

Economic Modelling Working Group

The Economic Modelling Working Group (EMWG) was established in 2003 to provide a methodology for the assessment of Generation IV (Gen-IV) systems against two economic-related goals, as follows:

- to have a life-cycle cost advantage over other energy sources (i.e. to have a lower levelized unit cost of energy);
- to have a level of financial risk comparable to other energy projects (i.e. to have a similar total investment cost at the time of commercial operation).

In 2007, the EMWG published cost estimating guidelines and the Excel-based software package, G4ECONS v2.0, for the calculation of two figures of merit: the levelized cost of energy and the total investment cost, and to assess Gen-IV systems against GIF economic goals. These EMWG tools were made available to the public through the GIF Technical Secretariat, which has resulted in several publications that demonstrate the EMWG methodology for the economic assessments of Gen-III and Gen-IV systems, as well for cogeneration applications, such as hydrogen production.

G4ECONS v2.0 was also benchmarked against the economic tools of the International Atomic Energy Agency (IAEA), namely the Nuclear Economics Support Tool (NEST) and the Hydrogen Economic Evaluation Programme (HEEP), and the results have been published in peer-reviewed publications. Lessons learnt from the benchmarking exercise and from the feedback of users has informed the refinement of the G4ECONS tool. The EMWG released the new version, G4ECONS v3.0, with an improved user interface, in October 2018.

In 2016, the EMWG started to investigate the challenges and opportunities for the deployment of Gen-IV systems in emerging energy markets with an increasing share of renewable energy resources. The terms of reference for the EMWG were amended in 2018 to incorporate the expanded mandate so as to inform the GIF Policy Group and the Experts Group on the policies and R&D needs for the future deployment of Gen-IV systems.

Since October 2016, the EMWG has been working collaboratively with the Generation IV International Forum's Senior Industry Advisory Panel (SIAP) to investigate challenges and opportunities for deployment of Gen-IV systems in electricity markets with a significant penetration of renewable

energy resources and to produce a position paper for the Policy Group. An abridged version of the EMWG position paper on the impact of increasing shares of renewables on the deployment prospects of Gen-IV systems was presented at the 4th GIF Symposium (2018) and an executive summary was posted on the GIF website (www.gen-4.org/gif/jcms/c_117863/2018-gif-symposium-proceedings). The study found that Gen-IV systems need to be more flexible compared to current reactors for deployment in low-carbon energy systems, and such requirements are already being proposed by the utilities. Large-scale energy-storage and cogeneration applications, for example, would allow flexible dispatch while ensuring high-capacity utilization. Nuclear-renewable hybrid energy systems with adequate energy-storage and cogeneration applications could, in this way, meet flexible demands from the grid while operating power generators at full capacity to ensure overall economically viable operation. However, such flexibility considerations impose additional requirements on the R&D of Gen-IV systems.

Activities in 2020

In 2020, the EMWG identified two priorities for its 2021 work program:

Advanced nuclear technology cost reduction strategies and a systematic economic review:

The EMWG will evaluate nuclear cost reduction strategies based on past/current lessons learnt, along with assessments of readiness levels for the technologies and the potential for cost reduction. Key areas for nuclear cost reduction and enabling technologies will be researched under design, and construction/production, as well as project management. EMWG members will research specific strategies and technologies (e.g. functional containment, advanced concrete, machine learning) to assess cost reduction potential, applicability to Gen-IV technologies and technology readiness, as well as to identify further RD&D that may be needed to advance the strategy. This activity will develop a GIF systematic economic review process, where cost reduction strategies will be shared among GIF members (via the ETWG) and used for training and publication purposes. Results and the methodology developed can inform the design and selection of future cost reduction demonstration projects. Information and updates on cost reduction strategies and the study outcomes will be posted on an online repository ("Nukipedia").

The paper will outline a systematic economic review process to:

- identify opportunities/conditions for cost reduction under the categories of design, construction/production, and project management, emphasizing cost reductions for the balance of plant, with varying applicability to all Gen-IV technologies;
- provide a methodology to review progress in designs towards reducing costs;
- inform and provide training on cost reduction strategies for reactor designers and other stakeholders.

Advanced nuclear technology private financing:

The EMWG has established a working group of financing experts to identify the changes that need to be made to international, low-carbon, sustainability principles in order to enable private sector financing of nuclear power, and particularly Gen-IV technologies.

The paper will consider:

- the enablers required to facilitate private financing of nuclear projects;
- the risks associated with nuclear projects, how such risks are mitigated and how these risks may vary (if at all) with Gen-IV technologies (adapted from existing materials);
- an assessment of international regimes on sustainable financing, including:
 - why nuclear projects are sustainable developments;
 - the environmental, social and corporate governance (“ESG”) metrics (i.e. those used by investors to assess companies and projects to determine whether an institution should

be invested), and what needs to change, if anything, to create a level playing field for energy technologies and to ensure that nuclear energy is assessed in line with other energy projects;

- the various taxonomies and how nuclear power meets the “do-no-harm” principle;
- the Green Bond Principles, and how nuclear meets these principles.



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