

Large-Scale Energy Research Center Concept Note

AUTOMATE NUCLEAR POWER SITE CONSTRUCTION

INTEGRATE CHEMICAL PROCESSING • DEVELOP STANDARDS



By Glenn Weinreb

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Executive Summary

Purpose. We propose the establishment of a Large-Scale Energy Research Center to: (a) develop machines that automate the construction of nuclear power sites, (b) develop standards that define how industrial processes are driven by nuclear reactor heat, and (c) develop large factory-built processing platforms that make hydrogen, ammonia, chemicals, and other energy-intensive products. The goal is to find applications that can beat fossil-based production on cost while avoiding CO₂ emissions.

Funding Strategy. The Center could seek philanthropic “climate” funding, with public-sector support also possible, for public-good R&D rather than commercial deployment (i.e. open-source instead of proprietary).

Initial Funding. An initial \$5–25M phase could support modeling, preliminary engineering, standards, technoeconomic analysis, and design of candidate machines and facilities. Compare reactor types, construction methods, industrial processes, sites, and deployment rates. Identify cases where nuclear-based electricity, heat, chemicals, or materials can beat fossil alternatives on cost; advance only the strongest cases toward prototypes.

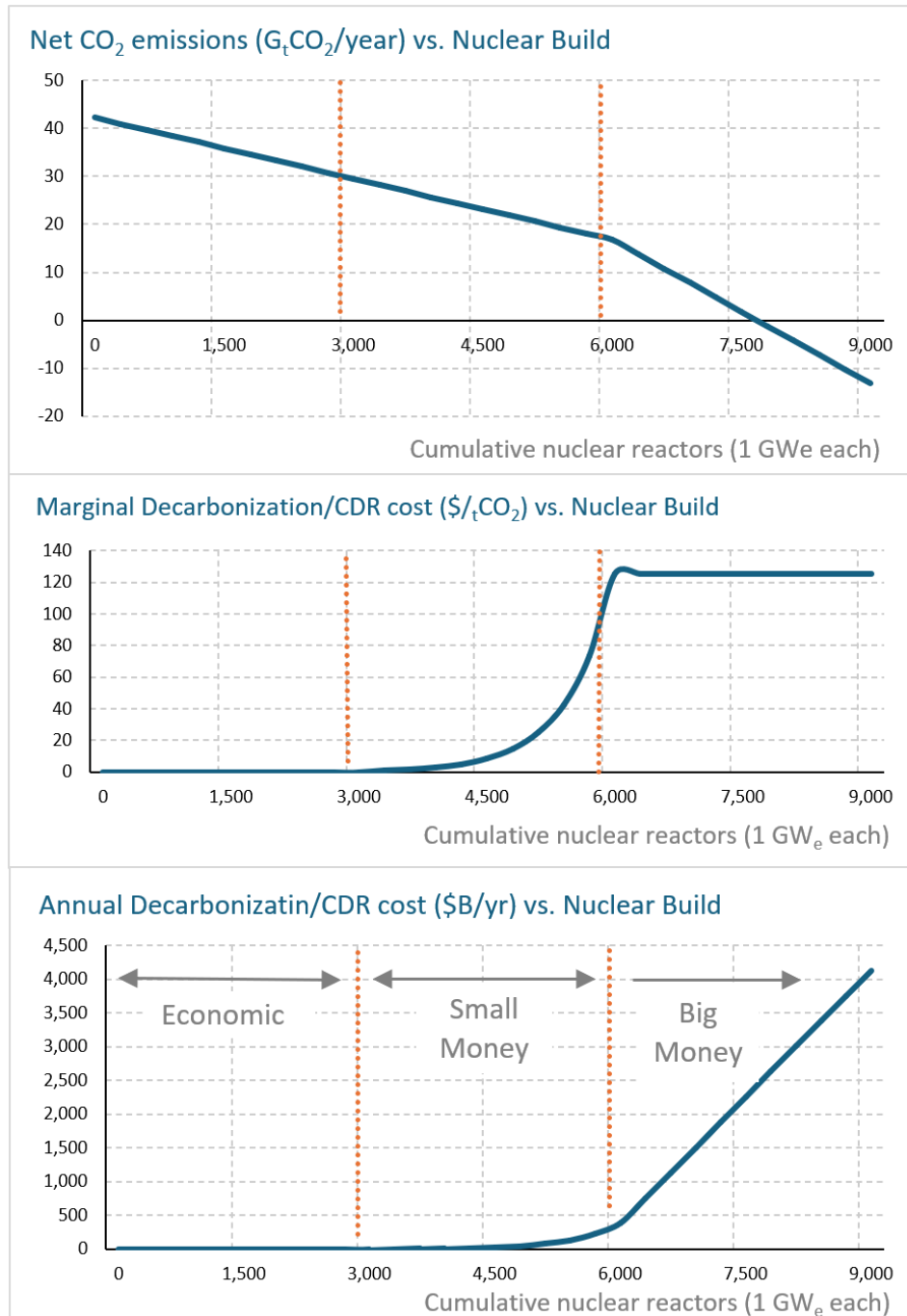
The Climate Problem. To bend the global warming curve, the world would need to build roughly 9,000 GW_e of nuclear power. This assumes: (a) solar radiation management ([SRM](#)) is not utilized, (b) nuclear reactors replace fossil fuel (“decarbonize”), and (c) nuclear reactors are used to remove CO₂ from atmosphere via direct air capture ([DAC](#)). If 9,000 GW_e are built over 9 years (1K/year), the average global temperature would peak at ~2.4°C, relative to 150 years ago. Alternatively, if built over 30 years (300/year), the average global temperature would peak at ~2.8°C; and if built over 90 years (100/year), the average global temperature would peak at ~3.6°C. Current global production of nuclear reactors is approximately 10 GW_e/year, therefore hundreds per year would represent a large increase. Scientists have warned against exceeding 1.5°C. Therefore, bending the warming curve with large-scale nuclear construction would still exceed this by a wide margin, assuming SRM is not utilized. For details, see the “How many nuclear reactors” chapter within the [GCM Proposal](#).

