Overview of Non-electric Applications of Nuclear Heat (NEANH)

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Natural Resources Canada

GIF Senior Industrial Advisory Panel
Special Session on Non-Electric Applications of Nuclear Heat
February 28, 2025, Ottawa, Canada

Outline

- A history of nuclear for non-electric applications
- Overview of the GIF NEANH Task Force
- Objectives and Status of the GIF NEANH Task Force
- Ongoing and upcoming work

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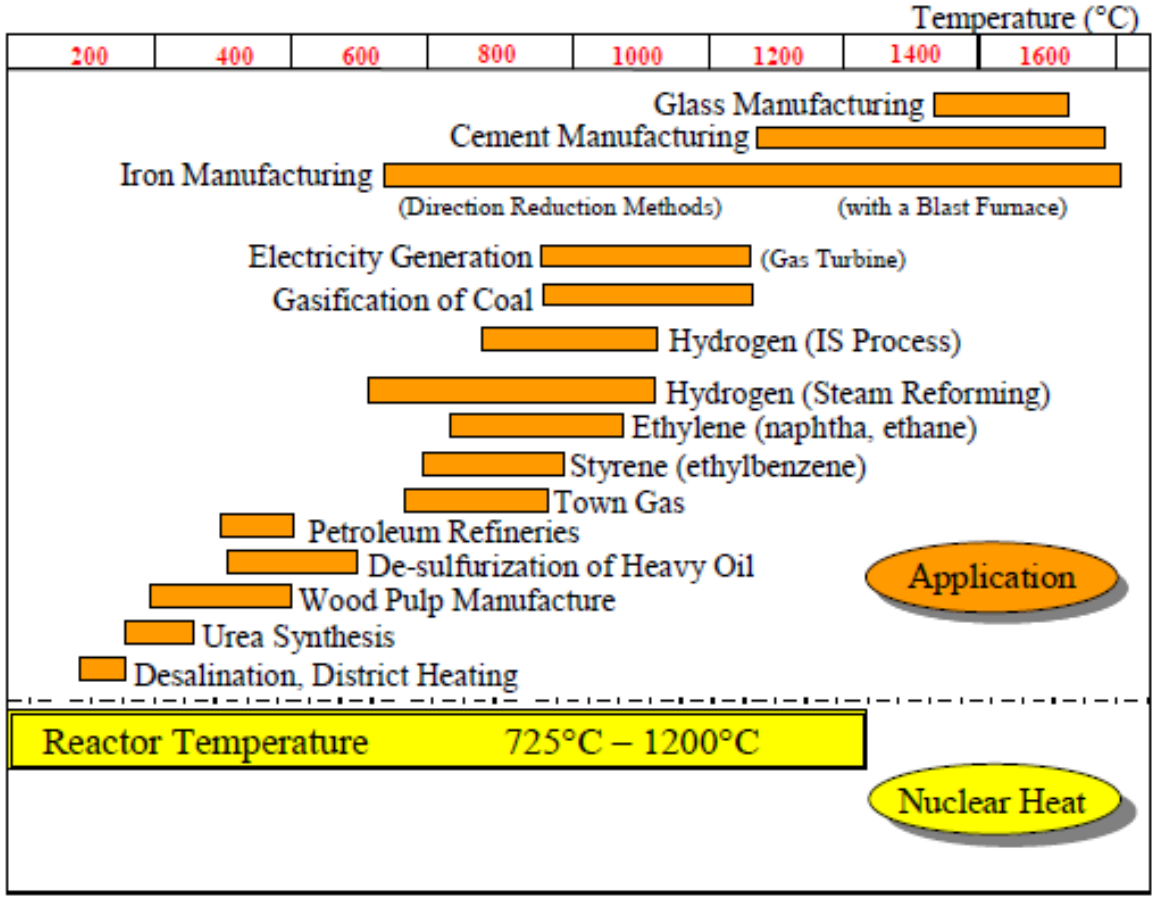
A history of nuclear for non-electric applications

A brief history - GIF & NEANH

- **GIF Gen IV concepts**
  - A Technology Roadmap was released in 2002
  - 6 systems – GFR,LFR, MSR, SFR, SCWR & VHTR
  - Ambitious goals – sustainability, economics, safety and reliability, proliferation resistance and physical protection

- **Gen IV beyond electricity production**
  - Roadmap on crosscutting energy products released in 2002
  - Four applications examined
    - desalination, district heating, hydrogen, high temperature process heat,
  - Collaborative R&D project on hydrogen production started in 2008 under the VHTR system



GIF - "Generation IV Roadmap – Crosscutting Energy Products R&D Scope Report" December 2002

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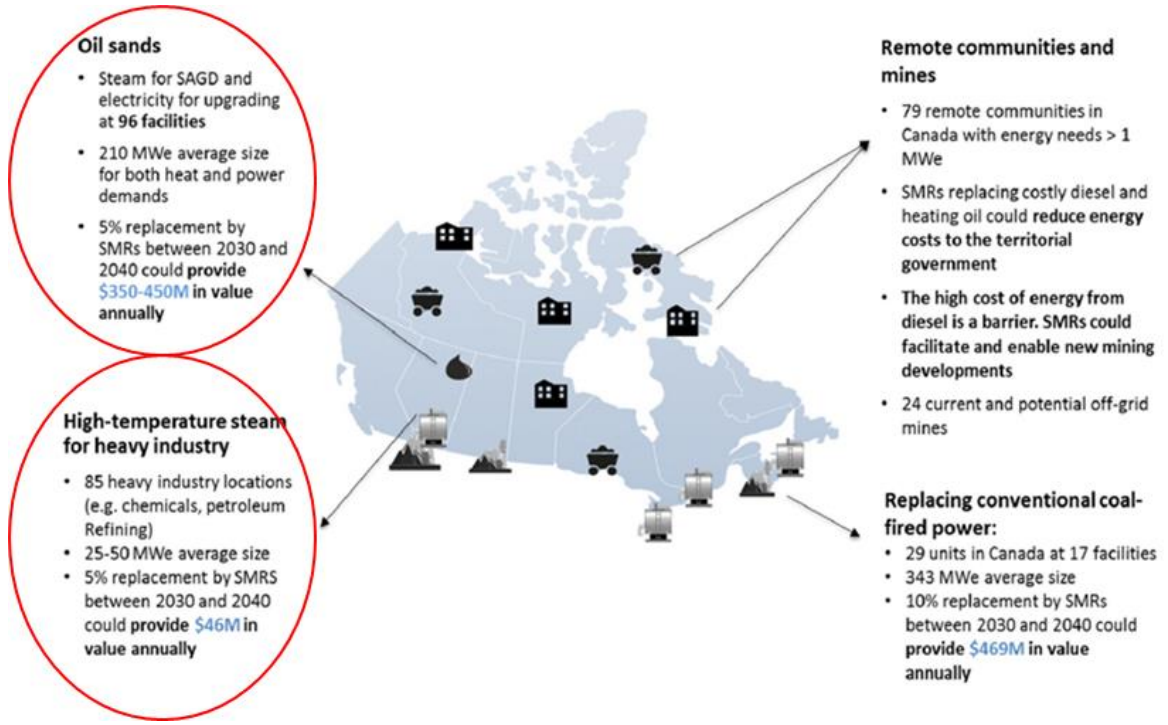
What changed since early 2000s for NEANH

- **Policies to incentivize transition to net zero by 2050**
  - Some industries considering nuclear energy option in decarbonization plans
- ***Worldwide development of SMRs presents new opportunities for decarbonization***
- ***Low-emission hydrogen production using nuclear energy is being pursued***
- ***NEANH offers possibilities of integrating nuclear and renewable power (hybrid energy systems)***

GIF set up NEANH Task Force in 2021



Canada's SMR Roadmap 2018 – Domestic Market Potential

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Past Experience – Use of Nuclear Heat

- Over 750 reactor-years of experience – accounts for less than 0.5% of the total nuclear thermal output of over 440 reactors.
  - Mostly water-cooled reactors
- ***District Heating:*** 43 reactors have been used, ~500 reactor years
  - Average 5% thermal output; range 5 to 240 MWth
  - Typically <150º C
- ***Desalination of water:*** 17 reactors have been used, ~250 reactor years
  - Mostly using thermal processes (multi-effect distillation and multi-stage flash), <130º C
- **Industrial Process Heat:** 7 reactors (4 in Canada)
  - Typically based on medium pressure steam, <250ºC

IAEA - "Opportunities for Cogeneration with Nuclear Energy" NP-T-4.1, 2017

IAEA - "Guidance on Nuclear Energy Cogeneration" NP-T-1.17, 2019

NEA – "Beyond Electricity: The Economics of Nuclear Cogeneration", 2022

Industrial Process Applications of Nuclear Heat

Country/ Reactor Type	Application	Location	Capacity of Steam System MWth	Operation
Canada, Bruce A CANDU reactors	Heavy Water Production, Bruce Energy Centre (BEC)	Onsite heavy water production Off-site supply to BEC	5,350	1981-1997
Germany, Stade PWR	Salt Refinery	Off-site	30	1984-2003
Switzerland, Gösgen, PWR	Cardboard factory	Off-site	54	1979-
UK, Calder Hall MAGNOX	Fuel plant	Adjacent site		1956-2003

Nuclear Steam System at Bruce, Canada

- **Largest nuclear bulk steam system built**
  - Medium pressure steam from 4 Bruce A reactors
- **Steam Users**
  - On-site: 2 heavy water production plants
  - Off-site: Bruce Energy Centre industrial park
    - Plastic and alcohol production, green houses
    - Cascading heat supply; Steam to condensate
- **Things to note**
  - Process plant on nuclear site
  - Contained significant quantities of H_2S gas (combustible, toxic, corrosive)
  - 3 barriers between nuclear plant and users
  - Back-up steam supply: 3 oil-fired boilers
  - Back-up power for condensate pumps
  - Different ownerships – NPP, heavy water plant, Bruce Energy Centre

Bruce Heavy Water Plant

Past Initiatives – with end user involvement

- ***NGNP Industry Alliance***
  - Formed in 2010 to develop high-temperature gas-cooled reactor and expand its industrial applications
  - Members included potential end user industries
  - Several process heat applications of HTGR were examined by INL – hydrogen, ammonia, coal to natural gas, synthetic diesel using natural gas, oil sands
  - Plant Design Requirements included requirements from prospective owner/operators and end users
- ***EUROPAIRS:*** End User Requirements fOr Process heat Applications with Innovative Reactors for Sustainable energy supply
  - Funded by European Commission in 2009 – evaluated potential coupling of HTGRs with industrial processes
  - 50% of industrial heat demand is below 550ºC - significant potential of HTGRs in replacing conventional fossil CHPs
  - Recommended strong partnership between nuclear technology developers and end users and joint technology development for coupling of reactors with industrial processes
    - Prototype demonstrations at industrial scale required to give confidence to industrial heat users

