

Outlook for Nuclear Power in and outside Japan

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Key Points of This Presentation

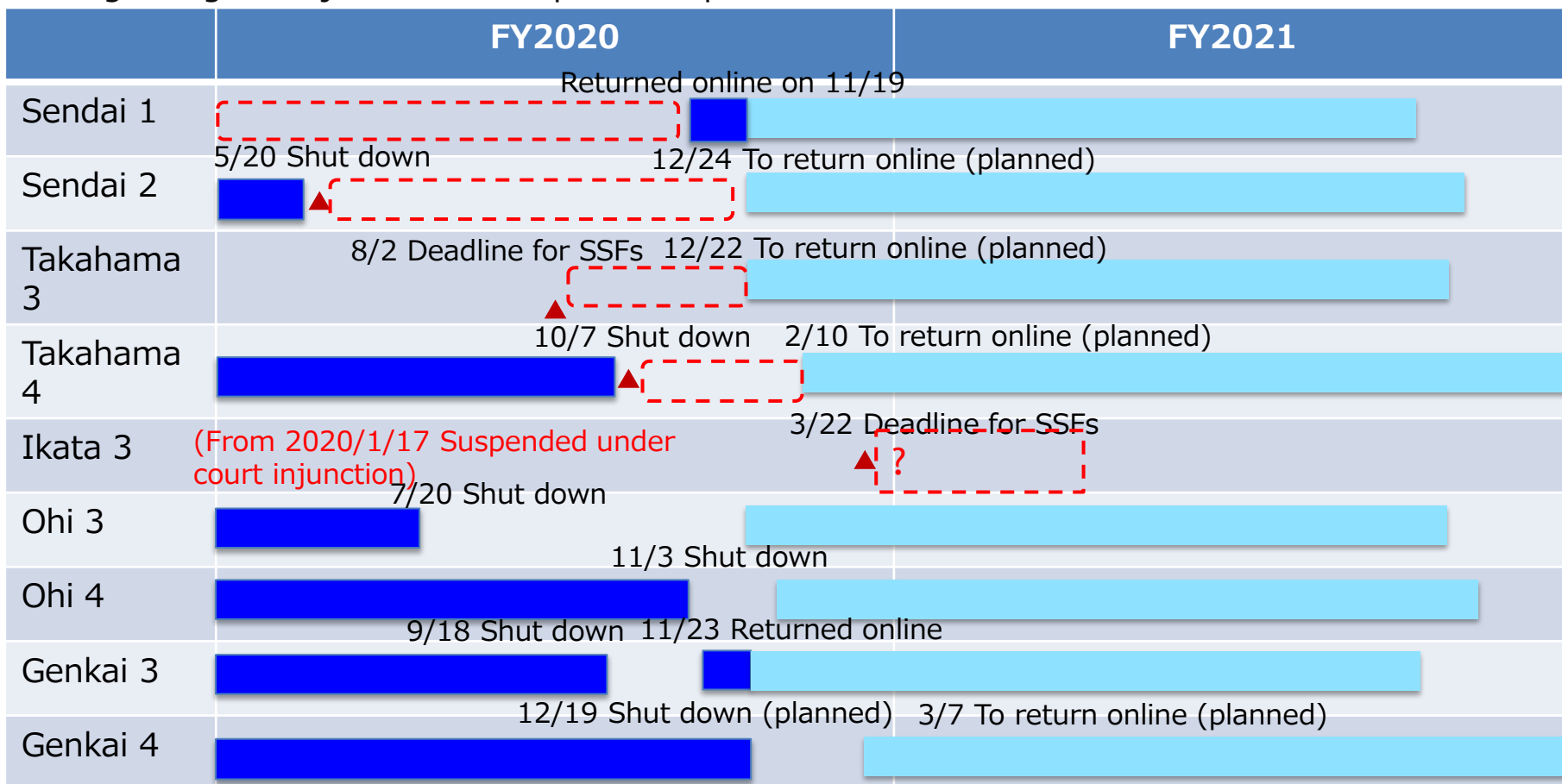
- ✓ Among the existing reactors in Japan, around 4 are expected to restart by the end of FY2021, in addition to the 9 that had restarted by 2018 with the permission of the Nuclear Regulation Authority. However, the outlook for restarting is not certain as it will depend heavily on non-technological factors such as court decisions and approval by municipalities.
- ✓ A literature survey, the first phase for selecting a HLW disposal facility site, began in Hokkaido's Suttsu Town and Kamoenai Village in November 2020. Information disclosure and discussions by the Nuclear Waste Management Organization of Japan (NUMO), the entity in charge of the HLW project, must be watched.
- ✓ On November 11, the recyclable fuel storage center in Mutsu City, Aomori, obtained approval for changes to its business concerning the safety assessment in accordance with the new regulation standards. On December 9, the MOX fuel processing facility of Japan Nuclear Fuel Limited obtained approval for changes to its MOX fuel fabrication business.
- ✓ UAE's Barakah Unit 1 went online in September and Belarus' Ostrovets Unit 1 in November 2020. Currently, 33 countries around the world are using nuclear power.

