Approach to Concept Selection

GRNS Meeting: Washington, D.C.
October 2-3, 2001

Overview

- ***System selection considerations***
- ***Alternative selection approaches***
- ***Discussion of path forward***

Selection Considerations

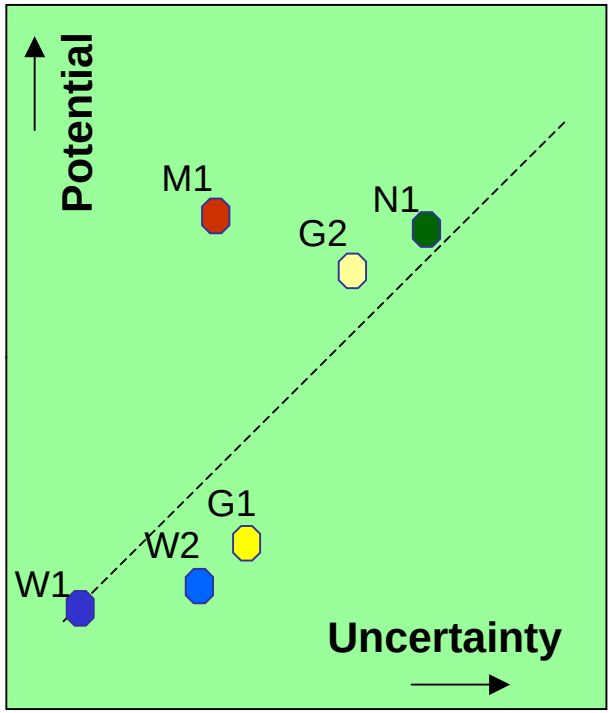
- *TWGs are evaluating system options that differ in*
  - *Potential to meet the different goals*
    - » *Tradeoffs in strengths and weaknesses*
  - *Technical uncertainty*
    - » *Maturity of underlying technologies*

- *Evaluation methodology is designed to characterize both potential and uncertainty*
  - *For concepts or concept sets*
  - *At the goal and sub-goal level*

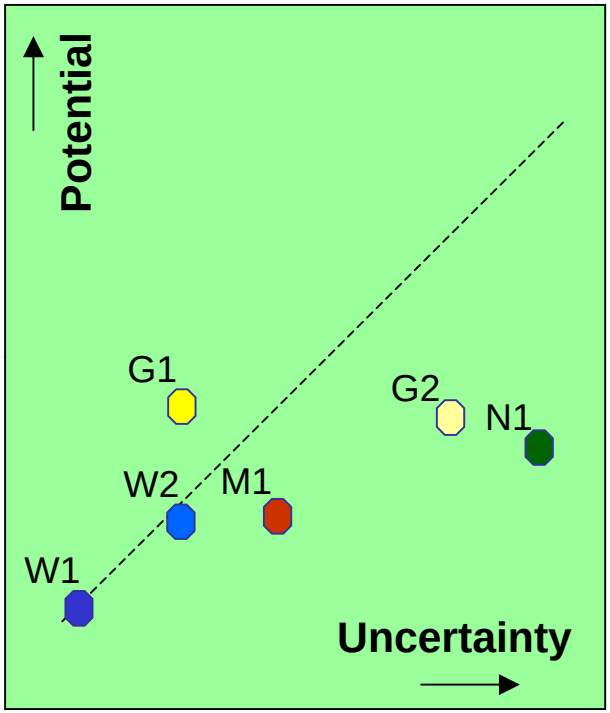
- *TWGs eliminate concepts with insufficient potential in the screening-for-potential evaluation*
  - *Remaining concepts exhibit tradeoffs*