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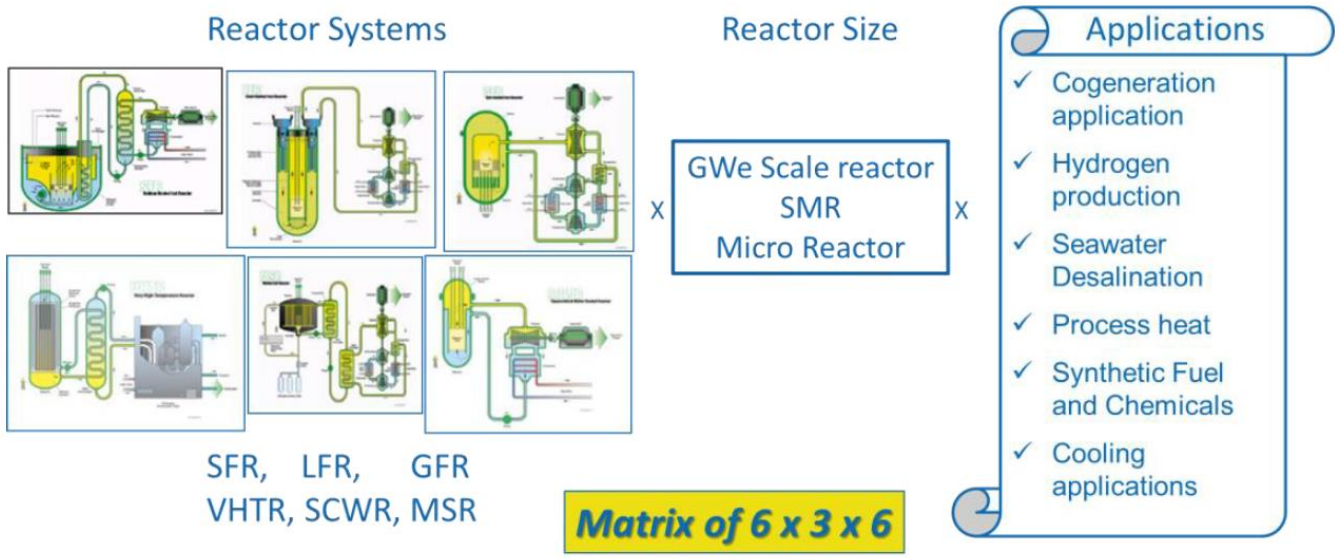
Overview of the GIF NEANH Task Force

Overview of the GIF Task Force on Non-Electric Applications of Nuclear Heat (NEANH TF)

Timeline: Formed in October 2021 for an initial term of 24 months.

Focus: The potential of Gen IV nuclear reactors for non-electric applications, including:

- Thermal energy alternatives to fossil fuels, and
- Complementary services to the electric grid.



NEANH Membership
Australia
Canada
China
Euratom
France
Japan
Korea
Russia
South Africa (Observer)
United Kingdom
USA
IAEA (Observer)
NEA (GIF TS)

Objectives of the NEANH Task Force

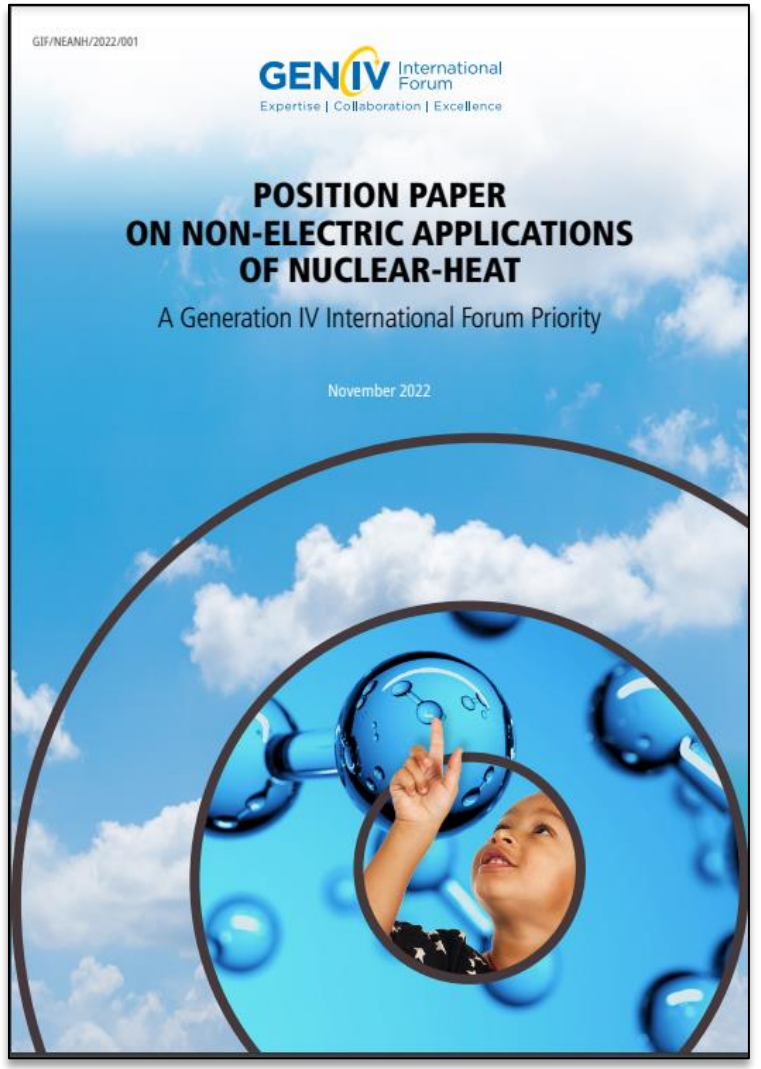
NEANH Task Force objectives are as follows:

1. Develop a position paper on non-electric applications coupled to GIF systems (completed)
2. Enhance the general level of knowledge of GIF members on non-grid applications of nuclear systems (ongoing)
3. Develop a network to connect GIF to the high temperature community outside the nuclear field (ongoing)
4. Highlight relevant system configurations (completed), and conduct systems analysis with regard to key performance indicators (upcoming)
5. Provide input to decision makers, industry, licensing authorities, investors, etc. on configurations that will support achieving policy goals (ongoing)

1 - GIF Position Paper on Non-Electric Applications of Nuclear Heat

NEANH Task Force members completed the ***Position Paper on Non-Electric Applications of Nuclear-Heat: A Generation IV International Forum Priority*** in November 2022, and published to the GIF website in 2023.

https://www.gen-4.org/gif/jcms/c_210695/neanh-position-paper-final



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2 - Enhance the general level of knowledge of GIF members on non-grid applications of nuclear systems

Virtual workshop with GIF members in July 2022

- Exchange knowledge and align GIF members in advance of engaging end-users.
- The meeting summary was made publicly available in 2023.
- https://www.gen-4.org/gif/jcms/c_210697/report-neanh-virtual-workshop-summary-2023-03-28-clean

Expanded engagement with other GIF groups

- VHTR Hydrogen Production PMB
- Economic Modelling Working Group

Support for the GIF Economic Modelling Working Group (EMWG)

- Supporting cost estimate guidelines for G4ECONS to include non-electric applications.

Expanded membership of the NEANH TF, now representing initiatives such as:

- IEA Hydrogen TCP Task 44: Hydrogen from Nuclear Energy,
- IAEA non-electric activities through the Nuclear Power Technology Development section,
- GIF VHTR Hydrogen Production PMB, and
- NEA Small Modular Reactor Industrial Applications Advisory groups (SMIA)

3 - Develop a network to connect GIF to the high temperature community outside the nuclear field

NEANH full-day workshop at GIF Industry Forum in October 2022

- The event was well-attended with participants including Gen IV reactor developers, energy modellers, industrial energy users, and researchers.
- Meeting proceedings were made publicly available in 2023.

https://www.gen-4.org/gif/jcms/c_209137/gif-neanh-workshop-proceedings-2022-10-03

150+ attendees to the NEANH workshop!

3 - Develop a network to connect GIF to the high temperature community outside the nuclear field

NEANH Workshop, Industry Panel: Energy End-Users

Panel Participants:

- Nuclear Energy Agency: Overview on NEA studies
- The Pathways Alliance / Canadian **oil sands industry**
- Dow Chemical / **chemical industry** leader
- Chevron Technology Ventures / **oil & gas, refineries**
- Ammonia Energy Association / **ammonia**
- Electric Power Research Institute / **district energy**

Key findings:

- Several end-user companies/consortia of companies have initiated studies on the utilization of nuclear energy to support decarbonization efforts.
- Companies need reliable data to support technology assessments.
- End-users do not want to operate nuclear reactors - opportunity for partnership with utilities.
- Key stakeholders need to be engaged (e.g., licensees and regulators, both nuclear and for industrial processes).

3 - Develop a network to connect GIF to the high temperature community outside the nuclear field

NEANH members have been participating in regional engagement activities throughout 2023:

- Sustainable Nuclear Energy Technology Platform (SNETP) forum in Gothenburg, Sweden in May 2023 Featured technical sessions and panel discussions.
- ARPA-E Nuclear Heat Workshop in Houston, USA in May 2023, Included technical and market focused presentations and breakout sessions.
- IAEA Technical Meeting on Advances in High Temperature Processes for Hydrogen Production with Nuclear Energy in Vienna, Austria in September 2023.

- Coming Soon: Currently planning an industry engagement workshop in coordination with the Korea Atomic Power (KAP) conference in Busan, South Korea, for April 26, 2024.

4 - Highlight relevant system configurations, and conduct systems analysis using KPIs

NEANH Database (ongoing, first draft inventory completed in 2023)

- Global repository of activities relevant to non-electric applications coupled with nuclear energy systems.
  1. Studies
  2. Collaborative initiatives
  3. Past or existing demonstration projects (or relevant commercial systems)
  4. Planned demonstrations or commercial systems
  5. Modelling tools
- The database will evolve to summarize entries or systems and to characterize them using **key performance indicators.**
- Targeting end-users beyond the nuclear field, such as:
  - Hard to abate industrial sectors,
  - Licensing authorities, and
  - Investors.

Performance Indicators:
Technological Readiness Level
Market readiness
License readiness
Timelines
Geographic Adaptability
GHG emission reduction potential
Energy security benefits
Cost/Benefit ($/t CO2 saved)
Economic viability
Supply chain
Investment considerations
Scalability
Ease of integration
Market size
Sustainability

5 - Provide input on configurations that will support achieving policy goals

Engagement with regulators

- NEANH members are engaged in informal discussions with regulators to help identify gaps, concerns, and timelines associated with the regulation of non-electric applications of nuclear.
- NEANH has ambitions to support regulators to help identify gaps, concerns, and timelines associated with the regulation of non-electric applications of nuclear.
- (Tentative) NEANH will develop a generic scenario through direct engagement with industry for analysis through a regulatory sandboxing initiative led by the UK Office for Nuclear Regulation.

Engagement with policy makers

- NEANH members reach a broad public audience through their participation in conferences and other public facing venues.
- Knowledge sharing within the monthly team meetings help NEANH members to understand the impacts of potential policy changes and may also inform policy within some member countries.

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Ongoing and upcoming work
2024 and beyond

1 - Non-Electric and Hybrid Applications of Nuclear Energy Workshop

The GIF Non-Electric Applications of Nuclear Heat (NEANH) Task Force is targeting a workshop to:

- Showcase GIF NEANH activities
- Target engagement with regulators, including industrial regulators (e.g., for a chemical facility)
- Respond to the feedback received during the GIF Industry Forum in 2022
- Build on the success of the 1st NEANH Workshop in Toronto, Canada in 2022

Location: BEXCO's Convention & Exhibition Hall, Busan, Korea.

Date: Friday, April 26, 2024, from 9:00 – 17:00

Organisers: Korea Atomic Energy Research Institute (KAERI) and the GIF NEANH Task Force.

Hosts: Korean Nuclear Industry Association (KAIF), and Korea Nuclear International Cooperation Foundation (KONICOF)

Registration: Please register for the 39th Annual KAP Conference to register for this event: http://kapconf.com/en/

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1 - Non-Electric and Hybrid Applications of Nuclear Energy Workshop

Draft Agenda

Thursday, 25 April, 2024 - Technical Tour

1. Visit to the APR1400 construction site
2. Hydrogen production demonstration facilities at Ulsan Techno Park

Available to all participants of the KAP conference.