Climate Strategy. The first several thousand reactors would probably be “economic.” In other words, produce energy at a cost less than fossil fuel, and move forward naturally. One potential climate strategy is to build these as quickly as possible, to the point where further construction is no longer economic, and then figure out what to do next. Another strategy is to reflect sunlight, yet this involves many challenges, as described in an illustrative [Sunlight Reflectivity Plan](#).

Continued on next page...

How Much does It Cost to Stop Global Warming?

The below [illustration](#) shows costs associated with building 9,000 GWe of nuclear power for purposes of decarbonization and DAC. This assumes automated site construction and direct use of nuclear heat for industrial processing.



Automated Site Construction

The basic construction concept is to move as much work as practical into controlled factories, move large preassembled components and modules to the site on reusable transport platforms, and use reusable rail-, gantry-, crane-, excavation-, and digital-control systems to perform repetitive site work. Figures D1-D3 provide a visual overview. These are illustrative concepts, not frozen designs. The program would compare them with conventional construction, transporters, cranes, alternative module sizes, and other competing approaches. For details, see the [Automated Fission Proposal](#).

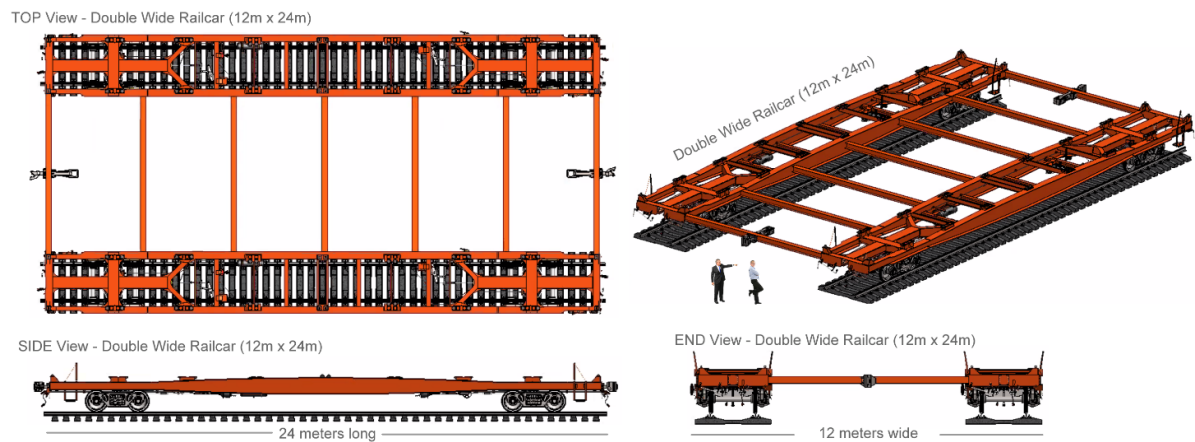


Figure D1: Illustrative 12 m x 24 m double-width railcar / transport platform. Dimensions and configuration are candidate engineering assumptions. Concept by Glenn Weinreb.

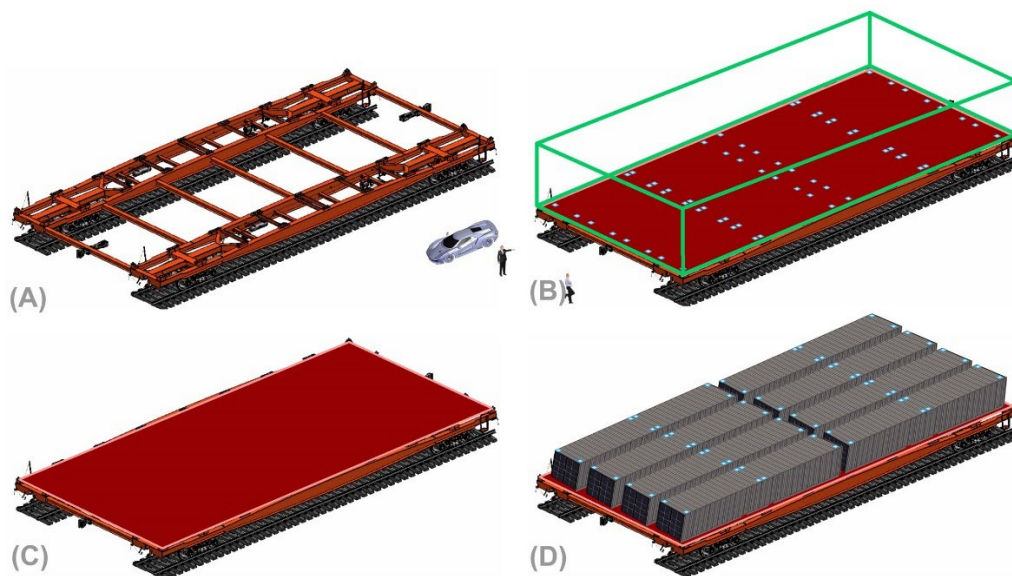
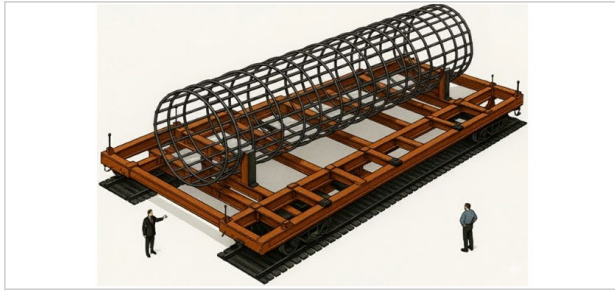
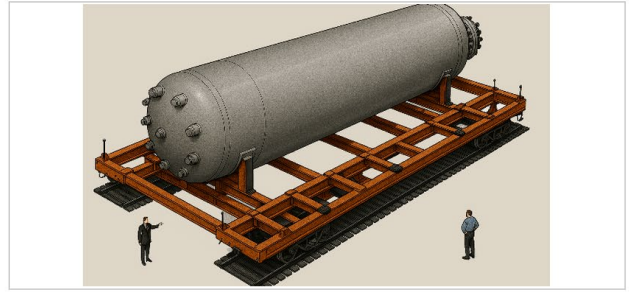