Japan (1) Outlook for Operation of NPPs: Group 1

- Sendai 1 & 2 have restarted following the completion of SSFs*.
- Takahama 3 & 4 are also technologically capable of restarting in FY2020.
- Whether Ikata 3 will restart depends on the court decision regarding the injunction to suspend the plant.

*Specialized safety facilities

- ▲ Deadline for construction
- ▭ Shut down after passing the deadline



■ Operation (actual)

■ Operation (planned)

*Plans for shutdown and returning online are based on operators' announcements as of 12/21.

Japan (2) Outlook for Operation of NPPs: Group 2

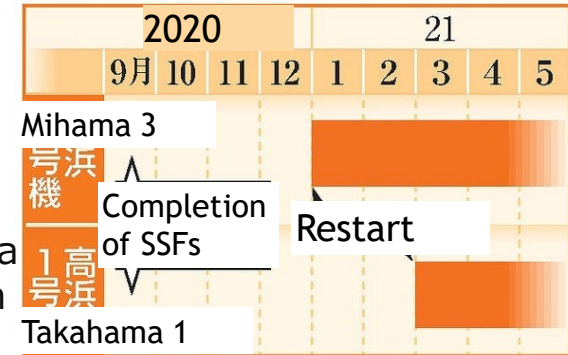
- Construction of safety features completed in September 2020 for Mihama Unit 3 and Takahama Unit 1

Source: September 18, 2020, Fukui Shimbun
<https://www.fukuishimbun.co.jp/articles/-/1167672>

- Safety features are due to be completed in FY2020 for Takahama Unit 2 as well
- The application for pre-service inspection for Kashiwazaki-Kariwa Unit 7 (Nov. 6, 2020) **clearly indicated** “the timing of completion of inspection prior to starting up the reactor (April 2021)”

Source: November 6, 2020, TEPCO PR
<https://www.tepco.co.jp/press/release/2020/pdf4/201106j0101.pdf>

Timeline announced by KEPCO



The application also stated that “The construction schedule does not indicate the timing for restarting. The understanding of local communities is a prerequisite for restarting the plant.”

	FY2020	FY2021
Mihama 3	Completed construction of safety features	▲ Oct. 25
Takahama 1		▲ Jun. 9
Takahama 2		▲ Jun. 9
Kashiwazaki-Kariwa 7	Submitted application for pre-service inspection	

