



Technology Goals for Generation IV Nuclear Energy Systems

Generation IV Roadmap NERAC Subcommittee

***Generation IV Roadmap Session
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People Involved in this Work

- **Generation IV Roadmap NERAC Subcommittee (GRNS)**
 - **Bobby Abrams** **Duke Engineering**
 - **Doug Chapin** **MPR Associates**
 - **John Garrick** **Consultant**
 - **Dan Kammen** **UC Berkeley**
 - **Sol Levy* **** **Levy & Associates**
 - **Ted Marston** **EPRI**
 - **Bill Naughton** **Exelon**
 - **Neil Todreas* **** **MIT**
- **Additional Authors**
 - **Ralph Bennett** ***** **INEEL**
 - **Bill Magwood**** **DOE NE-1**

*** Co-chair ** Author *** Presenter**

Evolution of Generation IV Goals

- ***One year of input, discussions and ongoing revision***
- ***Major activities and milestones:***
 - ***May Goals Workshop (May 2000 Washington, DC)***
 - ***August GIF Policy Meeting (Aug 2000 Seoul, Korea)***
 - ***NERAC Subcommittee Begun (Sep 2000)***
 - ***January NERAC Meeting (Jan 2001 Washington, DC)***
 - ***March GIF Policy Meeting (Mar 2001 Paris, France)***
- ***Goals are a central theme in the Technology Roadmap***

Generation IV Roadmap NERAC Subcommittee (GRNS) Charter

Goals

- **Recommend concept-independent performance goals**

Near-Term Deployment

- **Suggest paths forward to resolve the remaining research needs and institutional issues that must be addressed to enable the design, certification, and deployment by 2010 of evolutionary advances to existing reactor concepts**

Generation IV Systems

- **Review recommended R&D activities necessary to support the design and certification of Generation IV nuclear energy systems not later than 2030**

Generation IV R&D Plan

- **Recommend a Generation IV R&D plan, which provides the sequencing and initial cost estimates of research tasks, and identifies potential national and international collaborations**

Generation IV International Forum (GIF)

Chartered July, 2001



- **Major Support to the Roadmap**
 - 42 of 82 members
- **Observers from:**
 - International Atomic Energy Agency
 - OECD/Nuclear Energy Agency
 - European Commission
 - Nuclear Regulatory Commission
 - Department of State
- **High-level meetings**
 - January 2000 (Washington)
 - April 2000 (Washington)
 - August 2000 (Seoul)
 - March 2001 (Paris)
 - October 2001 (Miami)

Guiding Principles

- ***Technology goals for Generation IV systems must be challenging and stimulate the development of innovative systems.***
- ***Generation IV systems must be responsive to energy needs worldwide.***
- ***Generation IV concepts must define complete nuclear energy systems, not simply reactor technologies.***
- ***All candidates should be evaluated against the goals on the basis of their benefits, costs, risks, and uncertainties, with no technologies excluded at the outset.***

Caveats to the Goals

- ***The goals will guide the development of new nuclear energy systems on a broad front. While desirable, not all goals may be met by any single nuclear energy system.***
- ***The goals are not overly specific because the social, regulatory, economic, and technological conditions of 2030 and beyond are difficult to predict.***
- ***The goals must not be construed as regulatory requirements.***

Goals within Three Goal Areas

Sustainability

<i>Resource inputs</i>	<i>SU-1</i>
<i>Waste outputs</i>	<i>SU-2</i>
<i>Nonproliferation</i>	<i>SU-3</i>

Safety & Reliability

<i>Excellence</i>	<i>SR-1</i>
<i>Core damage</i>	<i>SR-2</i>
<i>Emergency response</i>	<i>SR-3</i>

Economics

<i>Life cycle cost</i>	<i>EC-1</i>
<i>Risk to capital</i>	<i>EC-2</i>

Sustainability Highlights

- ***Future systems can choose from a variety of fuels, reactors, and fuel cycles.***
- ***Fuel cycles are central to increasing the energy supply from nuclear, as well as reducing the environmental impact of high-level waste, and preserving the proliferation resistance.***
- ***The benefits need to be evaluated in terms of overall fuel life cycle costs, including those for wastes and supporting infrastructure and technology.***
- ***Radioactive wastes generated should be in a quantity and form that reduces the long-term stewardship burden.***
- ***Proliferation resistance incorporates both extrinsic (institutional) and intrinsic (design) barriers.***

Sustainability Goals

SU-1: Generation IV nuclear energy systems including fuel cycles will provide sustainable energy generation that meets clean air objectives and promotes long-term availability of systems and effective fuel utilization for worldwide energy production.

SU-2: Generation IV systems will minimize and manage their nuclear waste and notably reduce the long term stewardship burden in the future, thereby improving protection for public health and the environment.

SU-3: Generation IV nuclear energy systems including fuel cycles will increase the assurance that they are a very unattractive and least desirable route for diversion or theft of weapons-usable materials.

Safety & Reliability Highlights

- ***Safety is closely linked to public confidence.***
- ***Generation IV must be able to continue and improve upon best practices.***
- ***Investment protection is increased by striving for a low likelihood and degree of core damage.***
- ***Elimination of the need for offsite emergency response may eventually prove to be unachievable, but the goal will stimulate innovation.***

Safety and Reliability Goals

SR-1: Generation IV nuclear energy systems operations will excel in safety and reliability.

SR-2: Generation IV nuclear energy systems will have a very low likelihood and degree of reactor core damage.

SR-3: Generation IV nuclear energy systems will eliminate the need for offsite emergency response.

Economics Highlights

- ***Competitiveness is a requirement of the marketplace.***
- ***Future systems should encompass a range of options for construction and ownership.***
- ***Future systems should anticipate the need for a broader range of energy products, such as potable water, hydrogen, or process heat.***
- ***All elements of life cycle cost should be addressed, to assure competitive energy production during the time of deployment.***
- ***Future nuclear energy projects must attract the capital required; accordingly, the projects must demonstrate an acceptable level of financial risk.***

Economics Goals

EC-1: Generation IV nuclear energy systems will have a clear life-cycle cost advantage over other energy sources.

EC-2: Generation IV nuclear energy systems will have a level of financial risk comparable to other energy projects.

Summary

- ***Technology Goals have been developed by the Generation IV Roadmap NERAC Subcommittee (GRNS) and endorsed by the Generation IV International Forum (GIF).***
- ***Close interaction was provided with the Roadmap Integration Team (Bennett) and the DOE Office of Nuclear Energy, Science & Technology (Magwood).***
- ***Generation IV is 'all about' reaching for challenging goals with innovative systems.***

Full Technology Goals document (8 pages) is available at:

gen-iv.ne.doe.gov/pdf/finalgenivgoals_may01.pdf