Brief Introduction to SMRs

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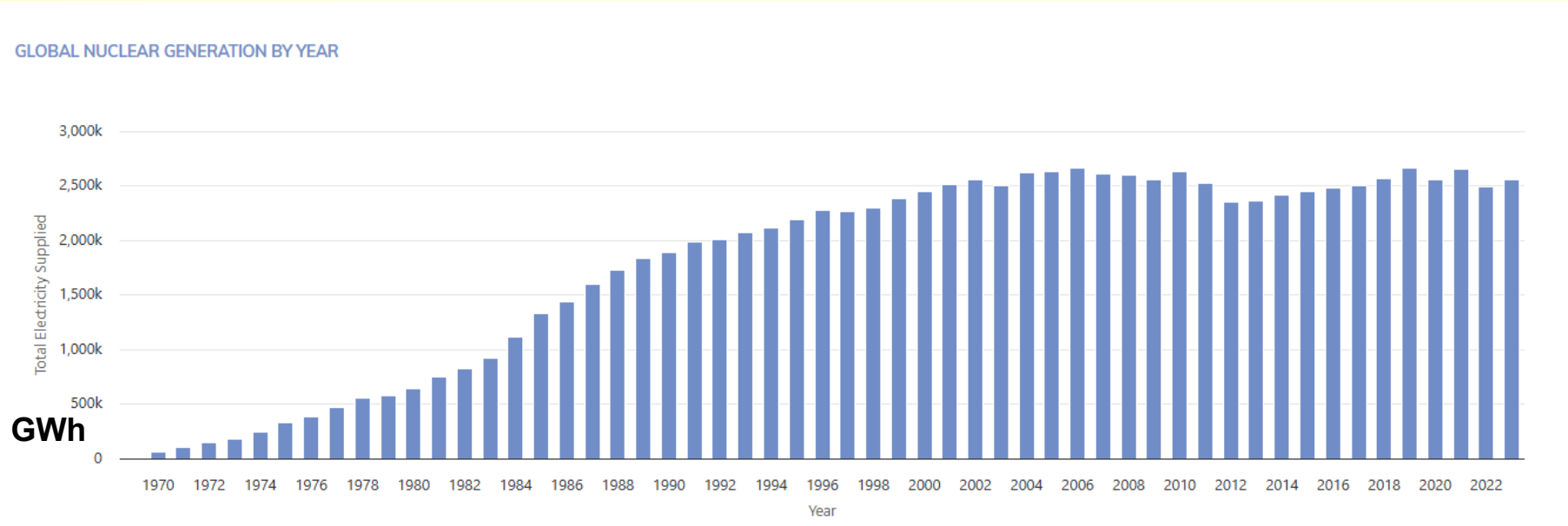
1970-2023年全球核能發電量

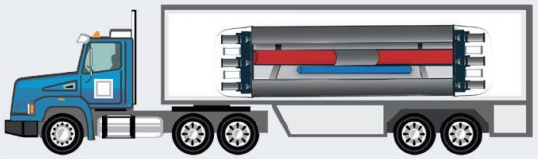
（GWh）



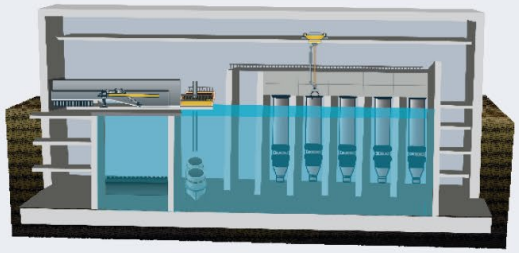
微小型反應器-SMR&MMR (1/4)

◆ 反應器分類

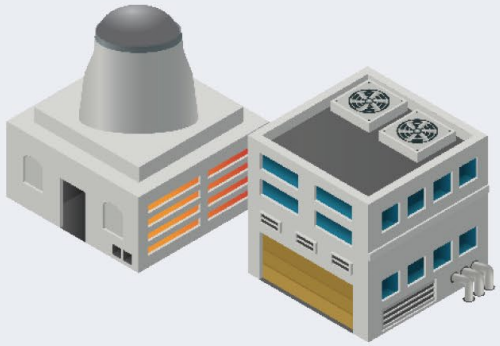
Micro Reactors
Range: 1 MW to 20 MW
Can fit on a flatbed truck, and are mobile and deployable.



Small Modular Reactors
Range: 20 MW to 300 MW
Can be scaled up or down by adding more units.



