



GEN IV Economic Modeling Working Group – IAEA Collaboration

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Outline

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

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)

- ***Current membership: Canada, China, France, Japan, Russia, South Africa, South Korea, the USA, IAEA (observer)***

- ***Typically two meetings per year***
 - April 2017, NEA, Paris
 - October 2017, Cape Town, South Africa

Benchmarking of Economic Tools - 1

- ***Completed Benchmarking of G4ECONS and IAEA's Nuclear Economics Support Tool (NEST) using common sets of input data for***
 - Thermal Gen IV SCWR
 - Break-even fast reactor
 - Burner fast reactor

- ***In collaboration with INPRO and PESS***

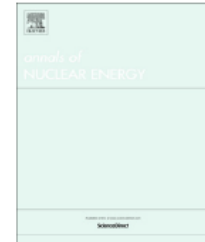
- ***Benchmarking results published in joint paper in 2017***



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Benchmarking of nuclear economics tools



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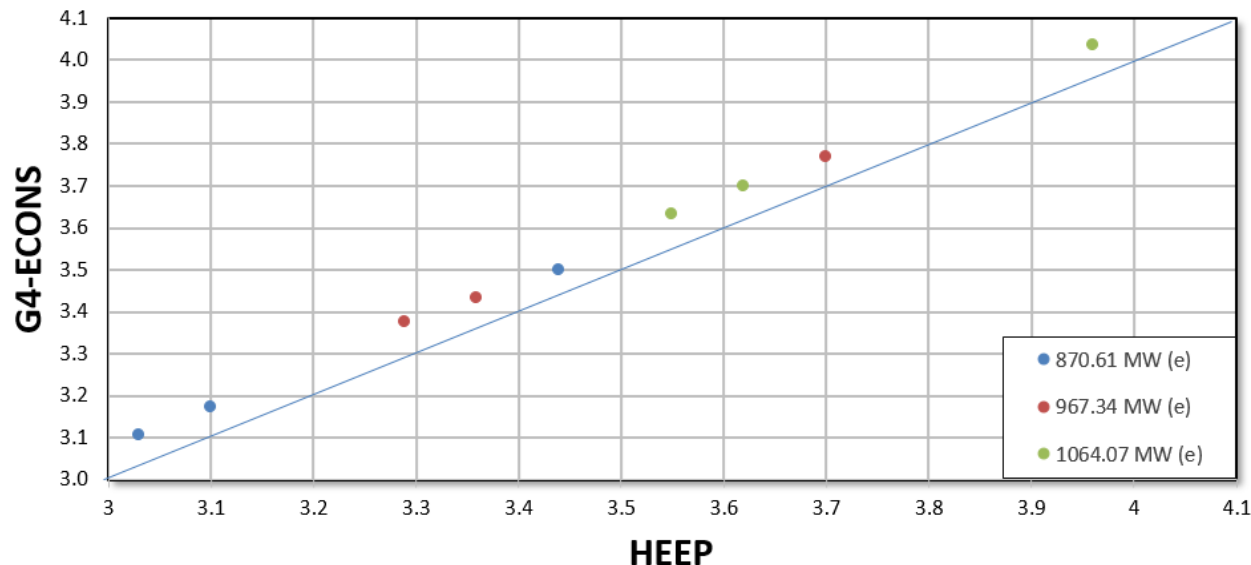
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ABSTRACT

Benchmarking of the economics methodologies developed by the Generation IV International Forum (GIF) and the International Atomic Energy Agency's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), was performed for three Generation IV nuclear energy systems. The Economic Modeling Working Group of GIF developed an Excel based spreadsheet package, G4ECONS (Generation 4 Excel-based Calculation Of Nuclear Systems). to calculate the total capital investment cost

Benchmarking of Economic Tools - 2

- **For large scale production of hydrogen using High Temperature Electrolysis process connected to nuclear plant**
- **Results from G4ECONS v2.0 and HEEP comparable; minor differences in levelized product cost (1-2.5%) attributed to calculation of interest during construction**
- **Joint paper with Department of Nuclear Energy sent for publication in 2017**



Current Focus of EMWG

- ***Study of issues/challenges of integration of new nuclear with renewable resources***