⇩ *Goal is to determine the most promising concepts for development*

Sustainability



Safety & Reliability



Economics

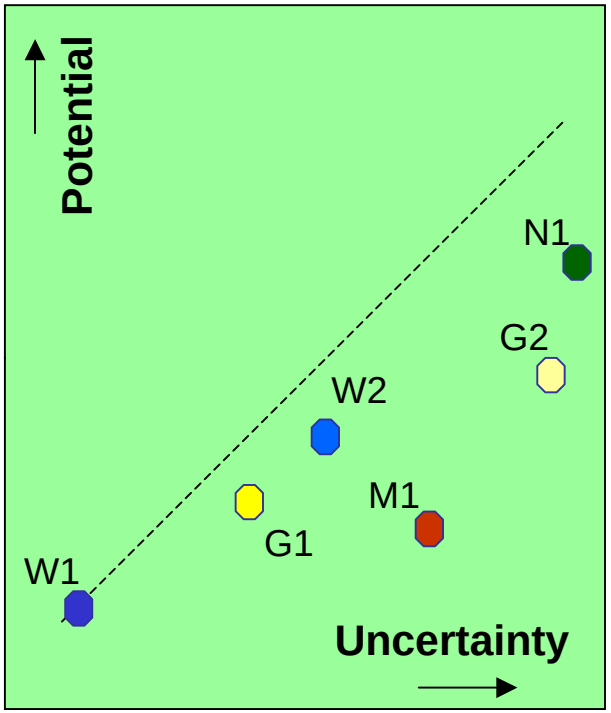
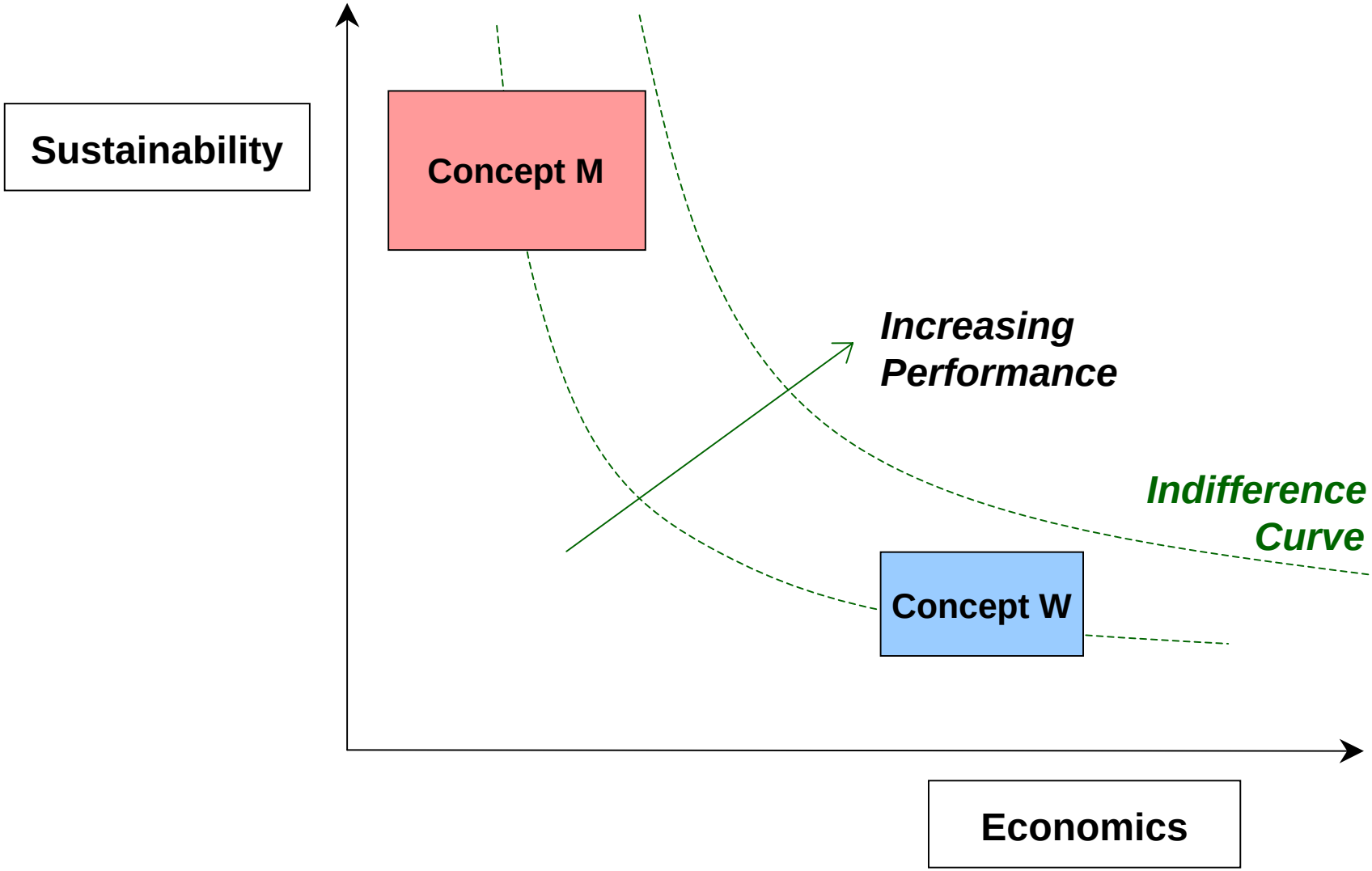
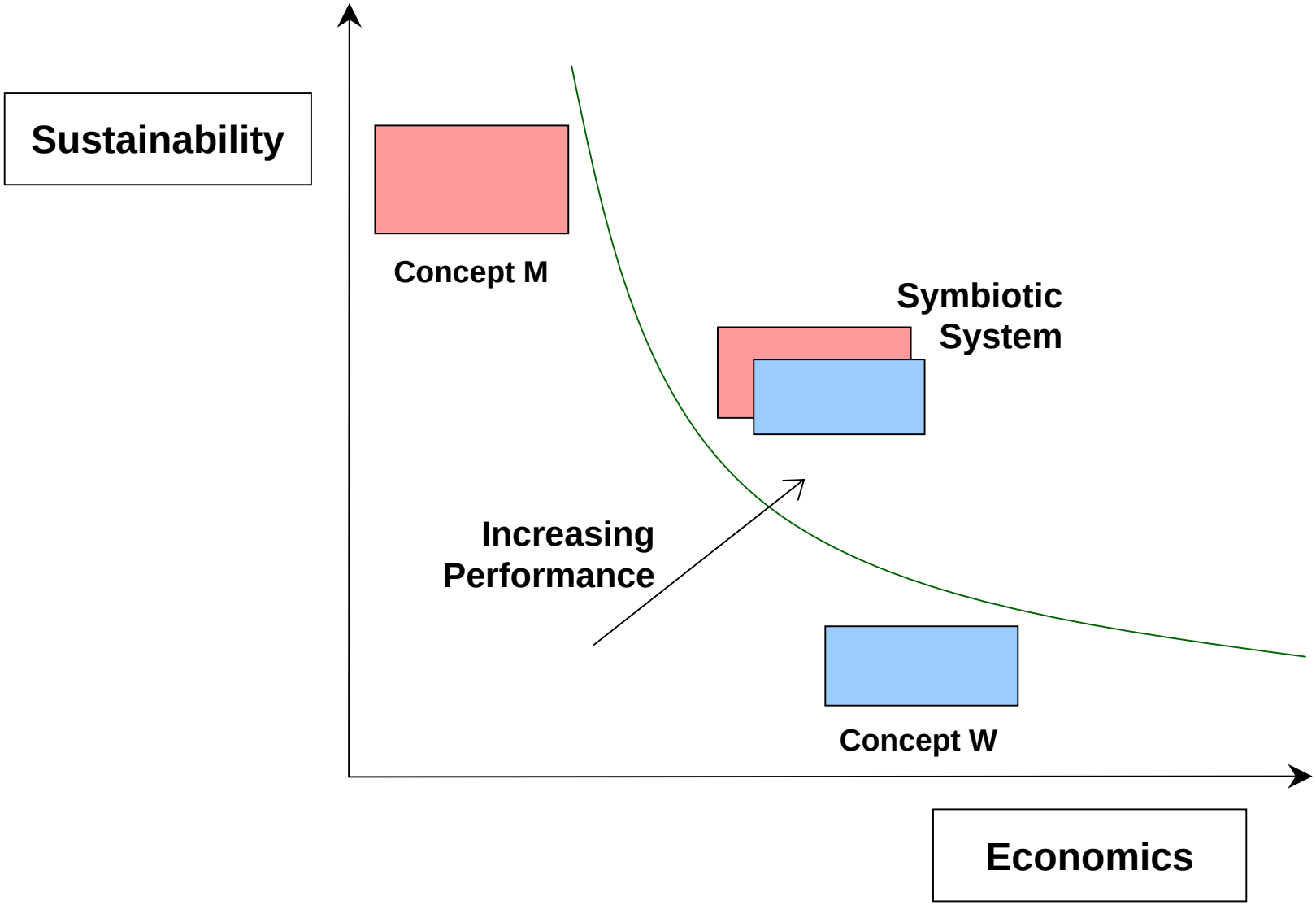