▲ Deadline for SSF construction

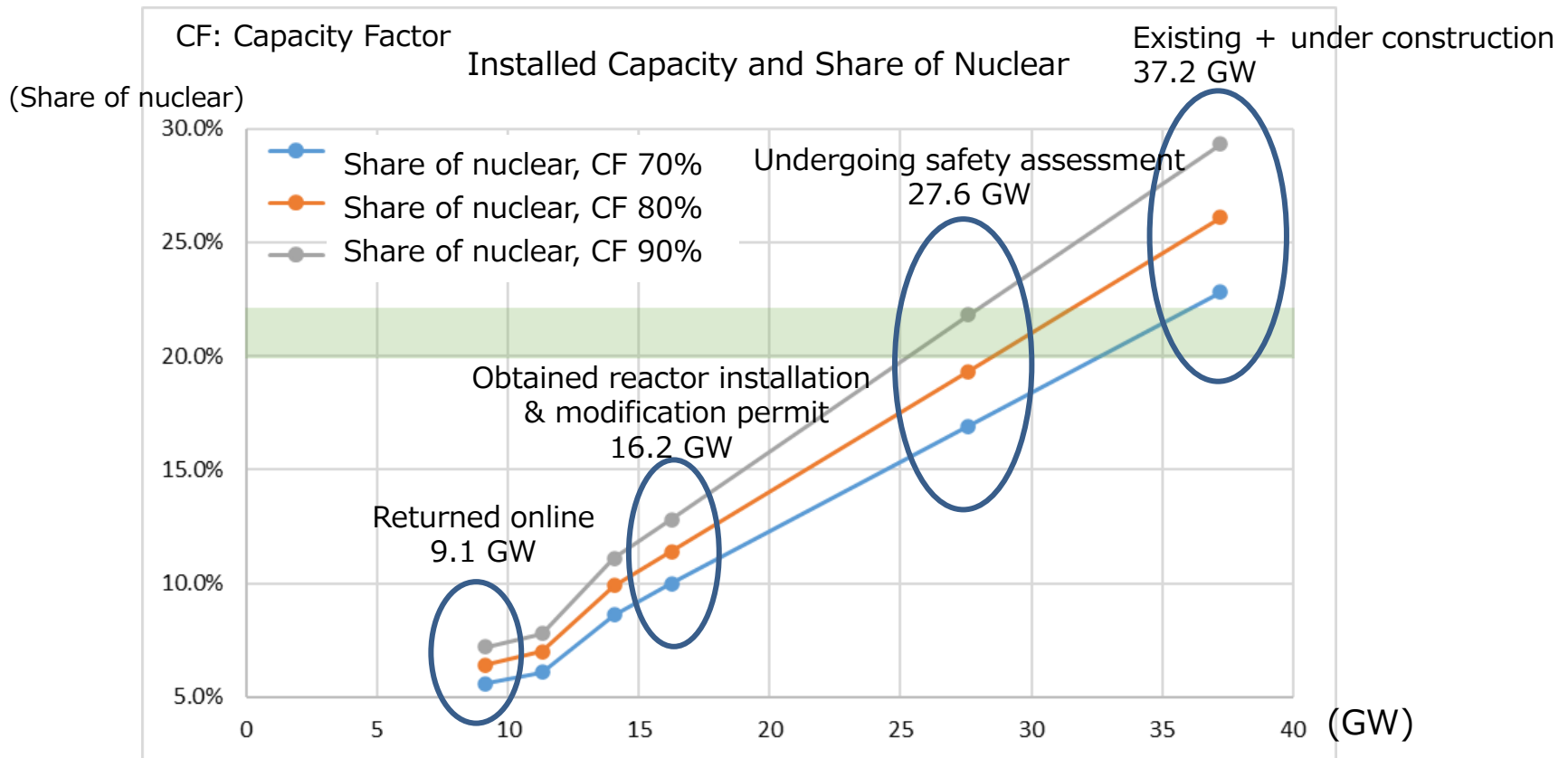


Japan (3) Conditions for Reaching "20-22%"

- 27 plants (existing and under construction, 27.6 GW in total) undergoing safety assessment + undisrupted operation

The calculation is very simple. Please try it yourself!

$$\text{Share of nuclear (\%)} = \frac{\text{Installed nuclear capacity (kW)} \times 8,760 \text{ h} \times \text{CF (\%)}}{\text{2030 total generation forecast (approx. 1 trillion kWh)}}$$



Japan (4) HLW Final Disposal Facility

- In October 2020, Hokkaido's Suttsu Town applied for a literature survey, the first phase for selecting a HLW disposal facility site.
- Around the same time, Hokkaido's Kamoenai Village accepted the government's request to undergo a literature survey.
- NUMO* began literature surveys in these two municipalities on November 17.

*NUMO: Nuclear Waste Management Organization of Japan
The entity in charge of the HLW final disposal project

