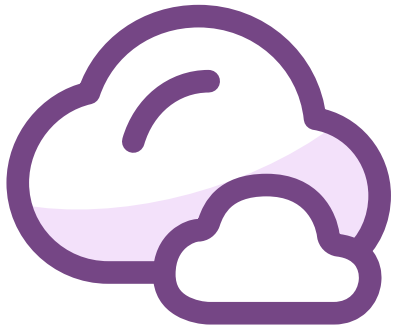

How can ETN Global Network bring these solutions to life (2/6)?

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(3) Are existing power plants capable to provide the flexibility needed to ensure grid resilience and supply security?

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1. Description of the problem root causes

- Existing assets not being able to respond to frequency (primary and secondary and tertiary frequency). New stations have this option (in some cases).
- Follow demand profile (more frequent start and stops). Increase of cyclic operation.
- Current assets are going to be required to operate at lower loads and to support an increasing RES market. However, emissions increase if you reduce the load below stable operating limit.

(3) Are existing power plants capable to provide the flexibility needed to ensure grid resilience and supply security?

2. What solutions did your groups brainstorm?

- If the gas turbines are not flexible enough, some auxiliary systems (e.g., collocation of batteries) are required.
- Further R&D on reduction of emissions at lower loads and with alternative fuels, with aim of increasing operating range. Specifically primary control measures.
- Improve link between demand and supply, with predictive model. Potential for smart grid.

(3) Are existing power plants capable to provide the flexibility needed to ensure grid resilience and supply security?

3. How can ETN Global Network bring these solutions to life?

- Help promote awareness out with the ETN Community regarding capabilities within the turbomachinery industry. Key to get to policymakers.
- R&D activities on emission control on the combustion system at low loads and with alternative fuels.
- Investigate CCGT with flexibility with CCS.
- Forecast report on grid evolution over the next 30 years (scenario-based).

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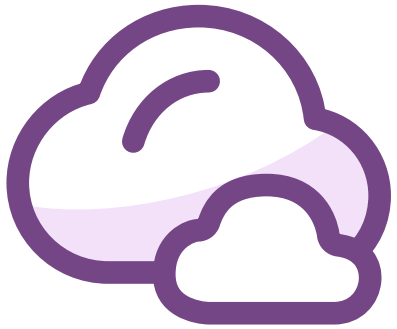

How can ETN Global Network bring these solutions to life (3/6)?

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(4) How can asset owners ensure long-term operational capacity for aging power plants when critical parts, spare parts availability, and legacy system support remain uncertain?

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1. Description of the problem root causes

- **Obsolescence:** OEM decides not to support the model due to
  - fragmented fleet,
  - unavailable material,
  - unavailable manufacturing process
- **Operator's reluctance** to third-party solutions
- **Loss of competence** both at the end-user's and OEM's

(4) How can asset owners ensure long-term operational capacity for aging power plants when critical parts, spare parts availability, and legacy system support are uncertain?

2. What solutions did your groups brainstorm?

- Set-up (leverage of the existing) **global database of spare parts** (also second hand)
- **Life-time extension** by adapting operation & maintenance
- OEMs should release/monetise **IP of stranded designs**
- Early acceptance/involvement of **non-OEM market**

(4) How can asset owners ensure long-term operational capacity for aging power plants when critical parts, spare parts availability, and legacy system support are uncertain?

3. How can ETN Global Network bring these solutions to life?

- Facilitate set-up/validation of the **“e-Bay” of spare parts**
- **Information sharing**
  - Life-time extension
  - Non-OEM use-cases

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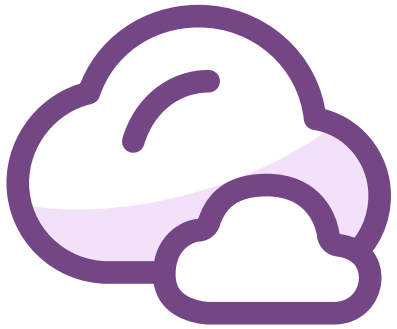

How can ETN Global Network bring these solutions to life (4/6)?

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(5) In the context of increasing digitalisation across industries, how can the market adapt to meet the evolving competitive demands of end-users?

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1. Description of the problem root causes

- Unclear data ownership
- Business cases unclear/put a monetary value to data
- Cost of sensors
- Operational data does not flow back consistently
- Different incentive schemes

(5) In the context of increasing digitalisation across industries, how can the market adapt to meet the evolving competitive demands of end-users?

2. What solutions did your groups brainstorm?

- Standardisation of data capture
  - Automated collection of operational data e.g. imaging
- Increased data sharing between industries
  - Areoa vs. Utilities
- Increase use of existing sensors/ e.g. smart sensors
- Share use cases

(5) In the context of increasing digitalisation across industries, how can the market adapt to meet the evolving competitive demands of end-users?

3. How can ETN Global Network bring these solutions to life?

- Standardise gathering of engineering data specifically for gas turbines
- Share best practices/use cases

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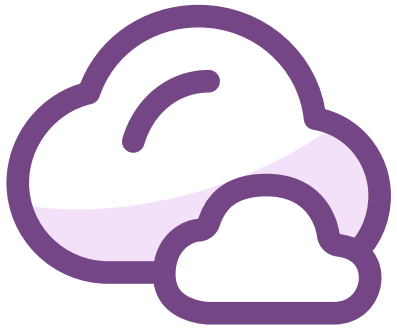

What does digitalisation (digital twins) mean to you? (5/6)?

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(6) How can we define and mitigate the risks that changing ambient conditions and extreme climate hazards pose to the resilience and operations of gas turbine power plants?

(6) How can we define & mitigate the risks that changing ambient conditions & extreme climate hazards pose to the resilience and operations of GT power plants?

1. Description of the problem root causes

- Gap between initial planning and actual condition
- Extremes/frequency of ambient swings
- Cost effectiveness/uncertainty/risk of technical solutions to climate change
- Lack of global system view on resilience

(6) How can we define & mitigate the risks that changing ambient conditions & extreme climate hazards pose to the resilience and operations of GT power plants?

2. What solutions did your groups brainstorm?

- Specific renumeration for resilience
- Technical authority for energy system resilience
- Asset performance modelling improvement to optimise investments (Computing mechanisms (AI...) - anticipating challenges rather than reacting)

(6) How can we define & mitigate the risks that changing ambient conditions & extreme climate hazards pose to the resilience and operations of GT power plants?

3. How can ETN Global network bring these solutions to life?

- Climate models from research institutes and/or universities
- Collect knowledge on risks of climate change on turbine operations to inform stakeholders
- Contact other organisations to understand their experience with climate resilience
- Develop a report on resilience (likelihood, cost to avoid, renumeration scheme)

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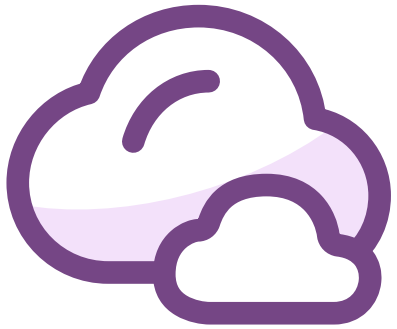

How can ETN Global Network bring these solutions to life (6/6)?

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