Illustration of Tradeoff Between Potential and Uncertainty (for Hypothetical Concepts)



Analysis of Performance Tradeoffs - 2D Illustration



Potential for Performance Synergy - 2D Illustration

Selection Considerations, cont'd

- ***The current plan is to retain several (up to 6-8) concepts in the Final Screening***

- ***Rationale for retaining multiple concepts***
  - ***Reduce technical risk***
    - » ***Increase likelihood of selecting successful concept***
    - » ***Base further down-selection on R&D results***
  - ***Increase flexibility to accommodate multiple "scenarios" and application "niches"***
  - ***Enhance prospects for international collaboration***

Selection Considerations, cont'd

Scenario	***Potential evolution of the global market for nuclear energy – scale of deployment, geographic distribution, demand for various energy products, resource costs, status of supporting infrastructures***
Niche	***Application for a nuclear energy system – capacity, energy products, site and infrastructure constraints***

Selection Alternatives

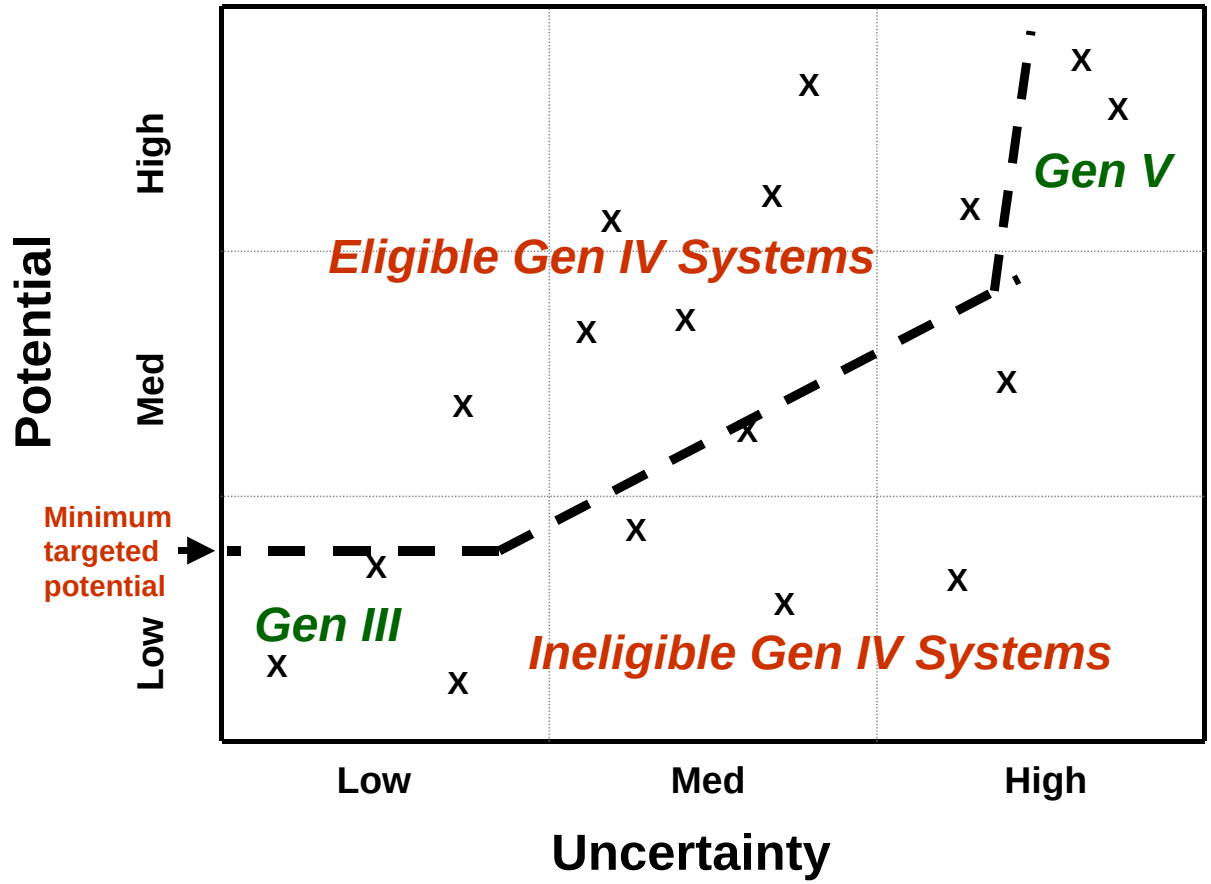
***Option 1*: Select ideal (best-performing) concepts; "one size fits all"**

