



# ***GEN IV International Forum***

## ***GIF Economic Modeling Working Group – IAEA Collaboration***

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***Co-Chair, EMWG***

***14<sup>th</sup> GIF-IAEA Interface Meeting***  
***8 July 2020***

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# Outline

- ***Mandate and Membership of EMWG***
- ***Collaborative Activities with IAEA to date***
- ***Current Focus of EMWG***

# ***EMWG: Mandate and Membership***

- ***Mandate: To develop methodology for assessment of Gen IV systems against GIF Economic Goals***
  - Life cycle cost advantage over other systems (lower LUEC)
  - Comparable financial risks (total capital investment cost (TCIC))
- ***Extended mandate:***
  - Maintain cognizance of challenges and opportunities for integration of Gen IV systems with renewables on the grid
  - Understand methodologies for economic impact of integration
  - Highlight R&D challenges to meet flexibility requirements
- ***Current membership: Canada, China, France, Japan, Russia, South Africa, South Korea, United Kingdom, the USA, IAEA (observer)***

# Collaborative Activities with IAEA to date

- **Focused on benchmarking of economic tools**
- **G4ECONS v2.0 and IAEA's Nuclear Economics Support Tool (NEST) in collaboration with INPRO and PESS**
  - Three types of fuel cycles: Thermal Gen IV SCWR, Break-even fast reactor, Burner fast reactor
  - Results used in the revision of G4ECONS to harmonize with NEST
  - Results published in *"Benchmarking of Nuclear Economic Tools"*, Megan Moore, Andriy Korinny, David Shropshire, Ramesh Sadhankar; *Annals of Nuclear Energy*, 103, (2017), 122-129
- **G4ECONS v2.0 and IAEA's Hydrogen Economic Evaluation Program (HEEP) in collaboration with NPTDS**
  - Large scale production of hydrogen using high-temperature steam electrolysis coupled with SCWR
  - Minor differences due to calculation of interest during construction
  - Results published in *"Benchmarking of Economic Models for Nuclear Hydrogen Production"*, Ramesh Sadhankar, Lauralee Sopczak, Donald Ryland, Rami El-Emam, Ibrahim Khamis; *Pacific Basin Nuclear Conference, San Francisco, USA, Sep. 30 – Oct. 4, 2018*

## ***Revision of G4ECONS***

- ***G4ECONS v3.0 (Excel-based) released for use; available on CD***
- ***Request can be made at ([https://www.gen-4.org/gif/jcms/c\\_42161/g4econs](https://www.gen-4.org/gif/jcms/c_42161/g4econs))***
- ***Incorporates***
  - ***Lessons from benchmarking studies with IAEA***
  - ***Improved user interface***
  - ***Tracks transuranic and fission product generation or destruction for fuel cycle study applications***
- ***Co-generation modules (hydrogen, desalination, steam) from v2.0 have been deleted***
- ***Training material available***

## ***Current Focus of EMWG***

- ***New action plan currently underdevelopment. Topics to be considered for study are:***
  - ***Financing of Gen-IV reactors***
  - ***Cost reduction strategies for Gen-IV technologies***
  - ***Issues/challenges of integration of new nuclear with renewable resources***
  - ***Market functionalities of Gen-IV reactors***

# GIF-IAEA Coordination Matrix – March 2018

Action Item From Interface Meeting	Next action	Comments	Action IAEA	Action GIF
<b>Economics:</b>	<p>Continue discussions on areas of cooperation between GIF and NENP/PESS on economics. New areas identified:</p> <ul style="list-style-type: none"> <li>- Hybrid energy systems / integration renewables and nuclear (see meeting at IAEA in Nov)</li> <li>- Studies on (V)HTRs and process heat application economics</li> <li>- Multi-criteria evaluation tools and study of threshold effects</li> <li>- Contributions invited to Track 8 on economics at the GIF symposium (Oct 2018)</li> </ul>	<ul style="list-style-type: none"> <li>- G4-ECONS V3 released in summer 2018: Benchmark exercises completed and results available and reasons for differences well understood.</li> <li>- The GIF activities initially focused on cost calculation tools will probably be extended to a more comprehensive economic analysis for integrated systems, as well as a focus on flexibility (joint workshop held between EMWG, SIAP (Senior Industry Advisory Panel) and System Steering Committees on 29 May 2019 in Vancouver.</li> <li>- The GIF activities will continue to look at system flexibility and other system level approaches to cost reduction.</li> <li>- IAEA-NEST tool includes multiple cost models covering open and closed fuel cycles, multiple reactors, sensitivity analysis, comparisons to alternative energy sources, etc. Currently migrating NEST to a modular software platform from Excel and including GUI for ease of use by Member States.</li> <li>- China, India and Russia have completed INPRO Methodology Sustainability Assessments in the area of Economics on CFR-1000, CFBR-600 and BN-1200.</li> <li>- PESS initiated activity in integration of renewables and nuclear with study "Global Review of Integration of Renewable Generation in the Electricity Markets</li> <li>- NPTDS is finalizing a TECDOC on Options to Enhance Energy Supply Security using Hybrid Energy Systems based on SMRs</li> </ul>	<p>A Van Heek (NE) J Phillips (NE)</p> <p>T. Jevremovic/ I. Khamis (NE) for hybrid systems and process heat applications</p>	<p>(EMWG co-chairs) Megan MOORE Fiona REILLY David SHROPSHIRE</p>

***Thank You!***