Shin Kori units 3 and 4 (Image: KHNP)

Friday, 26 April, 2024 – Full Day NEANH Workshop

1. ***Background and Overview:*** History of success and international perspectives on the future opportunity.
2. ***Industrial End-Users****:* A dialogue with those exploring Gen IV systems among a range of solutions to support industrial decarbonisation.
3. ***Challenges and Operational Experience:*** Challenges and experiences of systems coupled with industry.
4. ***Nuclear Technology Developers*****:** Technology developers discuss recent advancements and applications of their respective technologies.
5. ***Interactive Discussion*****:** A summary of the day's discussions with interactive audience participation.

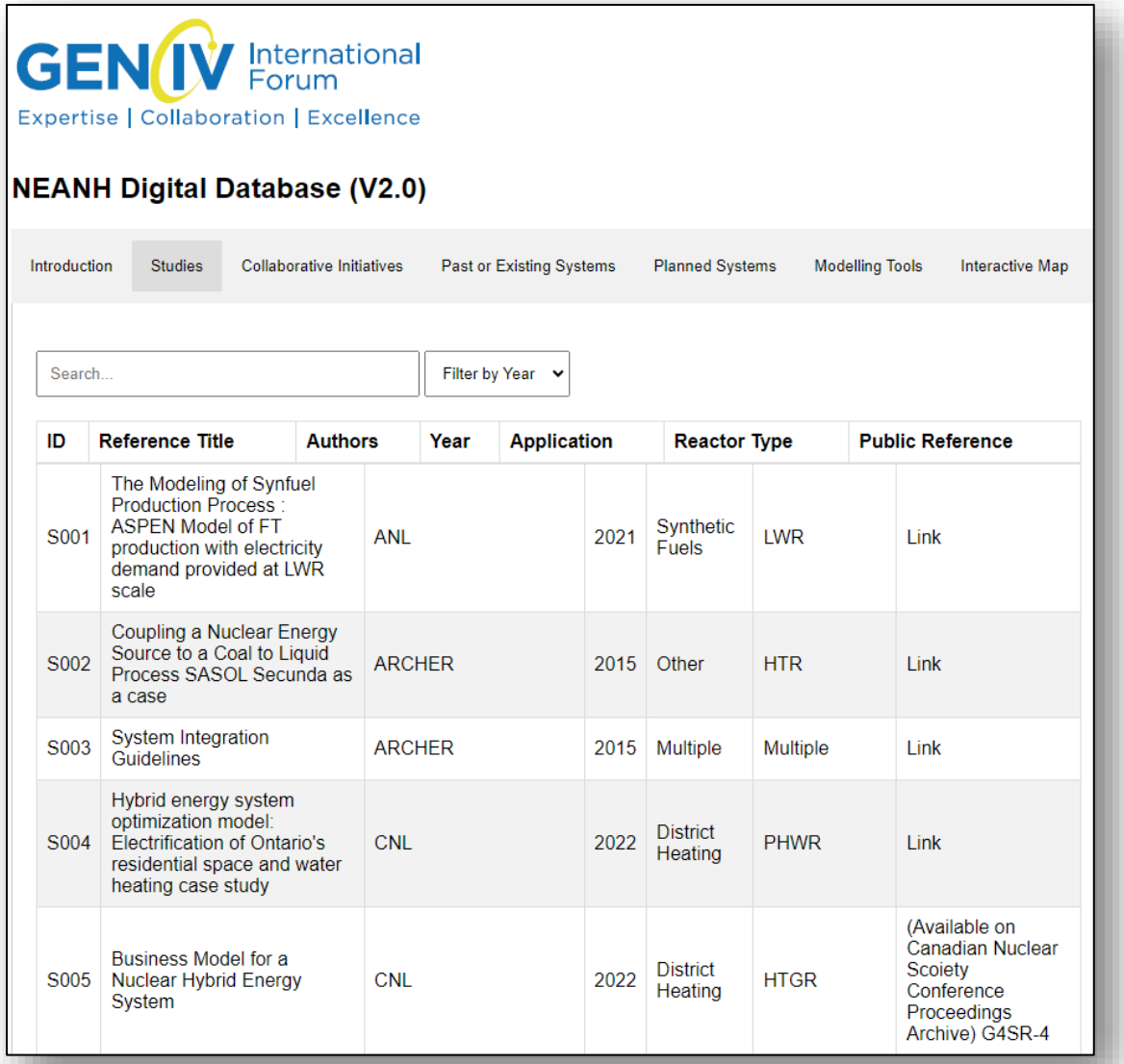
2 - Transition to a digital NEANH database

NEANH intends to launch the digital database on a revamped GIF site in summer 2024.

The NEANH database will be published and will evolve over time to include system summaries characterized using performance indicators.

The NEANH TF will pursue a digital database that is query-able and scalable to:

- Improve user experience
- Enable additional complexity in data structure
- Avoid version control issues associated with a flat file
- Allow users to submit data through a web-form for review by NEANH



ID	Reference Title	Authors	Year	Application	Reactor Type	Public Reference
S001	The Modeling of Synfuel Production Process : ASPEN Model of FT production with electricity demand provided at LWR scale	ANL	2021	Synthetic Fuels	LWR	Link
S002	Coupling a Nuclear Energy Source to a Coal to Liquid Process SASOL Secunda as a case	ARCHER	2015	Other	HTR	Link
S003	System Integration Guidelines	ARCHER	2015	Multiple	Multiple	Link
S004	Hybrid energy system optimization model: Electrification of Ontario's residential space and water heating case study	CNL	2022	District Heating	PHWR	Link
S005	Business Model for a Nuclear Hybrid Energy System	CNL	2022	District Heating	HTGR	(Available on Canadian Nuclear Scoiety Conference Proceedings Archive) G4SR-4

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3 - Conduct systems analysis on non-electric and hybrid energy systems

- Throughout 2023, NEANH members selected key performance indicators to evaluate systems where nuclear energy is connected to non-electric applications.
- Key Performance Indicators intend to be measurable, and will inform analysis on:
  - System readiness
  - Gaps, or areas that more work is needed
  - The overall opportunity
- Going forward, NEANH members will aim to agree on generic NEANH system scenarios for in-depth analysis using KPIs.

Performance Indicators:
Technological Readiness Level
Market readiness
License readiness
Timelines
Geographic Adaptability
GHG emission reduction potential
Energy security benefits
Cost/Benefit ($/t CO2 saved)
Economic viability
Supply chain
Investment considerations
Scalability
Ease of integration
Market size
Sustainability

3 - Conduct systems analysis on non-electric and hybrid energy systems

Initial system analysis workshop in January 2024

- The NEANH TF is working with international partners to conduct system analysis of Gen IV systems, including:
  - IEA Hydrogen from Nuclear Energy Task 44,
  - GIF VHTR Hydrogen Production PMB
  - International Atomic Energy Agency (IAEA), and
  - OECD Nuclear Energy Agency
- Initial focus is on a **high-temperature gas reactor to produce hydrogen through high-temperature steam electrolysis**.
- The report will communicate a simple message that clean Hydrogen from nuclear is
  - (1) technically feasibility, and
  - (2) can be financially viable in some markets.
- Other systems will be considered based on stakeholder interest

Initial system Analysis workshop as part of the Joint IEA-GIF Meeting on Hydrogen from Nuclear Energy on January 23-25, 2024, at Idaho National Laboratory, Idaho Falls, Idaho, USA

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3 - Conduct systems analysis on non-electric and hybrid energy systems

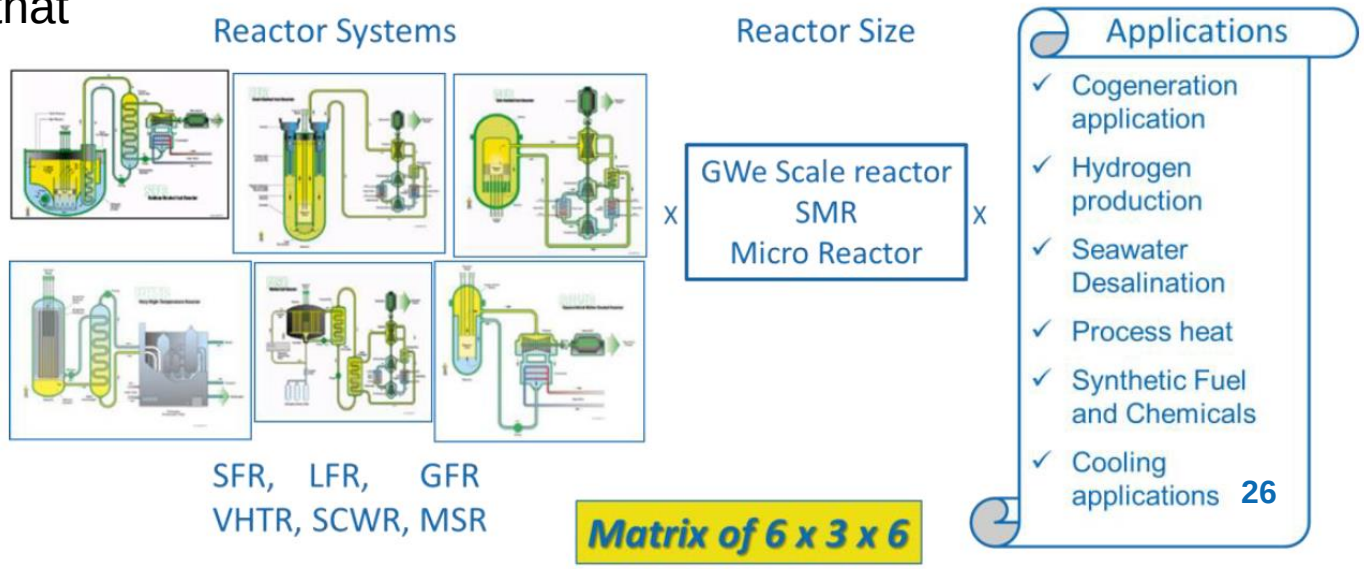
Proposed system analysis approach

Type 1 - Subjective survey of system readiness

- Leverage existing frameworks
- Seeks expert views on the status or readiness of each system
- Identifying gaps associated with specific systems
- Could identify common challenge areas that are common regardless of country

Type 2 - Objective system modelling and analysis

- Assessment of generic NEANH system scenarios using open source modelling tools



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System readiness questionnaire: Hydrogen production from high-temperature steam electrolysis using a HTGR

- Questionnaire developed to complement quantitative analysis, and crowd-source input from industry, researchers, technology developers, government, and others

- The questionnaire requests quantitative input on:
  - Technological Readiness Level
  - Commercial Readiness Index
  - Timelines

- Experts are encouraged to complete the Questionnaire and circulate the link within your networks.

- Please follow this link to complete the questionnaire: https://forms.office.com/e/khU53G4x4u

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Thank you

NEA
NUCLEAR ENERGY AGENCY

NEA Activities on Non-Electric Applications

Brent Wilhelm
Nuclear Technology Development and Economics (NTE)

SIAP Special Session on Non-Electric Applications of Nuclear Heat
Ottawa, Canada, 28 February 2024

Outline

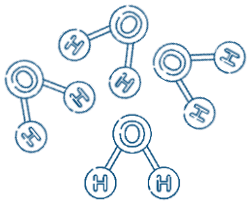
- **NEA activities on hydrogen from nuclear energy**
  - REPORT: Role of Nuclear Power in the Hydrogen Economy
  - H2-VAL Working Group
- **NEA Industrial Case Studies for SMR Markets**
  - Mining
  - Coal replacement
  - District energy
  - Industrial cogeneration

NEA activities on hydrogen from nuclear energy

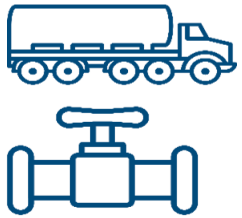
Activities in 2022

- *The Role of Nuclear Power in the Hydrogen Economy* report published in September 2022.