From a PR statement by
NUMO President Kondo dated
November 17, 2020



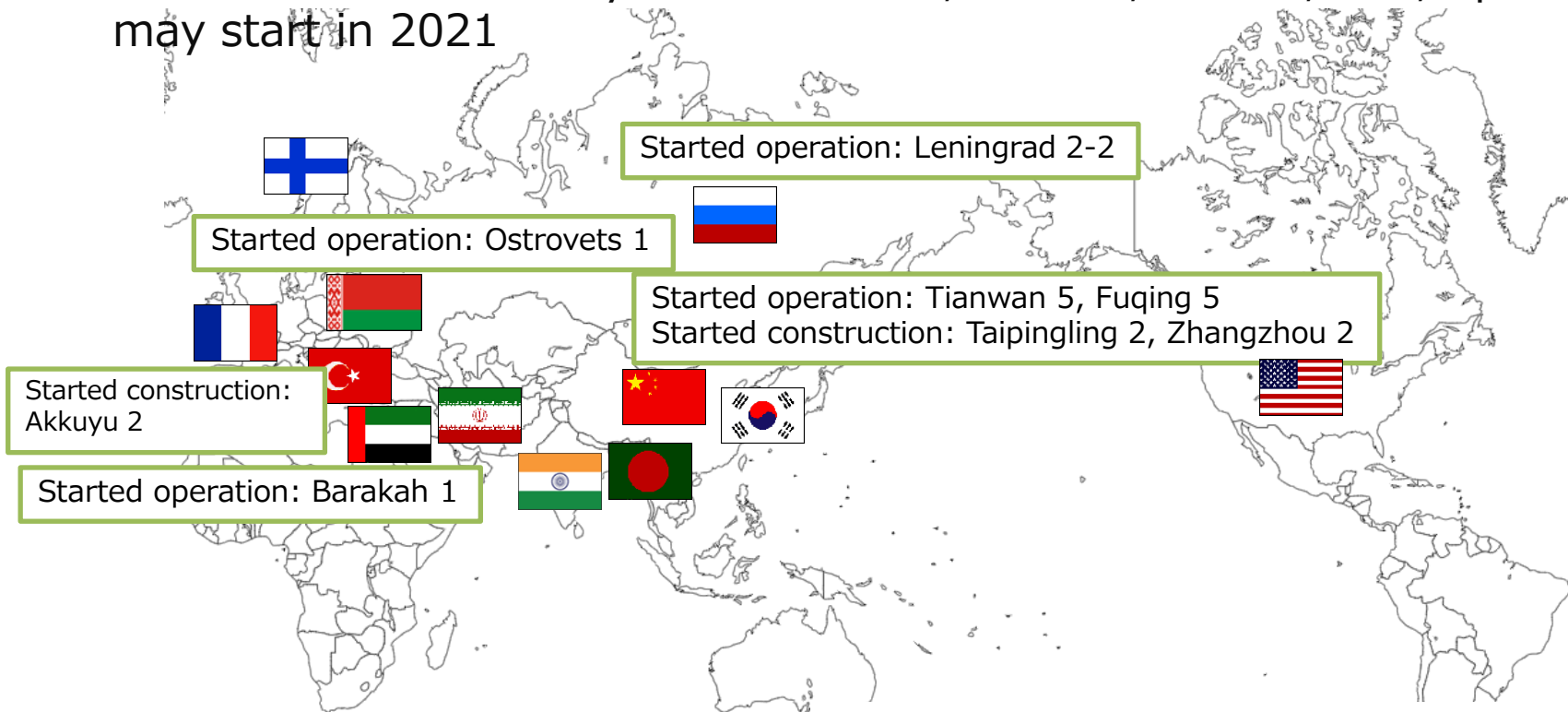
Today, a modification permit for our FY2020 business plan was received from the Ministry of Economy, Trade and Industry. Accordingly, NUMO will conduct a literature survey in Suttsu Town and Kamoenai Village in Hokkaido Prefecture. For now, we plan to start by collecting and organizing necessary literature and data, including geological maps and academic journals, while **explaining to the local community how the literature survey will proceed**.

We regard the survey as a **part of dialogs** with the local communities, in which we study the geological properties of the municipalities which have shown an interest in the project through literature and data, and provide information **to deepen their understanding of the geological disposal project**. No radioactive waste of any kind will be brought into the municipality during the survey period.

In the literature surveys for Suttsu Town and Kamoenai Village, NUMO plans to not only share the details of the project, including the geological disposal technology and its safety, and the status and results of the survey, but also the possible effects and risks of the project on local industries through "forums for dialog." We plan to keep conducting dialogs to also discuss the vision for economic development of the local communities.

Outside Japan (1) Construction Plans Proceed in Emerging Countries

- Newly started operation: 5 reactors (China, UAE, Belarus, Russia)
- Started construction: 3 reactors (Turkey, China)
- Construction under way also in the US, Finland, France, etc.; operation may start in 2021



**Countries using nuclear power:
31→33 (as of December 2020)**

Outside Japan (2) From Start of Construction to Start of Operation in Emerging Countries

● Belarus: Ostrovets Nuclear Power Plant, Unit

- 2006: The government approved the new construction plan for two nuclear power plants
- 2009: Atomstroyexport, a subsidiary of Russian nuclear company Rosatom, was selected as the main contractor
- 2012: Construction agreement was concluded
- 2013: Construction of Unit 1 started, 2014: Construction of Unit 2 started
- Sep. 2020: Lithuania, Estonia, and Latvia decided not to import power from Belarus
- Nov. 2020: Unit 1 went online
- 2021: Unit 2 to go online?



