

NEA Workshop: High Temperature Reactor and Industrial Heat Application

Rethinking Nuclear Deployment for Zero-
Carbon Energy at Scale – A Vision for 2050

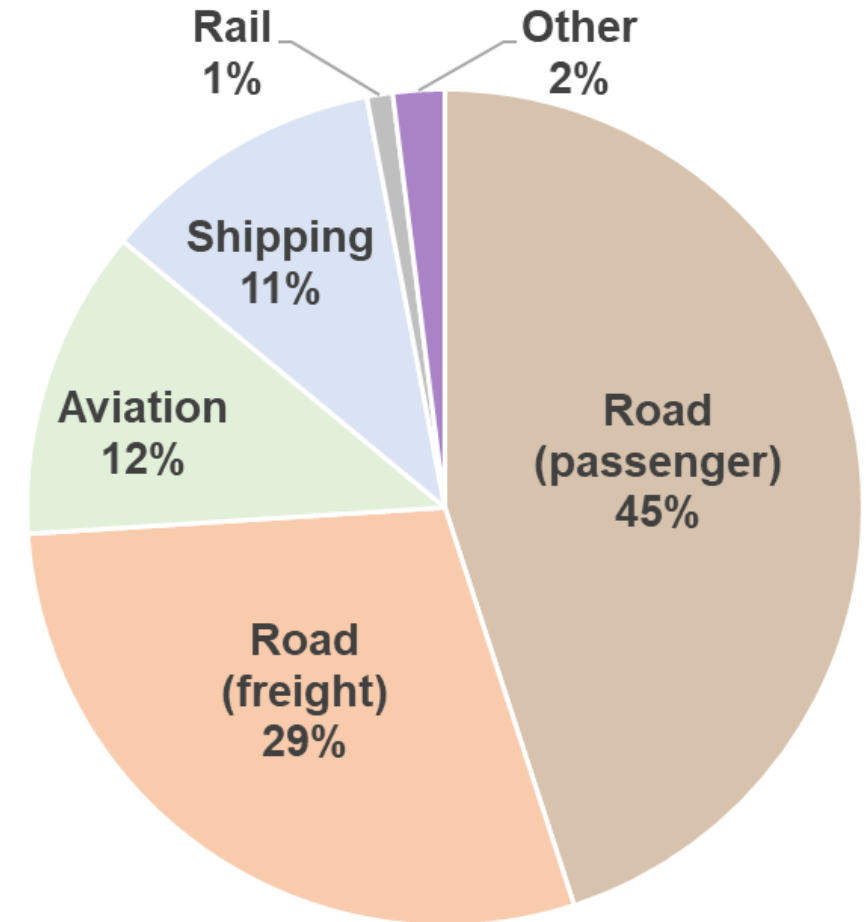
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October 7, 2021



Heavy Duty Transport Represents a Small But Important Fraction of Global Energy Consumption and CO₂ Emissions

- 8 billion tonnes global energy-related CO₂ emissions in 2018
 - with transport comprising 24% of that total
- Heavy duty transport accounts for just over 50% of transport-related CO₂
 - **13% of CO₂ emissions from global energy consumption overall**
 - **Difficult to decarbonize sector via electrification and other approaches**



Breakdown of Transport CO₂ Emissions in 2018

Sources: IEA. World Energy Balances, 2020. https://iea.blob.core.windows.net/assets/23f096ab-5872-4eb0-91c4-418625c2c9d7/World_Energy_Balances_Overview_2020_edition.pdf

H. Ritchie. Cars, planes, trains: where do CO₂ emissions from transport come from? Our World in Data. October 6, 2020. <https://ourworldindata.org/co2-emissions-from-transport#licence>

Rethinking Nuclear Deployment Models

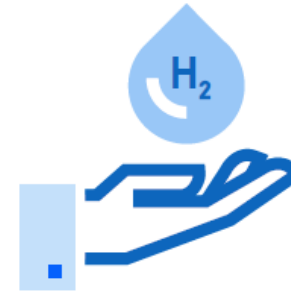


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Rethinking Deployment Scenarios
to Enable Large-Scale, Demand-
Driven Non-Electricity Markets
for Advanced Reactors

JUNE 2021

Vision for scalable, dispatchable, zero-carbon energy from nuclear by 2050.



Hydrogen-based and synthetic
fuels to decarbonize heavy
transportation



Potable water as the "oil" of
the 21st century

White paper no. 3002022311 available for download at:
<https://www.epri.com/research/products/000000003002022311>

Full report coming soon: *Rethinking Deployment Scenarios to Enable Large-Scale, Demand-Driven Non-Electricity Markets for Advanced Reactors*. 2021. 3002018348.

What Conditions Enable Nuclear Deployment at Scale?