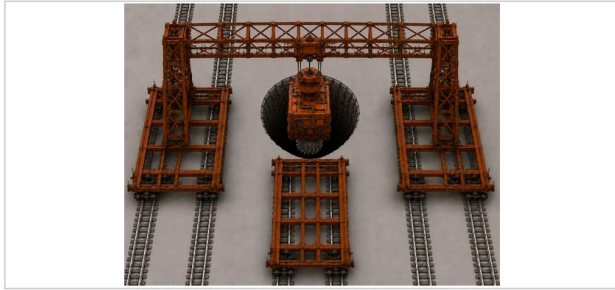
Figure D2: A common heavy transport platform can be configured as (A) base frame, (B) large module/container carrier, (C) flat working surface, and (D) multiple shipping-container carrier.



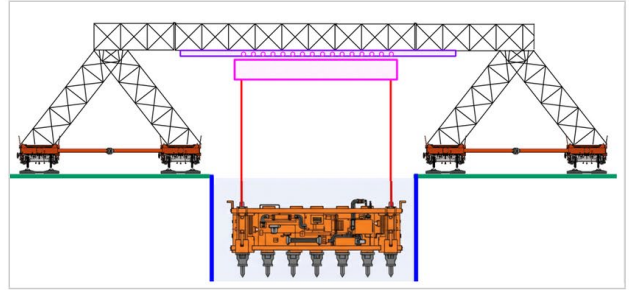
(A) Factory-built rebar assembly



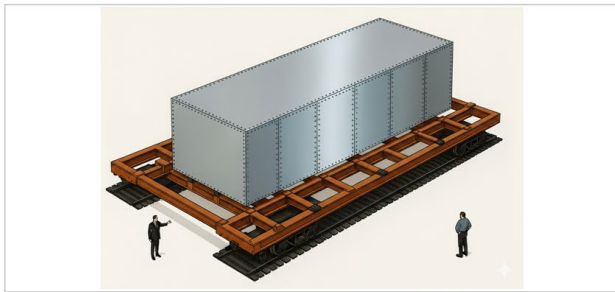
(B) Large reactor component



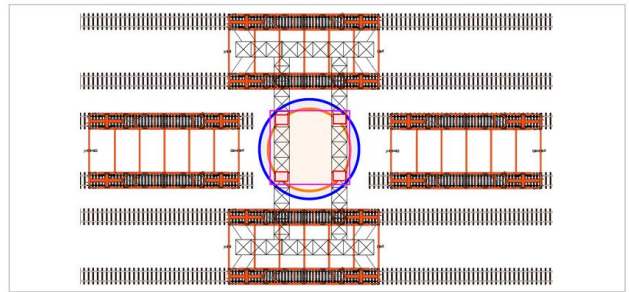
(C) Gantry transfer / positioning



(D) Excavation tooling



(E) Factory-built equipment module



(F) Rail / gantry site layout

Figure D3: Representative factory-to-site construction system. Factory-built rebar assemblies, reactor components, and equipment modules move on reusable transport platforms and transfer to reusable gantry/rail systems for excavation, positioning, and installation. Concept illustrations by Glenn Weinreb.