- ***Position paper based on literature review***

- ***Scope of study***
 - Flexibility requirement for advanced reactors
 - Impact of grid management (interconnections, storage, demand-side management), co-generation, hybrid systems etc.
 - Impact of policies (value of reliability/resiliency)

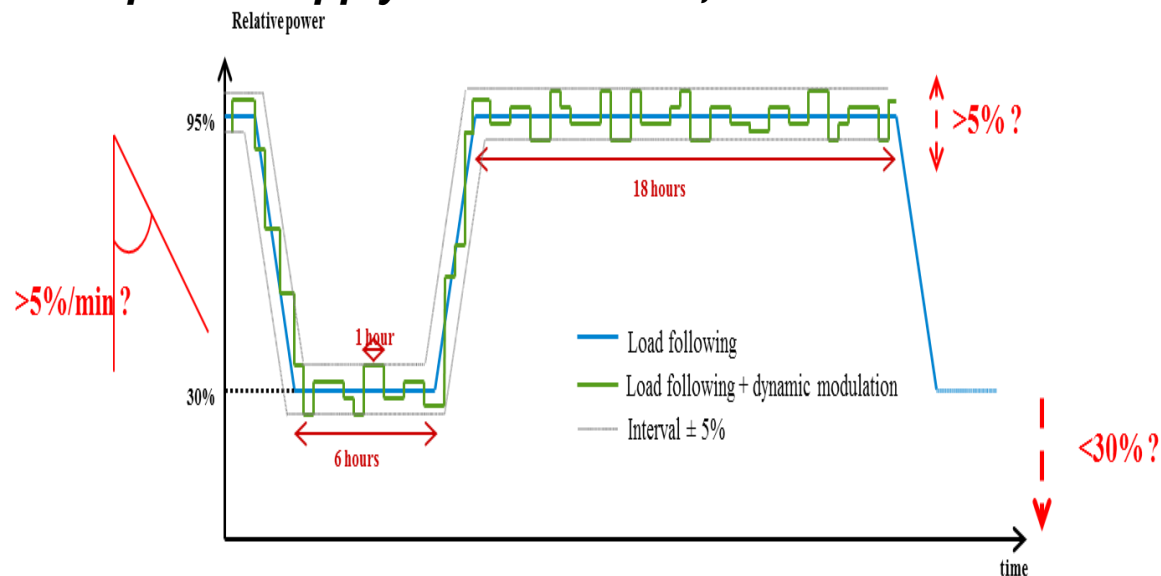
Issues

- **Increasing share of variable renewable sources on the grid**
 - Driven by decarbonization policies
 - Govt incentives/subsidies
 - Improved technologies/lower costs of implementation (e.g. Solar PV)
- **Adverse impact on nuclear generation**
 - Load-following mode operation; more so than the current capabilities
 - Unfavourable economics - more so in deregulated markets – flattening demand for electricity, negative prices, reduced load factors, higher maintenance costs, shorter life expectancies
 - Could lead to early retirements of current plants, dis-incentivise investment in new plants
- **Affects reliability of power supply to the consumers**

“The people who are making decisions about how to introduce renewables into the market don’t seem to be fully aware of long term consequences.” – Bill Magwood, Nucleonics Week, Sept 28, 2017

Interim Findings

- ***New-built reactors will need to be more flexible compared to current generation***
- ***Policies will be required for optimize mix of renewable, nuclear and other generators and energy storage on the grid; grid scale energy storage may be required***
- ***Hybrid systems are potential solution; SMRs could be more flexible***
- ***Policy changes will be required to correct the market flaws to benefit consumers from a grid-based power supply that is reliable, resilient and economical***



Topics of Interest to EMWG

- ***How Gen IV systems could meet future energy needs***
- ***Cost uncertainty analyses***
- ***Economic model for small modular reactors***
- ***Gen IV deployment scenario analysis***
- ***Analysis of cost overruns on nuclear projects***
- ***Financing of new nuclear***
- ***Value of stability of nuclear power and resiliency of the grid***

Continued IAEA Participation

- ***EMWG values continued participation of IAEA***
- ***EMWG meetings provide forum for information exchange***
- ***Opportunities for leveraging***

Thank You!