- Large future markets for drop-in clean fuel substitutes for hard-to-decarbonize sectors could provide market pull to drive commercialization of cost-competitive advanced reactors
 - Getting to a true Nth-of-a-kind
 - Establishing an order book
 - Realizing true economies of serial manufacturing
- Four business models/scenarios:
 - Ammonia production for commercial shipping
 - Synthetic jet fuel production for commercial aviation
 - Power generation, fuel production, and desalination
 - Direct H₂ injection into existing gas infrastructure



Source: Image use courtesy of Jetstar Airways (jetstar.com) under the Creative Commons Attribution-Share Alike 2.0 Generic license.

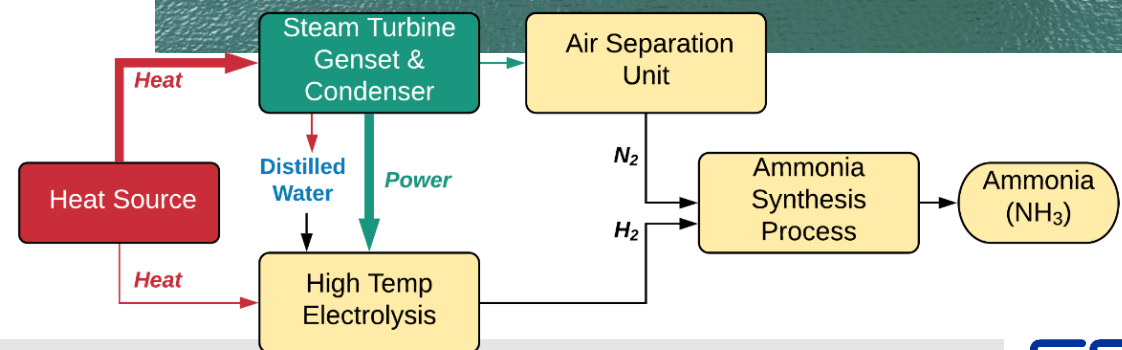
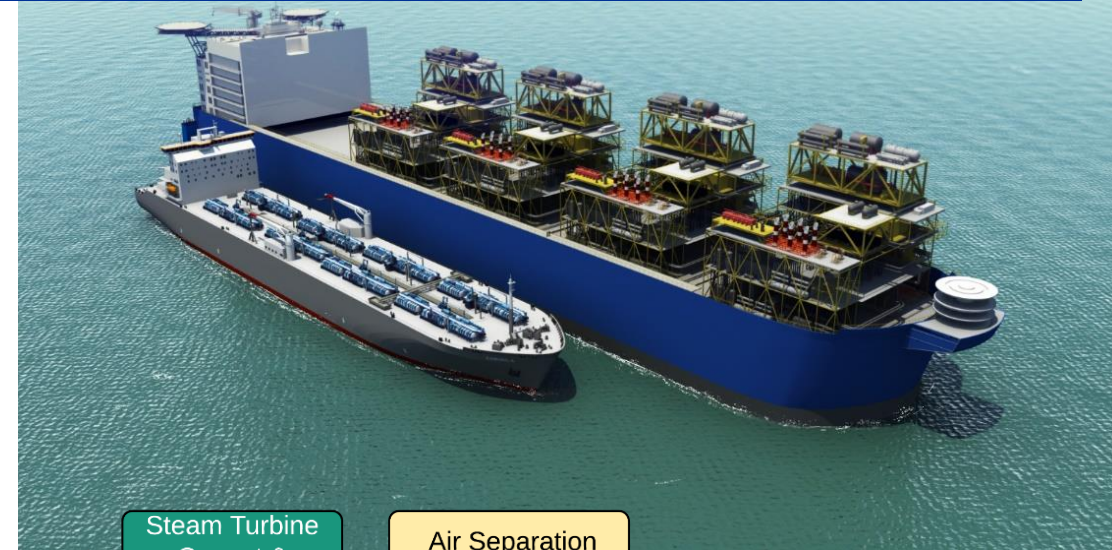
**shipyard-based,
offshore deployment**

Carbon Neutral Ammonia for Commercial Shipping

Key Tenets of Vision

- Fabrication of entire standardized plant/platform in a shipyard environment
- Delivery of plant/platform to the point of use via marine conveyance
- **Production of storable, conveyable, drop-in substitutes for fossil fuels in hard-to-decarbonize sectors via floating production, storage, offloading (FPSO) model**
- Traceable techno-economic analyses

- **Commercial shipping conveys 90% of global trade**
 - Consumes 3 million barrels of fuel oil per day / ~200 GWth
 - Difficult to decarbonize
- **Large existing established global ammonia market (\$50 B/170 MMT annual demand)**
 - Expansion to marine fuel could add ~\$140 billion annually



A blue-tinted photograph of four people, two men and two women, standing in a row. They are dressed in professional attire, including lab coats and a hard hat. The text 'Together...Shaping the Future of Energy™' is overlaid in white on the image.

Together...Shaping the Future of Energy™