- ***Specify relative importance of goals (or performance targets)***
- ***Retain***
  - ***Highest-potential concepts***

  or
  - ***Concepts whose potential is sufficiently high in relation to uncertainty***

Advantages	*Drawbacks*
Simplicity	***Potential lack of diversity among selected concepts***
Objectivity	***Lack of flexibility to accommodate different scenarios and applications***

Representation of Final-Screening Evaluation



Selection Alternatives, cont'd

***Option 2*: Accommodate scenario uncertainty, diversity of application niches, and other factors explicitly in system selection**

Advantage: ***Increased flexibility to optimize selections***

Disadvantage: ***Greater complexity of implementation process***

- ***A systematic process for implementing this option is not yet developed***
  - ***Minimizing complexity and subjectivity are key challenges***
  - ***A tentative procedure is described here for review***

Example of "Option 2" Process

- *Identify leading scenarios (2 to 3)*
  - *Relative importance of the different goals allowed to vary by scenario*
- *Determine key application niches for each scenario*
  - *Assign priority weight to each scenario/niche combination*
- *Quantify performance of each concept for each scenario/niche, using*
  - *TWG evaluation of concept against each goal*
  - *Scenario-dependent goal weights*
  - *"Suitability factor" indicating how well the concept fulfills the niche*
- *Select the N concepts yielding the best aggregate (weighted) performance for all scenarios and niches*
- *Accommodate other desired characteristics (e.g., diversity of technologies) via constraints*

Example of Scenarios and Relative Importance of Goals

	Scenarios				
	Maintain generation share in developed countries	Increase generation share for global warming mitigation			
		In developed countries		World-wide	
GEN IV Goals	Current fleet replacement	Electricity production	Electricity and additional energy products	Electricity production	Electricity and additional energy products
Sustainability - 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.	+	+	++	+	++
Sustainability - 2. Generation IV nuclear energy systems will minimize and manage their nuclear waste and notably reduce the long term stewardship burden in the future, thereby improving protection for the public health and the environment.	++	++	++	++	++
Sustainability - 3. Generation IV nuclear energy systems and 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 and Reliability - 1. Generation IV nuclear energy systems operations will excel in safety and reliability.	+	++	+	++	++
Safety and Reliability - 2. Generation IV nuclear energy systems will have a very low likelihood and degree of reactor core damage.	+	+	+	++	++
Safety and Reliability - 3. Generation IV nuclear energy systems will eliminate the need for offsite emergency response.	++	++	++	++	++
Economics - 1: Generation IV nuclear energy systems will have a life-cycle cost advantage over other energy sources.	++	++	++	+	+
Economics - 2: Generation IV nuclear energy systems will have a level of financial risk comparable to other energy projects.	+	+	+	+	+

Potential Application Niches*

Application Characteristics	System Type
Limited site availability	Large-capacity system (monolithic or multi-module plant)
Small increment of capacity / distributed generation	Small-size system
Small grid size/ remote regions	Small, transportable system
Hydrogen production	Very high temperature system
Load following	Low capital cost and/or producer of multiple energy products

*For increased worldwide generation scenario

Concept Selection Path Forward

- ***Additional selection considerations ?***
- ***Identification of preferred selection approach***
  - ***Among the two options presented***
  - ***Other options ?***
- ***Specification of scenarios and targeted applications for "option-2" (or similar) approach***
- ***Implementation process***