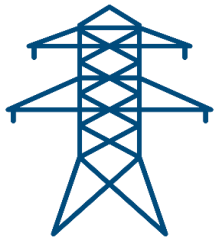
- Understanding the competitiveness of hydrogen produced from Nuclear:
  I. Plant-level analysis
  II. Value Chain analysis
  III. System level analysis



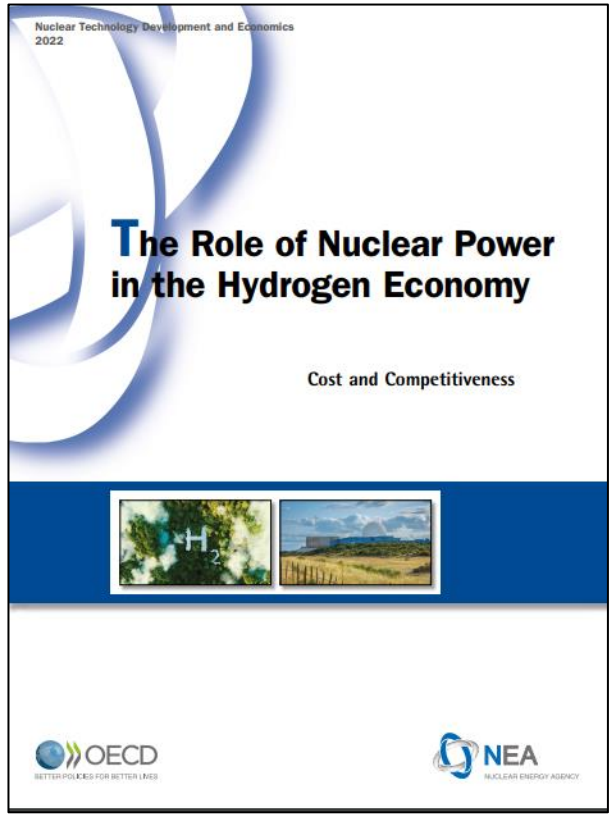
I. Hydrogen Production



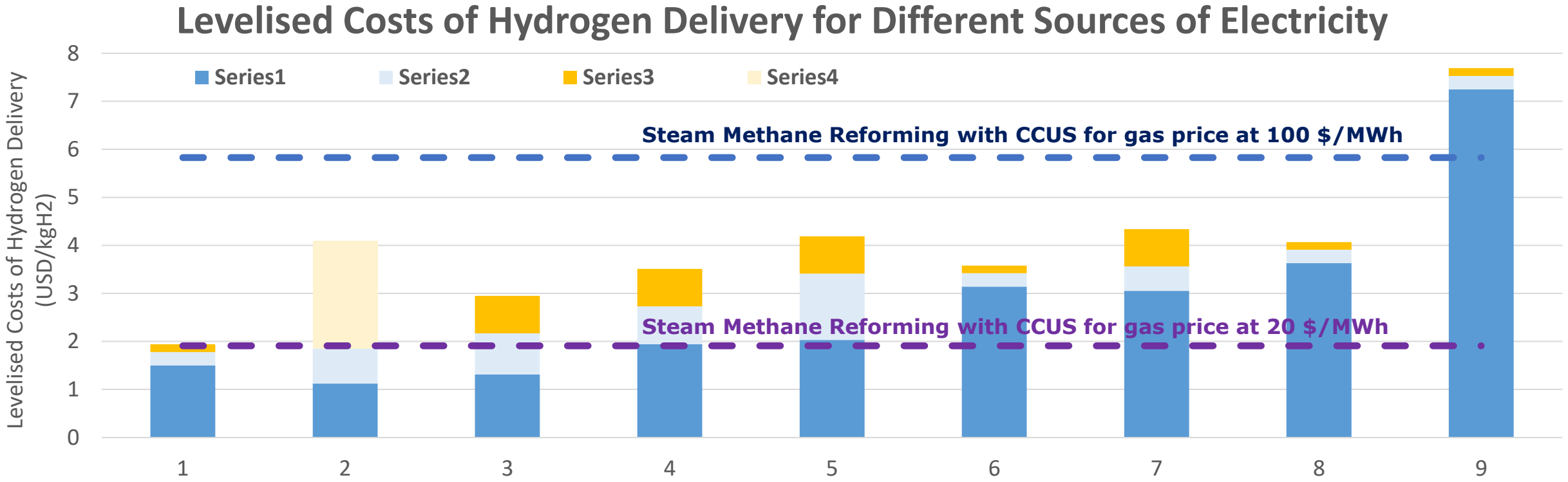
II. Hydrogen Delivery



III. Hydrogen Integration



Nuclear competitiveness is improved when taking into account the full value chain



I. Taking into account value chains costs from hydrogen delivery improves the competitiveness of nuclear power plants and grid-connected electrolysers.

II. By 2030-2035, hydrogen delivery costs is likely to be between 3 and 4 USD/kgH2 in most places of the world.

Note: CCUS = Carbon Capture Utilization and Storage

H2-VAL Scope and Objectives

- Review of key challenges and opportunities for nuclear-hydrogen systems as part of **industrial clusters**, including electrical and thermal **coupling**, **safety case** and possible **business models**;

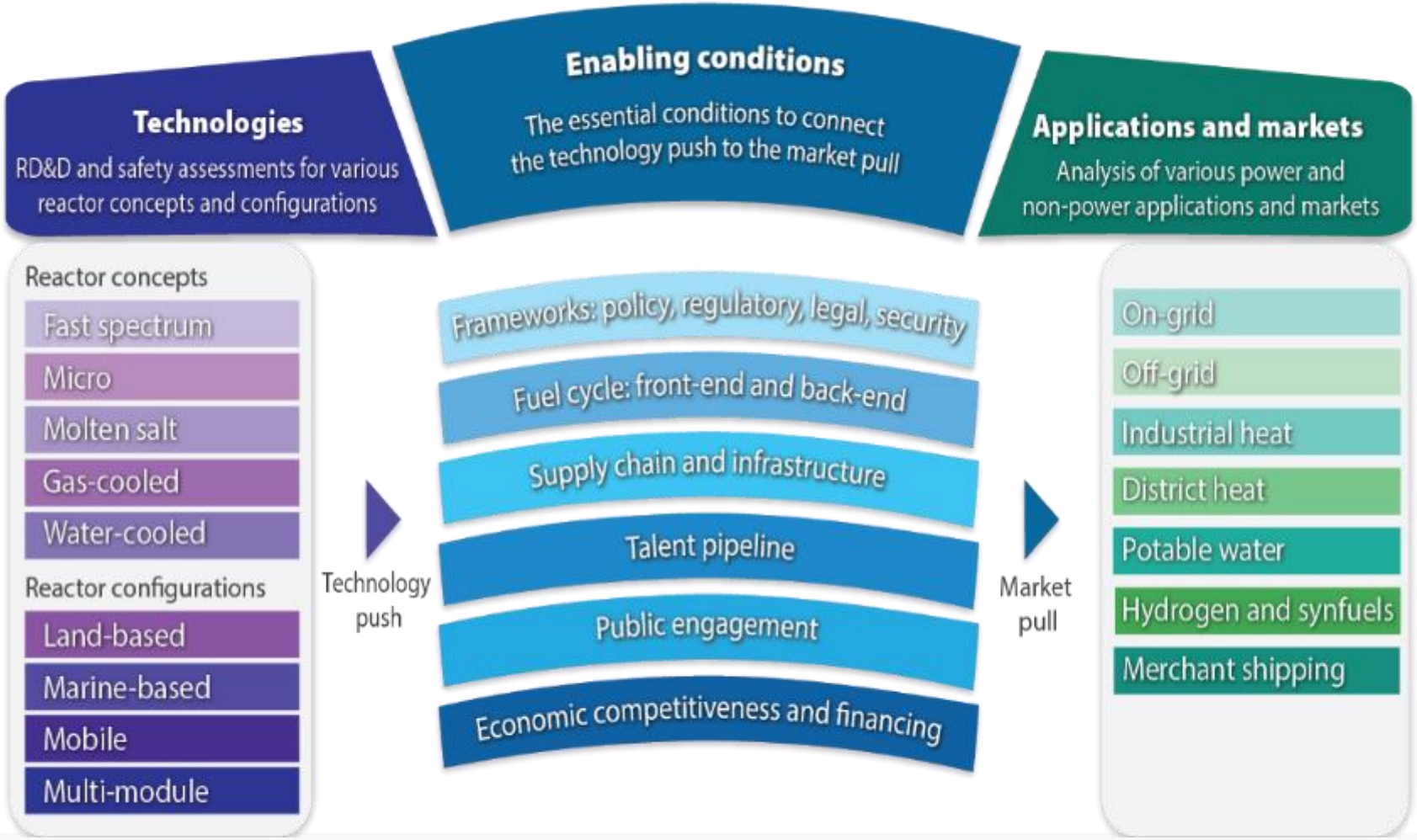
- Discussion of **market potential** and **technical requirements** for nuclear-produced hydrogen and **associated derivatives** (e.g. ammonia, synthetic fuels, etc.);

- Assessment of possible **development strategies** for nuclear-based hydrogen value chains, including hydrogen transport, storage and distribution.

NEA Industrial Case Studies for SMR Markets

NEA SMR Strategy

Beyond technical feasibility, the NEA SMR Strategy connects the technology push of the landscape with the market pull for innovative nuclear concepts, addressing the full set of conditions for success.



https://www.oecd-nea.org/jcms/pl_73775/the-nea-small-modular-reactor-smr-strategy

NEA Industrial Case Studies for SMR Markets

1. Mining

(in publication process)

2. Coal replacement

(early draft produced)

3. District energy

(under development)