Integrated Chemical Processing

The concept is to build standardized chemical processing platforms, transport them to a nuclear-industrial site, and connect them through common heat, electrical, material, safety, and data interfaces. Figures E1–E3 provide a quick visual overview of the site, processing-yard, and heavy-platform transportation concepts. For details, see the [Integrated Chemical Processing Proposal](#).

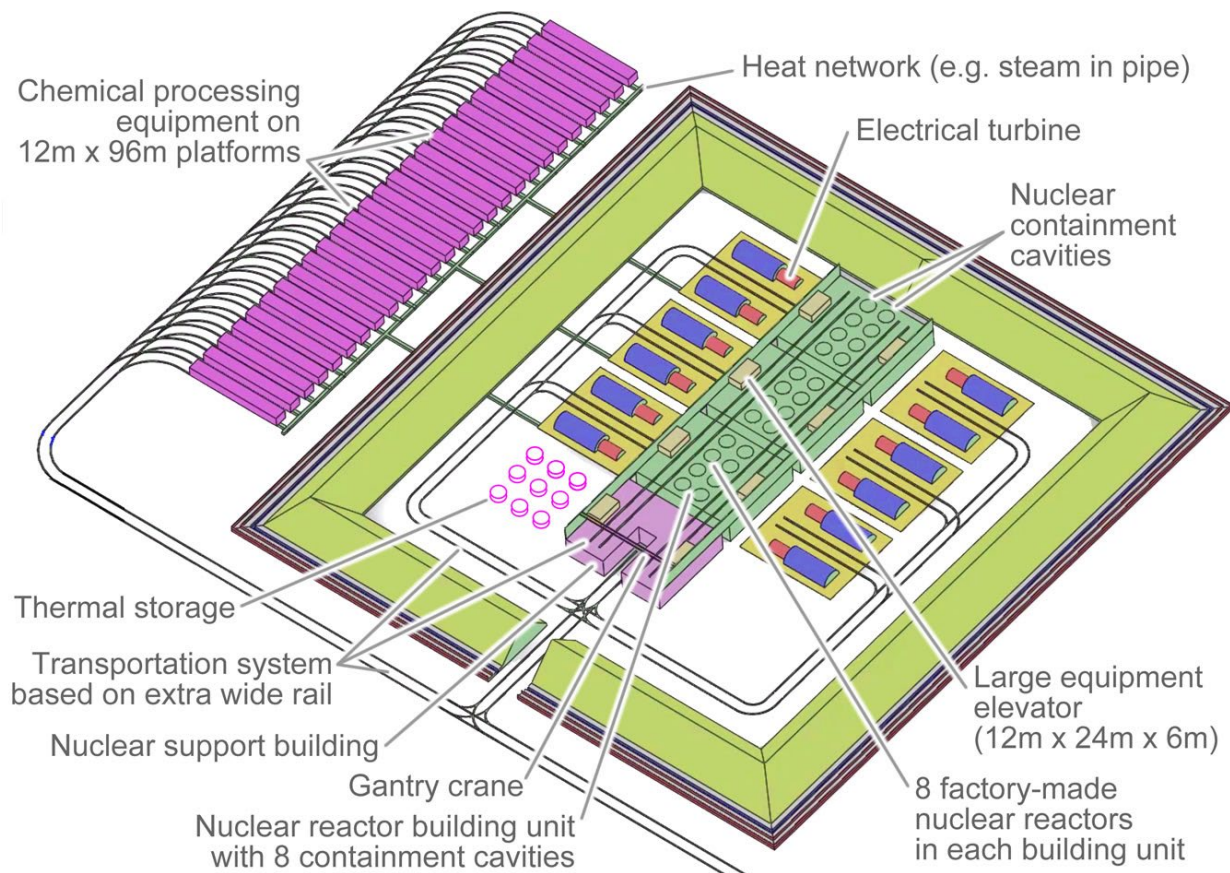


Figure E1: Nuclear reactors co-located with multiple platforms of industrial processing equipment. Concept illustration by G. Weinreb.