Full-Size Reactors
Range: 300 MW to 1,000+MW
Can provide reliable, emissions-free baseload power.



https://www.energy.gov/sites/prod/files/2020/01/f70/011620%20Advanced%20Reactor%20Types%20Factsheet.pdf

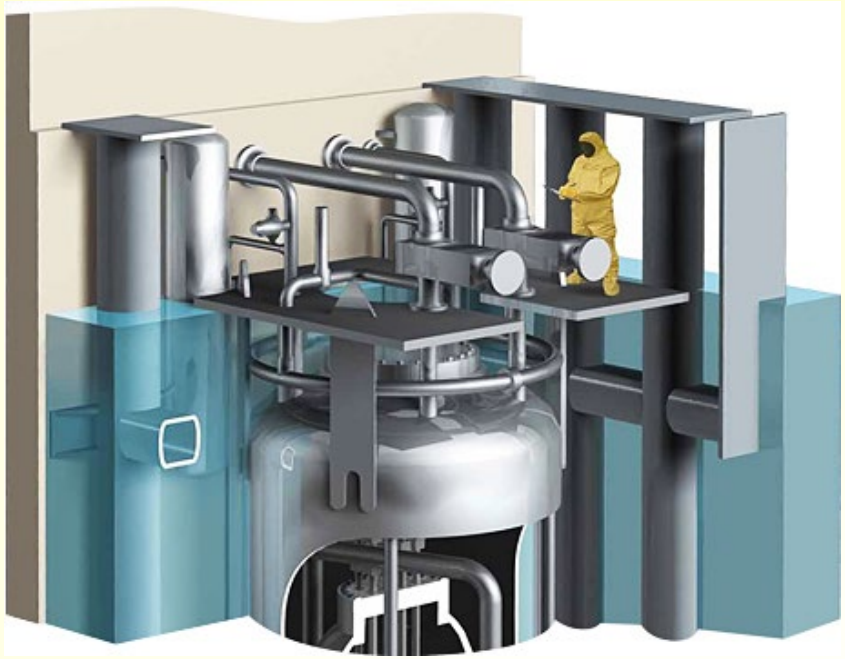
供電吃緊時就會奉命上線支援的小機組

核電廠內一部緊急用氣渦輪輕油發電機裝置容量：**40 MW**

4口之家用電量：5 kW (0.005 MW)

微小型反應器-SMR&MMR (2/4)

- **SMR特點**
  - 價格便宜
  - 低環境衝擊
  - 本質性安全
  - 較高民眾接受度
  - 小區域及偏鄉供電
  - 模組建置
  - 工程耗時短
  - 管制機關審查時間短



https://www.energy.gov/ne/advanced-small-modular-reactors-smrs

微小型反應器-SMR&MMR (3/4)

◆ MMR特點

- 工廠製造後現地安裝
- 運送與移除簡單快速
- 物理定律下的高安全性
- 可靠富彈性的供電模式
- 運轉相對容易
- 數年不須裝填新燃料
- 符合各種型態的用電需求
- 可與其他供電設施整合

https://www.energy.gov/ne/downloads/infographic-what-nuclear-microreactor-0

微小型反應器-SMR&MMR (4/4)

◆ SMR應用實例

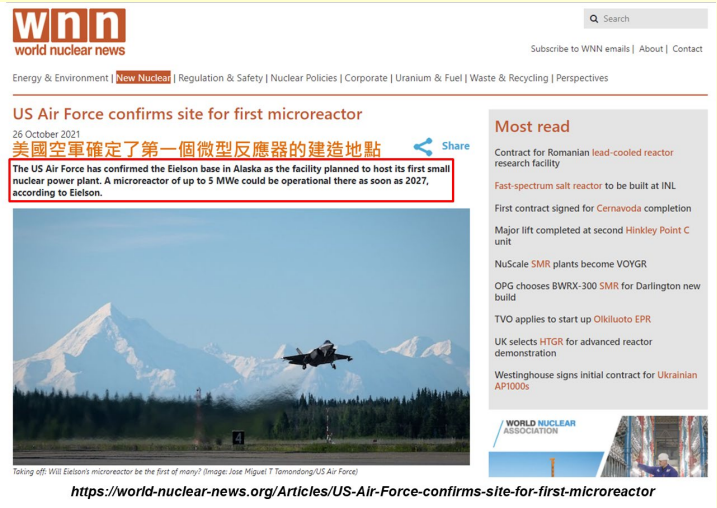
山東石島灣核電站 (210 MWe)

https://baike.baidu.hk/item/石島灣核電站/1407051

俄羅斯浮動式核電站 (100 MWe)

https://en.wikipedia.org/wiki/Floating_nuclear_power_plant

◆ MMR應用實例



https://world-nuclear-news.org/Articles/US-Air-Force-confirms-site-for-first-microreactor

https://www.epa.gov/

比爾蓋茲泰拉能源的小型反應器

Natrium反應器

ADVANCED NUCLEAR TECHNOLOGY

Generation IV non-light water reactors offer many advantages, including potentially better economics, improved fuel utilization, higher operating temperatures for industrial process heat applications and integrated energy storage systems, and the ability to close the fuel cycle. Sodium-cooled fast reactors have the highest technology readiness levels of any advanced non-light water reactor that enables the technology to be commercialized fast enough to have an impact on decarbonization.

The Natrium reactor builds on existing nuclear energy plant technology on a number of fronts. It offers safety enhancements, reduces even further the risk of weapons proliferation, minimizes waste production, uses uranium fuel more efficiently and lowers costs.