4. Industrial cogeneration

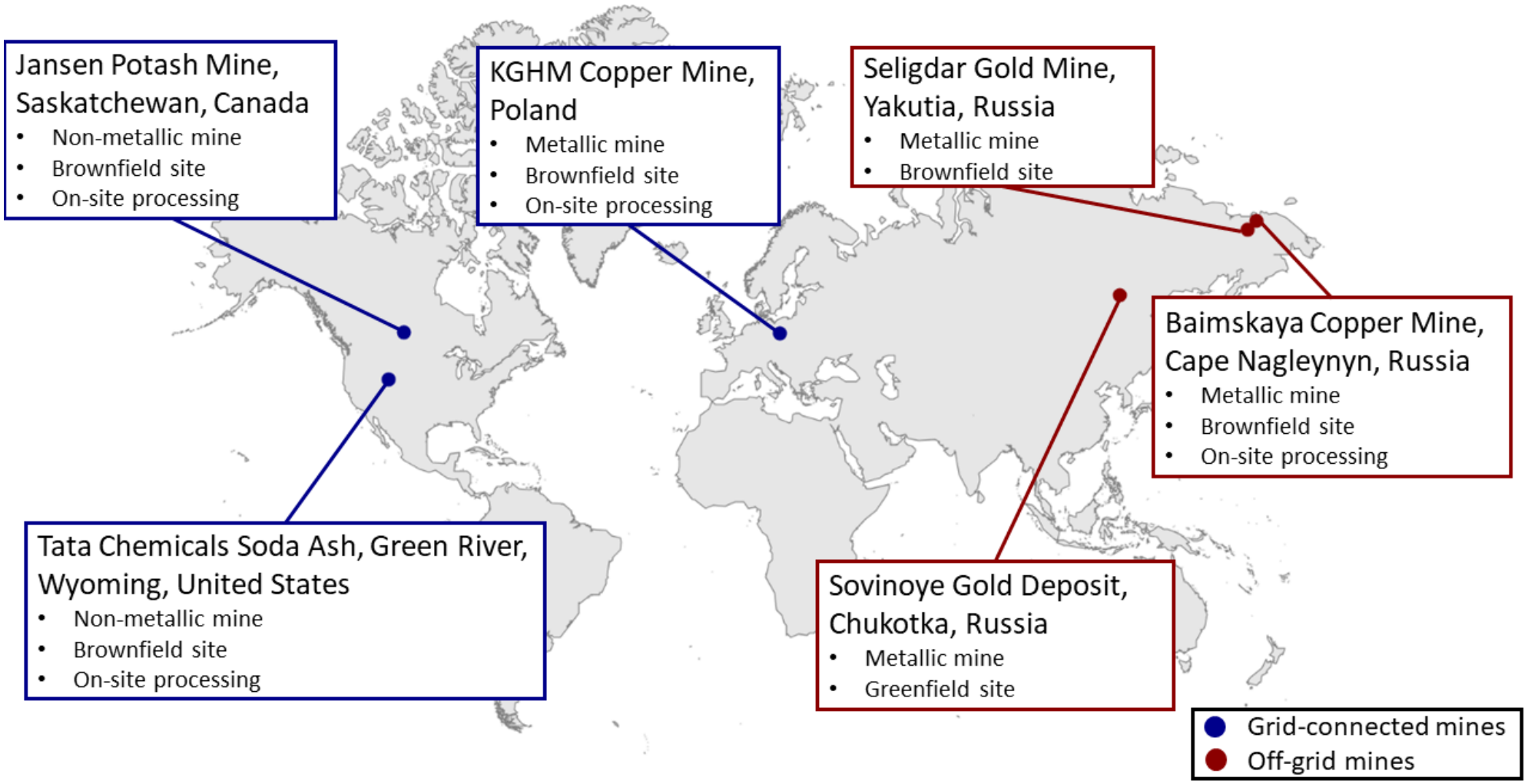
(under development)

The choice of industrial case studies is based on the markets that are viewed as the **most near-term for SMR deployment**

These also represent sectors that have been identified as **"hard to abate"** in leading decarbonization pathways

1. Mining industrial case study

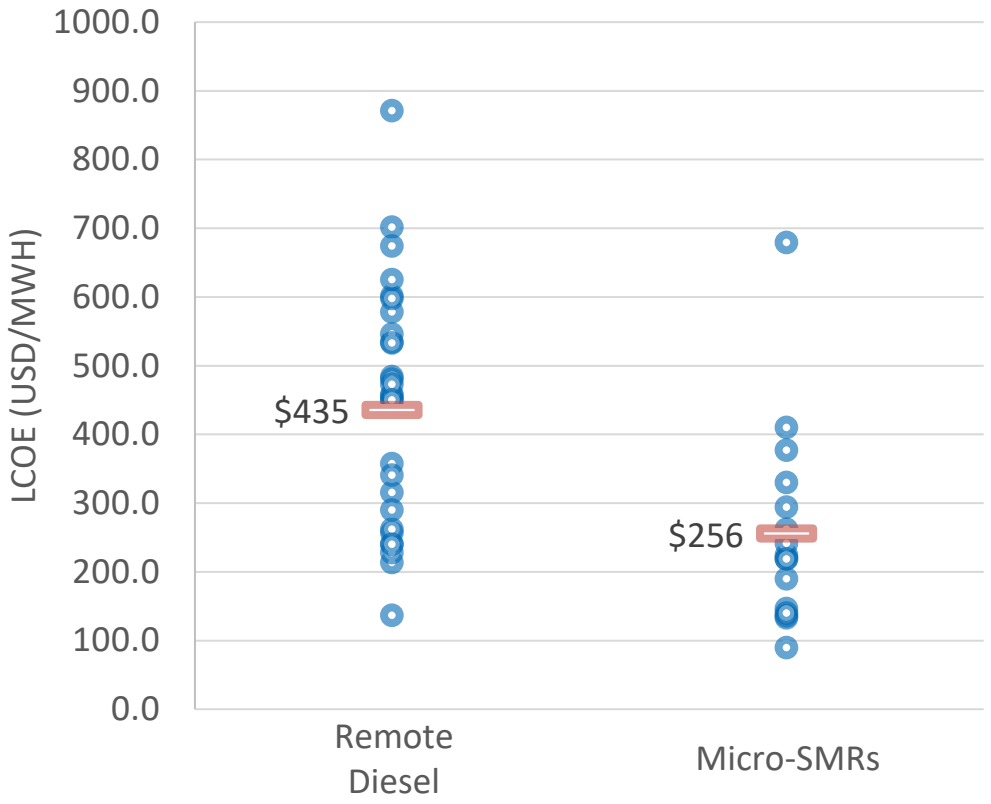
Growing interest in SMRs for mining



1. Mining industrial case study

Opportunity for remote (off-grid) mining

Comparison of real LCOE values for remote diesel and predicted LCOE values for micro-SMRs*.



High and unpredictable energy costs

- Infrastructure costs more than double, and operating costs more than 60% higher compared to centrally located mines[1].
- Cost of transmission found to be between $1.3 to 5.2M 2023USD / km in remote areas.

Reliability of supply issues

- Consistency of supply is critical, and a challenge due to insufficient infrastructure or supply disruptions.

Hard to abate sector

- Effort to reduce CO2 emissions associated with electricity generation, haulage, and on-site processing
- Many mining companies have committed to emissions reduction targets by 2030, 2035, 2040, and 2050.

Growing need for mining in remote regions

- Today, remote mining accounts for ~ 5% of mining activity[2].
- New demand for high value commodities such as rare earth elements is expected to incentivize new remote mines.

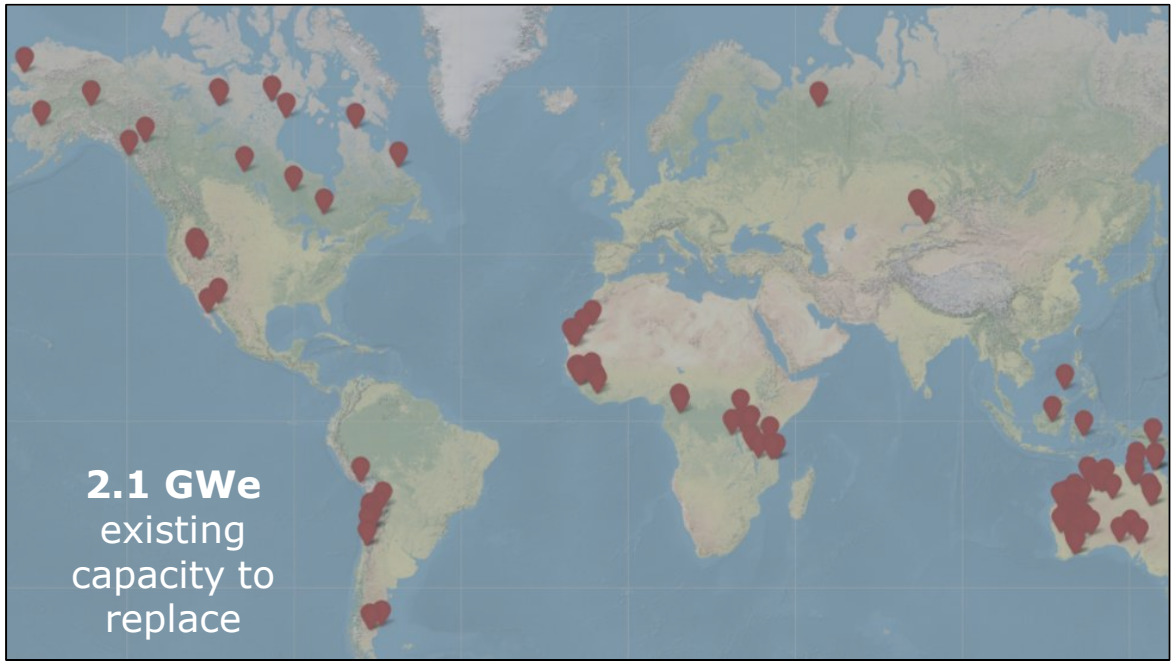
[1] Mining Association of Canada, Facts & Figures 2021, the State Of Canada's Mining Industry, 2021. [2] Ontario Ministry of Energy. (2016). Feasibility of the Potential Deployment of Small Modular Reactors (SMRs) in Ontario. Hatch. *13 unique sources available upon request.

1. Mining industrial case study

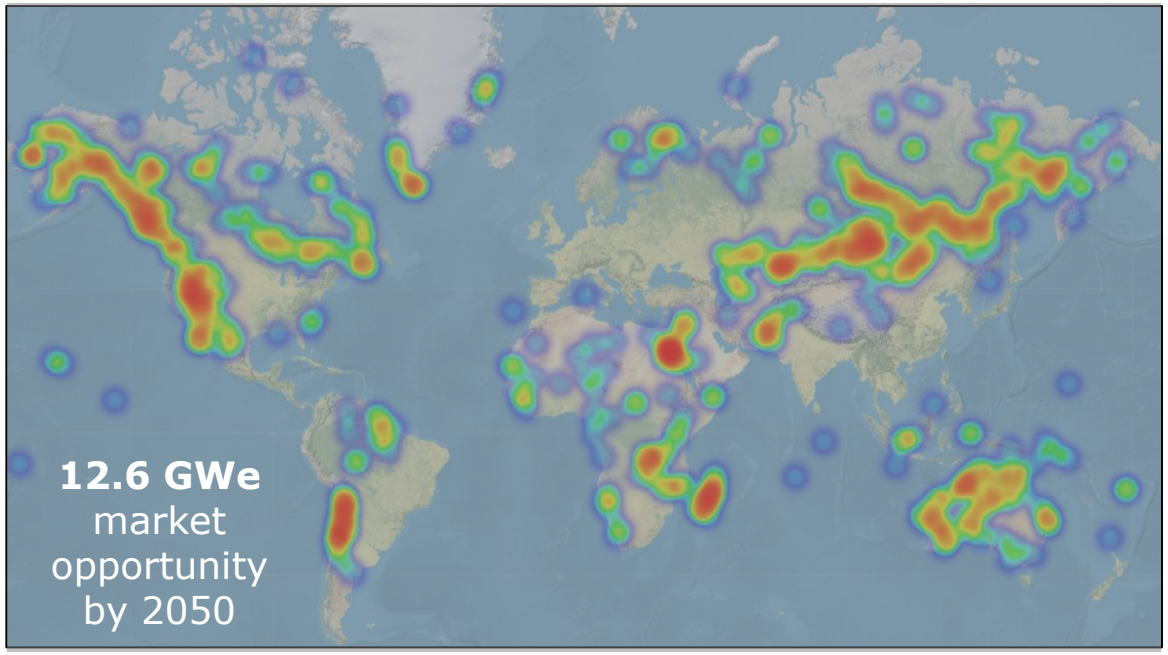
Market size assessment for remote mining

- Existing mines and mineral deposits more than 20kms from an electricity grid were determined to be "remote".
- A "representative" remote mine determined to have installed thermal generating capacity of 16.3 MWe and a lifetime of 16 years based on a literature review of 50 off-grid mining projects.