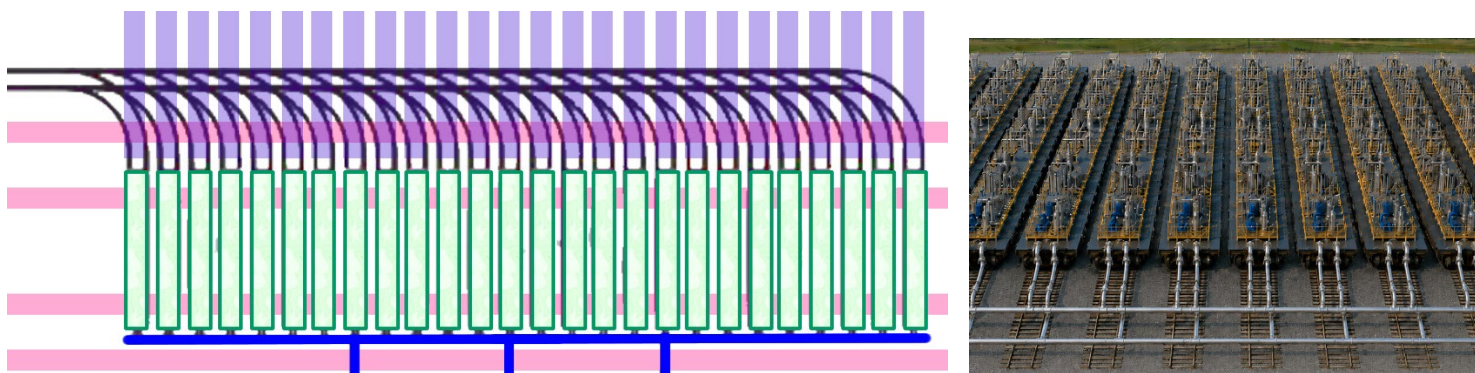


Figure E2: Chemical processing yard consisting of standardized processing platforms positioned side-by-side. In this illustration, platforms are shown in green, pipes carrying heat from the nuclear reactors are shown in blue, underground tunnels that support pipes in between platforms are shown in light violet, and underground tunnels that support moving material into and out of the chemical processing platforms are shown in light purple.