Existing brownfield remote mines

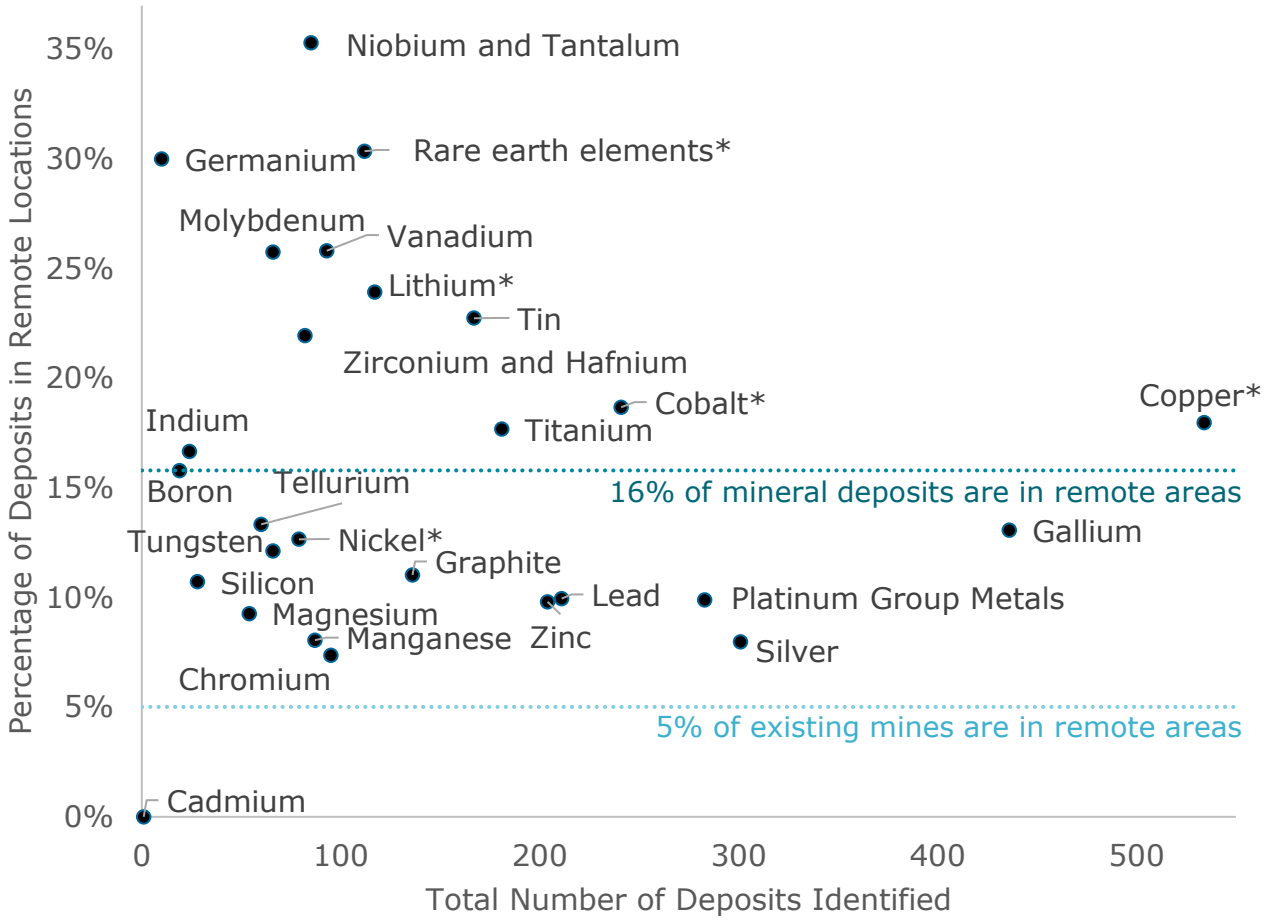


Future greenfield remote mine sites



1. Mining industrial case study

Critical minerals



- Key energy transition minerals are systematically located in remote areas
  - 30% of rare earth element mineral deposits
  - 24% of lithium deposits
  - 19% of cobalt deposits
  - 18% of copper deposits
  - 13% of nickel deposits

Micro-SMRs could enable access to additional critical minerals needed in the clean energy transition.

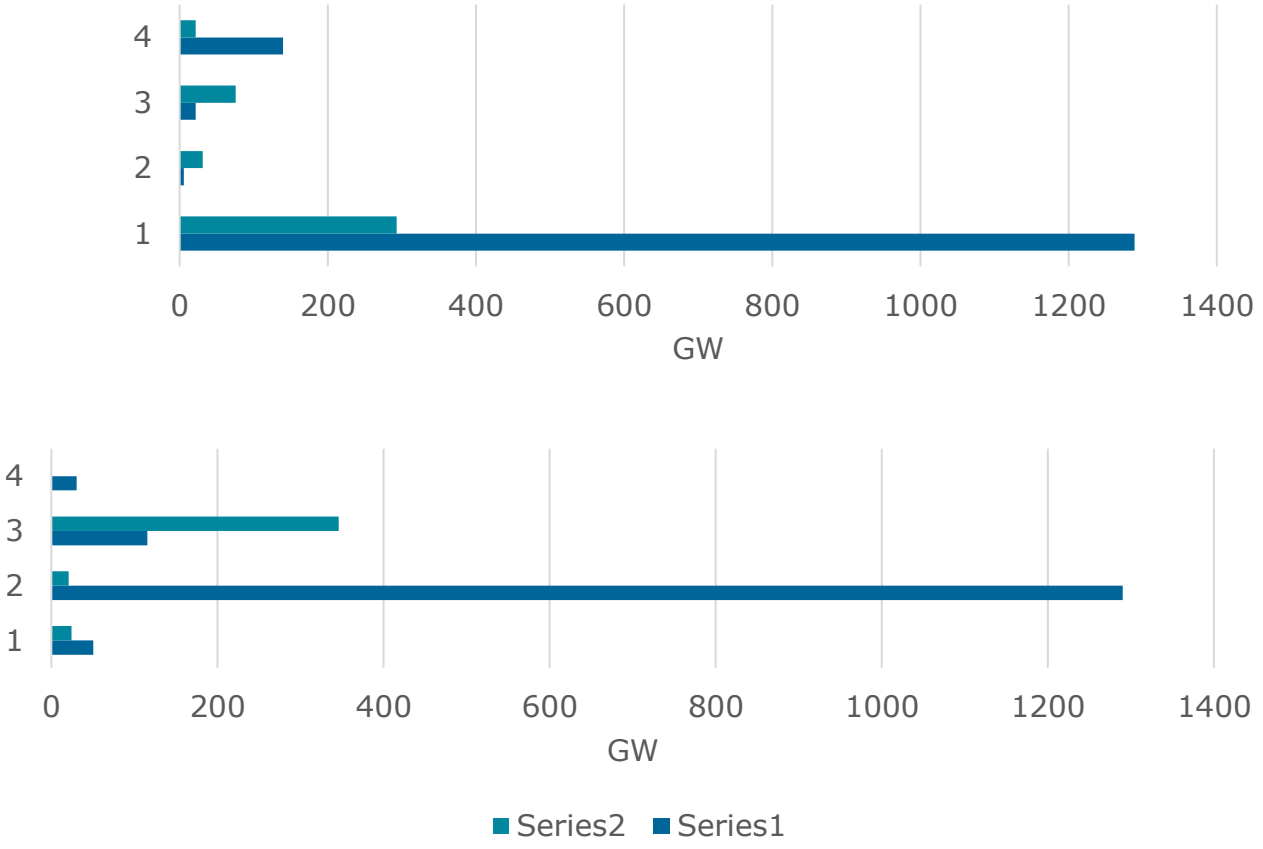
Note: An asterisk indicates the five key energy transition minerals identified by the International Energy Agency in the 2023 critical mineral market review, which are rare earth elements, lithium, cobalt, copper, and nickel.

2. Coal replacement industrial case study

Coal in climate policies

- According to the IEA, achieving net zero will necessitate **cease coal generation globally by 2040**
- Most of current coal capacity **is not subject to phase-out commitments**. However, around 21 countries (primarily in the OECD) have established firm coal phase-out policies with specific dates
- Conversely, **the majority of the coal infrastructure is covered by net zero policies**. Most OECD countries aim to achieve this by 2050, with most non-OECD countries targeting a post-2050 date

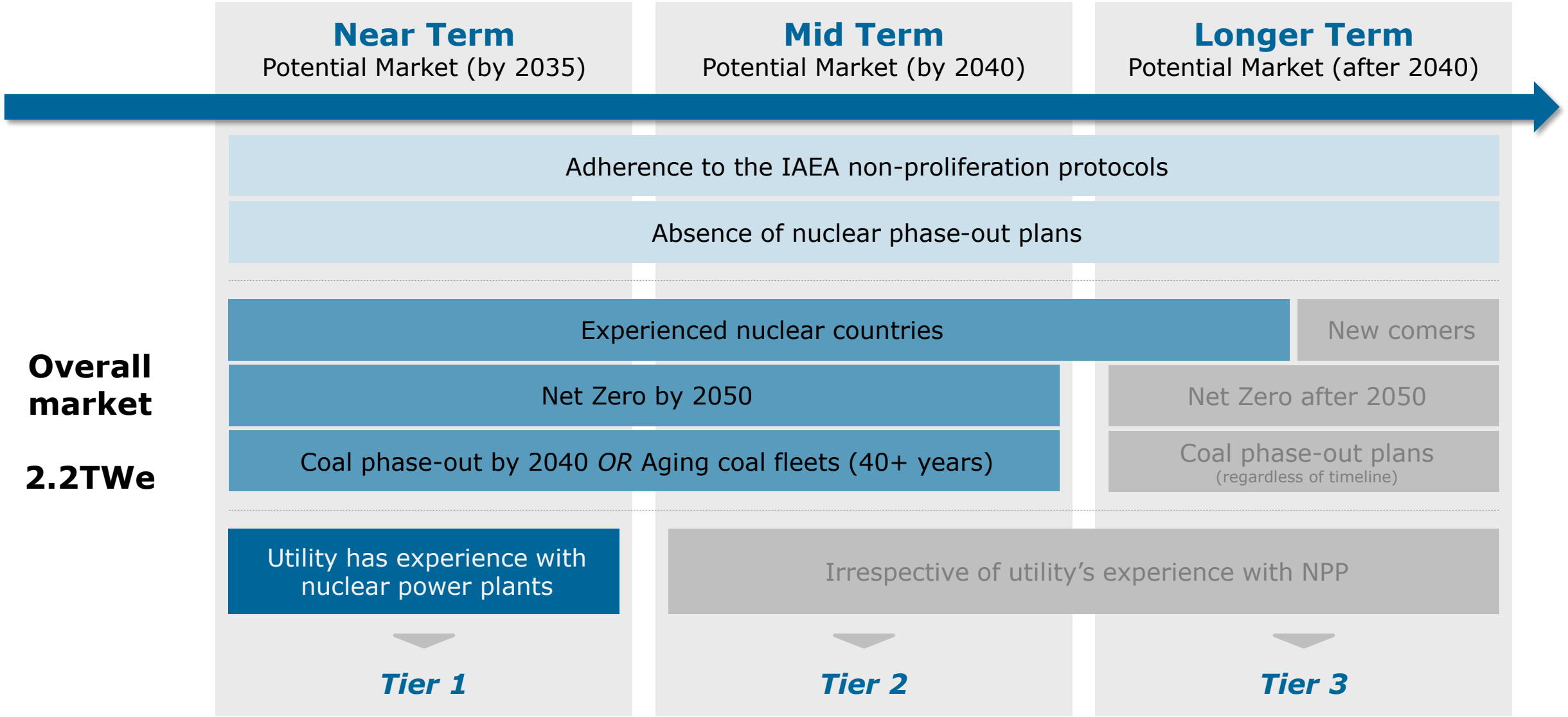
Distribution of coal capacity by type of policy commitments, 2023



Source: NEA analysis based on Global Coal Plant Tracker

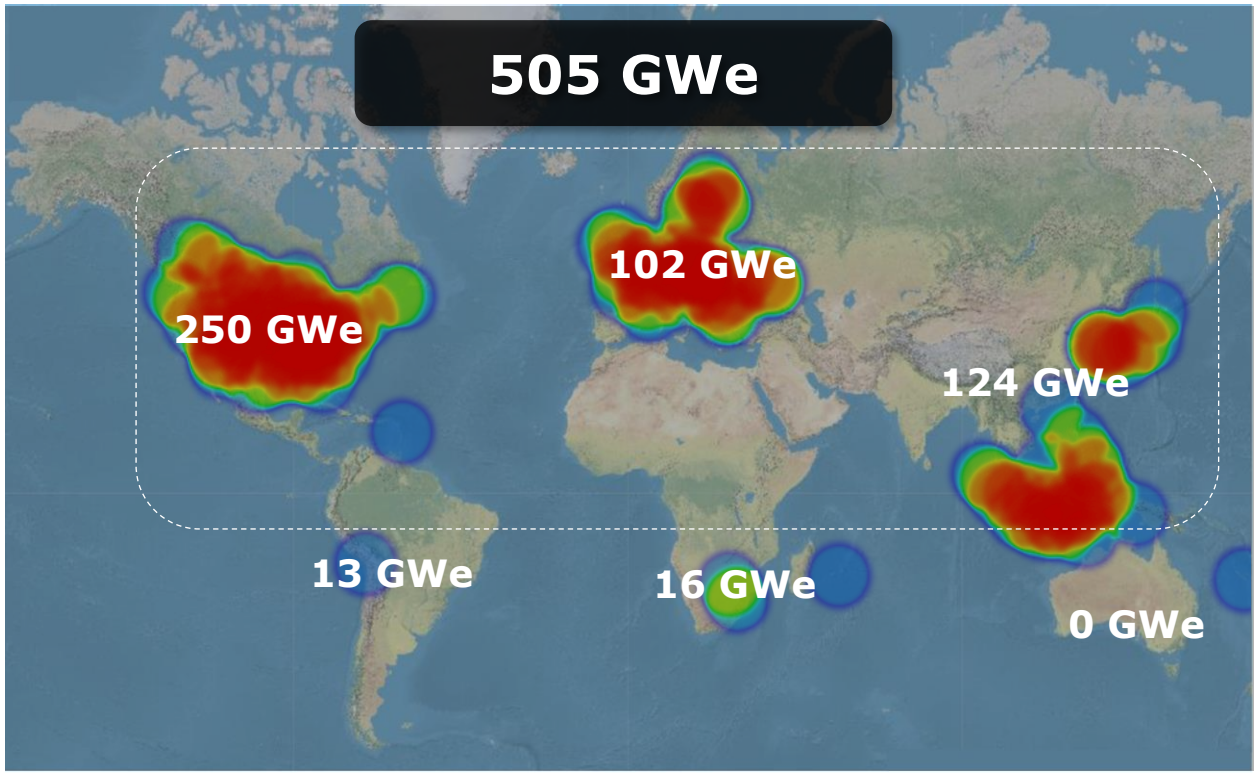
2. Coal replacement industrial case study

Methodological approach



2. Coal replacement industrial case study

Total Preliminary Market Estimate for Coal Replacement

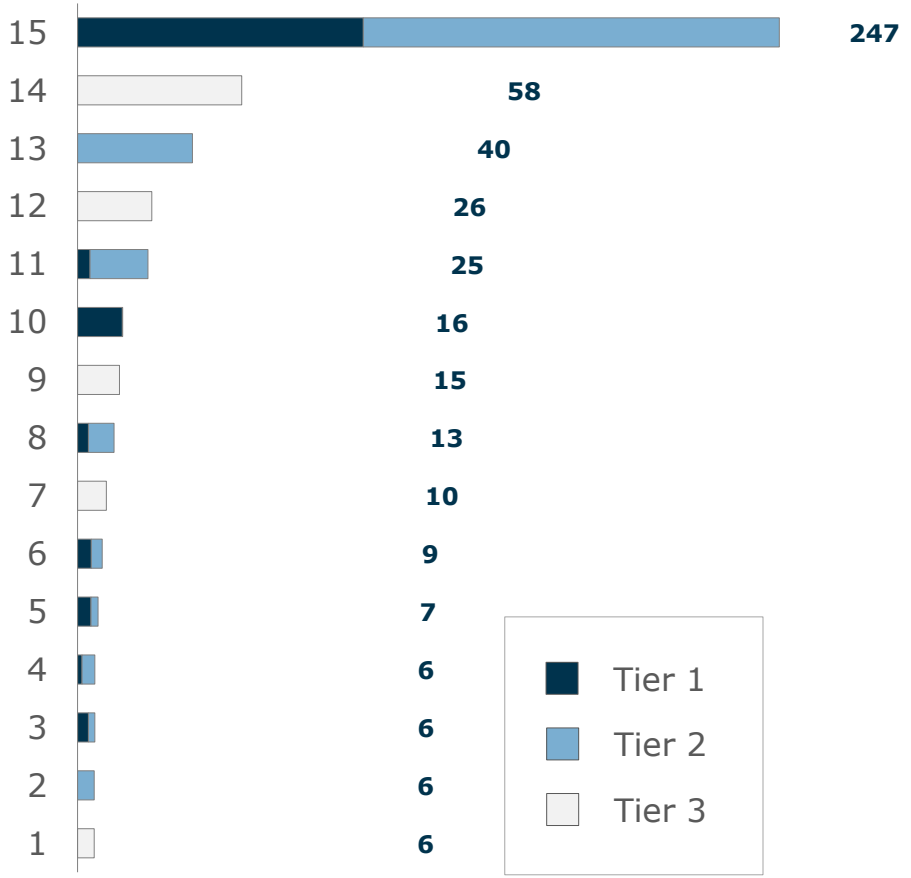


High concentration with 10 countries representing 90% of the market

75% of market could be seized in the **by 2040**

Potential Market by Country (Top 15)

in GWe



Source: NEA analysis based on Global Coal Plant Tracker

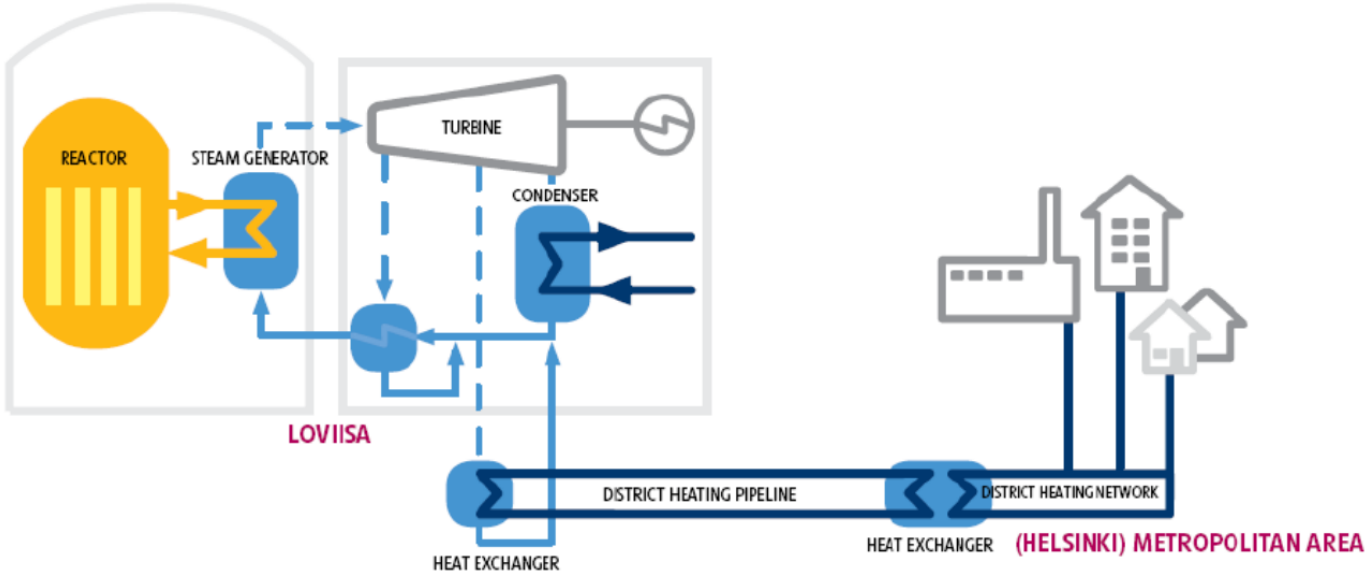
3. District energy industrial case study

Scope

- Opportunity for SMRs to replace fossil fuels in existing and future district energy applications, including market size, drivers, and technical considerations.
- Conducted in partnership with Electric Power Research Institute (EPRI)

Status

- Advertised work at 2023 IDEA Annual Conference
- 28 end user questionnaire respondents
- 10 detailed interviews conducted
- Existing market data has been collected, primarily in North America and Europe



Source: Fortum, Presented at Joint NEA/IAEA Expert Workshop on the "Technical and Economic Assessment of Non-Electric Applications of Nuclear Energy" OECD Headquarters, Paris, France , 4-5 April 2013

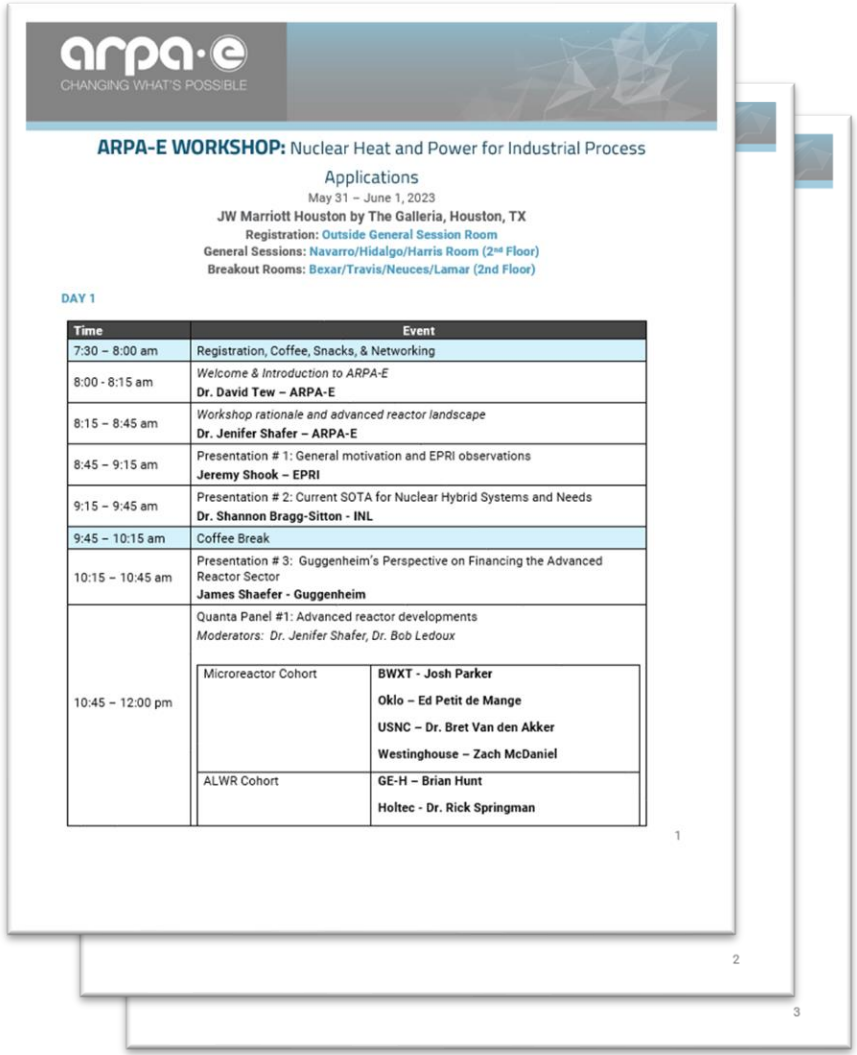
4. Industrial cogeneration case study

Scope

- Focuses on the oil & gas, petrochemical, and chemicals sectors, including upstream and downstream activities.
- Feature end-users "stories" from industrial companies
- This report is a key objective for the NEA in 2024