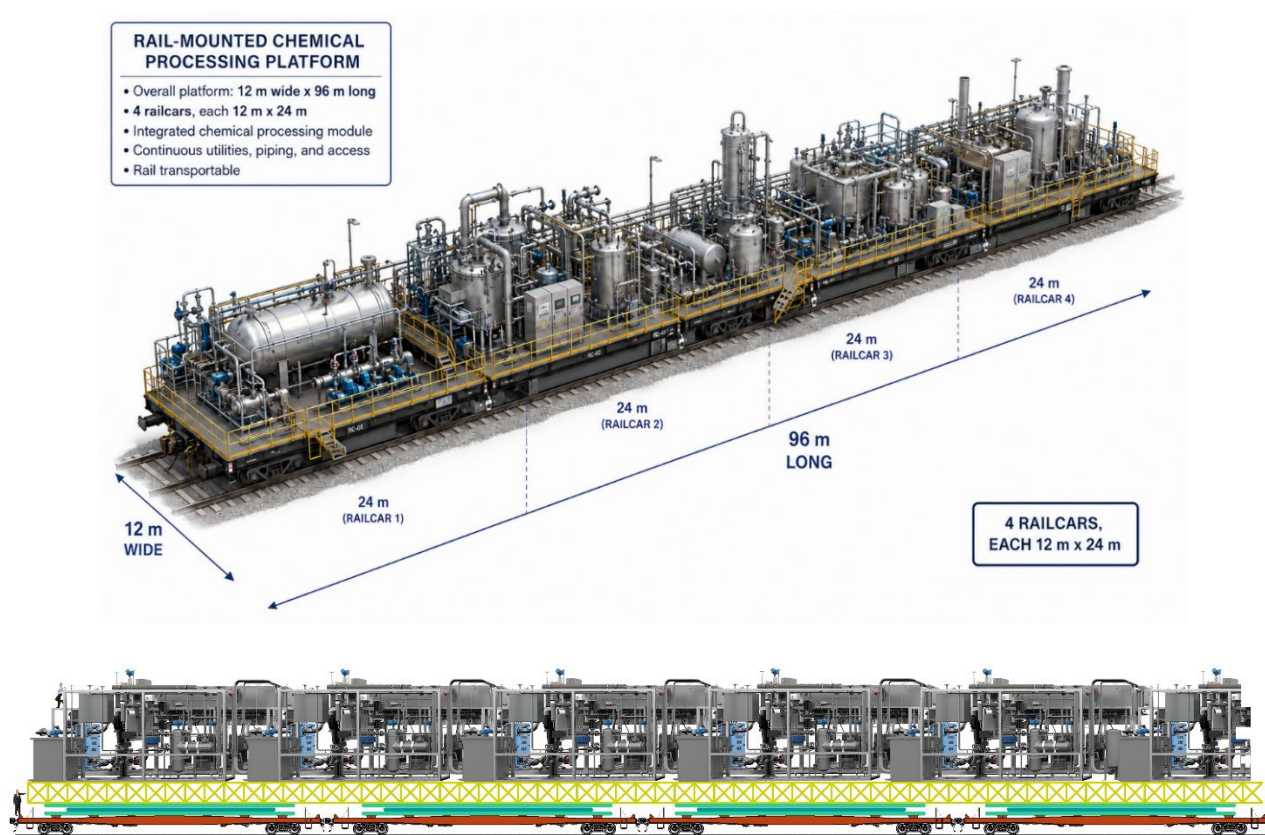


Figure E3: Concept illustration of a 12 m × 96 m chemical-processing platform transported on a rigid truss mounted on four double-width railcars.

Related Material

Open-Source Proposals

The following proposals are intended as starting points for researchers. A host university, scientific team, or funding source can independently review the assumptions, develop alternatives, revise budgets, and publish improved versions via the [CC BY 4.0](#) open-source license.

Automate Nuclear Power Site Construction

https://www.ma2life.org/g/cm/cmp_fission_automate_site_construction.pdf

https://www.ma2life.org/g/cm/cmp_fission_automate_site_construction.docx

Co-locate Chemical Processing with Nuclear Power

https://www.ma2life.org/g/cm/cmp_fission_chemical_processing.pdf

https://www.ma2life.org/g/cm/cmp_fission_chemical_processing.docx

Economic Fusion Moonshot

https://www.ma2life.org/g/cm/cmp_economic_fusion_moonshot.pdf

https://www.ma2life.org/g/cm/cmp_economic_fusion_moonshot.docx

Large-Scale Energy Research Center | Concept Note

https://www.ma2life.org/g/cm/large_scale_energy_research_center.pdf

https://www.ma2life.org/g/cm/large_scale_energy_research_center.docx

Climate Decision-Making Research Center | Concept Note

https://www.ma2life.org/g/cm/climate_decision_making_research_center.pdf

https://www.ma2life.org/g/cm/climate_decision_making_research_center.docx

Climate Moonshot Portfolio

<https://www.aplantosavetheplanet.org/cmp>

Videos

Low-Cost Nuclear Power [#11]

<https://www.youtube.com/watch?v=AllbovU67wI>

Automated Nuclear Power Construction [#12]

<https://www.youtube.com/watch?v=afO0cy1I7Qo>

Integrated Chemical Processing [#13]

<https://www.youtube.com/watch?v=4gqmKGV1h5Y>

Full Video Series

<https://www.aplantosavetheplanet.org/video>