Status

- Initial engagement as part of the ARPA-E's "Nuclear Heat and Power for Industrial Process Applications" workshop in Houston, May 31 – June 1, 2023
- Literature review in progress
- Engagement and data analysis in early 2024.



arpa·e
CHANGING WHAT'S POSSIBLE

ARPA-E WORKSHOP: Nuclear Heat and Power for Industrial Process Applications

May 31 – June 1, 2023
JW Marriott Houston by The Galleria, Houston, TX
Registration: Outside General Session Room
General Sessions: Navarro/Hidalgo/Harris Room (2nd Floor)
Breakout Rooms: Bexar/Travis/Neuces/Lamar (2nd Floor)

DAY 1

Time	Event
7:30 – 8:00 am	Registration, Coffee, Snacks, & Networking
8:00 - 8:15 am	*Welcome & Introduction to ARPA-E* **Dr. David Tew – ARPA-E**
8:15 – 8:45 am	*Workshop rationale and advanced reactor landscape* **Dr. Jenifer Shafer – ARPA-E**
8:45 – 9:15 am	Presentation # 1: General motivation and EPRI observations **Jeremy Shook – EPRI**
9:15 – 9:45 am	Presentation # 2: Current SOTA for Nuclear Hybrid Systems and Needs **Dr. Shannon Bragg-Sitton - INL**
9:45 – 10:15 am	Coffee Break
10:15 – 10:45 am	Presentation # 3: Guggenheim's Perspective on Financing the Advanced Reactor Sector **James Shaefer - Guggenheim**
10:45 – 12:00 pm	Quanta Panel #1: Advanced reactor developments *Moderators: Dr. Jenifer Shafer, Dr. Bob Ledoux* Microreactor Cohort: **BWXT - Josh Parker**; **Oklo – Ed Petit de Mange**; **USNC – Dr. Bret Van den Akker**; **Westinghouse – Zach McDaniel** ALWR Cohort: **GE-H – Brian Hunt**; **Holtec - Dr. Rick Springman**

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Thank you for your attention

Extra slides

The Nuclear Energy Agency

34 countries seeking excellence in nuclear safety, technology, and policy

- The premier international platform for cooperation in nuclear technology, policy, regulation, research, and education
- 34 member countries plus strategic partners (e.g., China and India)
- 8 standing committees and more than 80 working parties and expert groups
- 20 joint undertakings
- Global relationships with industry and universities

NEA countries operate approximately 81% of the world's installed nuclear capacity

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Upcoming GIF related Events

Takuya FUNAHASHI,
SIAP Technical Secretariat

Upcoming GIF related Events 1 of 2 (Open for Everyone)

Title	Date	Place	Notes
GIF Webinar: Analysis of the Reactivity Loss of the Phenix Core Cycles for the Experimental Validation of the DARWIN-FR Code Package	14:30-16:00 (CET), 28th, February 2024	Online Registration link is the below:	Presenter: Victor Viallon, CEA, France
MDEP High-Temperature Gas-Cooled Reactor (HTGR) Workshop	18th to 20th March 2024	Online Registration link is the below: https://us06web.zoom.us/meeting/register/tZUrdOytqDIjEtW0Yt0e_dM-7ufah8U2dKJK	Detailed agenda: https://www.oecd-nea.org/mdep/events/HTGRWS-2024/
GIF Webinar: Overview of Canadian R&D Capabilities to Support Advanced Reactors	13:30-15:00 (CET) 20th, March 2024	Online Registration link is the below:	Presenter: Lori Walters, CNL, Canada
GIF Webinar: Multiphysics Depletion & Chemical Analyses of Molten Salt Reactors	14:30-16:00 (CEST) 17th, April 2024	Online Registration link is the below:	Presenter: Samuel Walker, INL, USA

Upcoming GIF related Events 2 of 2 (Open for Everyone)

Title	Date	Place	Notes
Non-Electric and Hybrid Applications of Nuclear Energy Workshop	9:00-17:00 (GMT+9), 26th, March 2024	BEXCO's Convention Hall and Exhibition Hall, Busan, Korea	On the margins of the 39th Korea Atomic Power (KAP) Annual Conference. Register for the 39th Annual KAP Conference to register for this event: http://kapconf.com/en/
GIF Webinar: GIF-IAEA Webinar on Regulatory Activities in Support of SMRs and Advanced Reactor Systems	14:30-18:30 (CEST) 22nd, May 2024	Online Registration link is the below:	Guest Speakers: Mr. Tarek Tabikh; CNSC Mr. Greg Oberson, US NRC Ms. Paula Calle-Vives, IAEA Moderators: Dr. Patricia Paviet, US DoE Mr. Vladimir Kriventsev, IAEA
GIF SIAP Special Sessions: AI and Knowledge Management (TBC)	Early October	Ottawa, Canada	During G4SR-5 (1st – 4th, October)

Further GIF Webinar information:
https://www.gen-4.org/gif/jcms/c_82831/webinars

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Non-Electric and Hybrid Applications of Nuclear Energy Workshop

39th Korea Atomic Power Annual Conference
April 24-26, 2024 / BEXCO, BUSAN
A Pathway to Overcome the Climate Crisis with Nuclear Power

The GIF Non-Electric Applications of Nuclear Heat (NEANH) Task Force is targeting a workshop to:

- Showcase GIF NEANH activities
- Target engagement with regulators, including industrial regulators (e.g., for a chemical facility)
- Respond to the feedback received during the GIF Industry Forum in 2022
- Build on the success of the 1st NEANH Workshop in Toronto, Canada in 2022

Location: BEXCO's Convention & Exhibition Hall, Busan, Korea.

Date: Friday, April 26, 2024, from 9:00 – 17:00

Organisers: Korea Atomic Energy Research Institute (KAERI) and the GIF NEANH Task Force.

Hosts: Korean Nuclear Industry Association (KAIF), and Korea Nuclear International Cooperation Foundation (KONICOF)

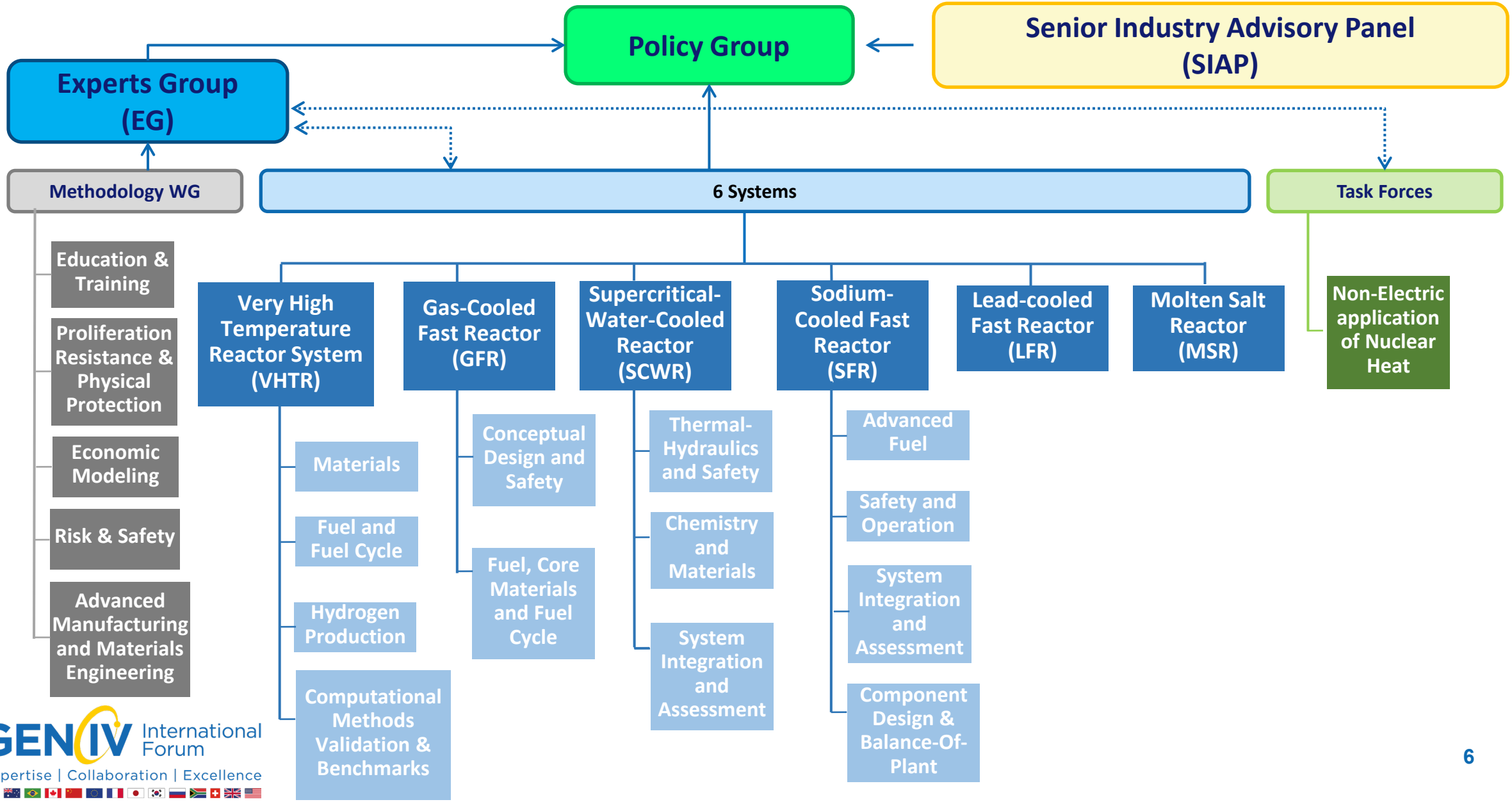
Registration: Please register for the 39th Annual KAP Conference to register for this event: http://kapconf.com/en/

Upcoming GIF meetings (GIF Member Only)

- 2024 Spring GIF EG/PG (hosted by EURATOM in Brussels) from May 13 to 17, in-person.
- 2024 Fall GIF EG/PG (hosted by UK in London) from October 14 to 18, in-person.
- 2025 Spring GIF EG/PG (hosted by Switzerland) from April 7 to 11, in-person.

https://www.gen-4.org/gif/jcms/c_205394/2024-and-spring-2025-egpg-meetings

Structure of GIF



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