● UAE: Barakah Nuclear Power Plant

- 2009: State-run nuclear company ENEC was established. In December, a South Korean corporate consortium was selected as the main contractor and an agreement was concluded for four APR-1400 reactors
- 2010: International Advisory Board (IAB) was established
- 2012: Construction of Unit 1 started, construction of Units 2 to 4 is to start in 2013–2015
- Aug. 2020: Unit 1 went online
- 2021–2023: Units 2 to 4 to go online?

Acquiring practical know-how through IAB

Outside Japan (3) NuScale's SMR Construction Plan (1/2)

- Power companies in Utah, USA and its vicinity plan to build a NuScale small modular reactor (SMR) in Idaho National Laboratory (INL).

<https://inl.gov/article/frequently-asked-questions/>

Year	Event
2015	DOE provided \$167 million to UAMPS* ¹ as preparation costs for COL for the NuScale reactor. 32 of UAMPS' 45 members joined CFPP* ² .
2016	NuScale applied for design certification (DC) by NRC.
2018	DOE, UAMPS, and Battelle Energy Alliance signed an MOU to include SMRs in the JUMP program* ³ , and use it also for a PPA to meet the electricity demand in INL.
2018-19	UAMPS member voted on a loan to CFPP.
2020/9/11	NRC issued a standard design approval (SDA) for NuScale's SMR, the first for an SMR. https://world-nuclear-news.org/Articles/US-regulator-issues-first-ever-SMR-design-approval
2020/10/16	DOE decided to provide \$1.355 billion to CFPP over 10 years. https://www.uamps.com/file/41df5556-8f47-47c3-af10-d3665271fd20

Source: <https://www.energy.gov/ne/articles/doe-office-nuclear-energy-announces-agreement-supporting-power-generated-small-modular>

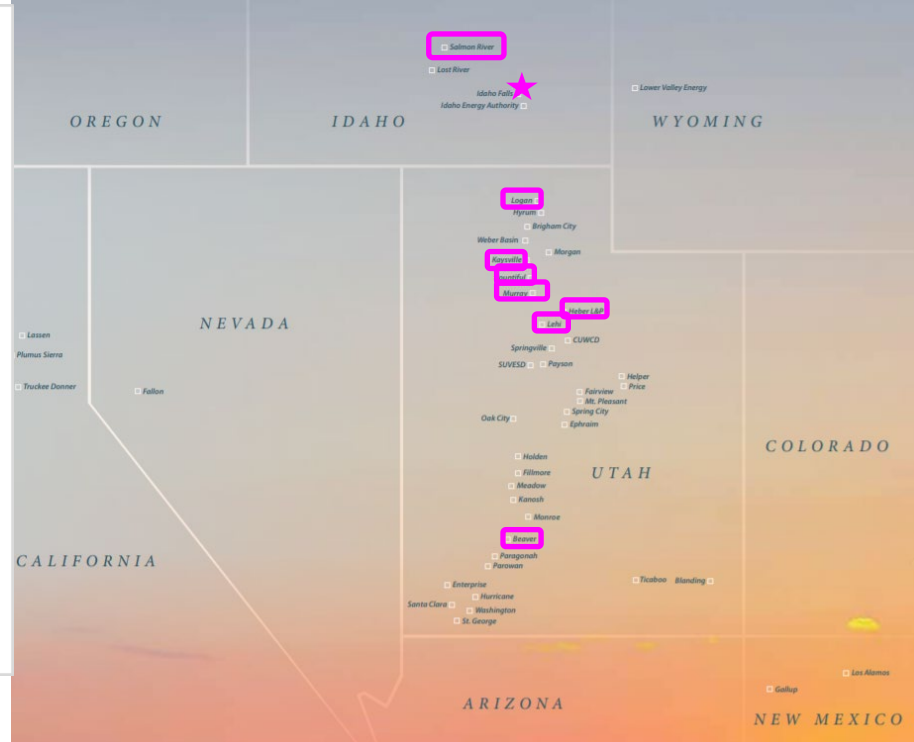
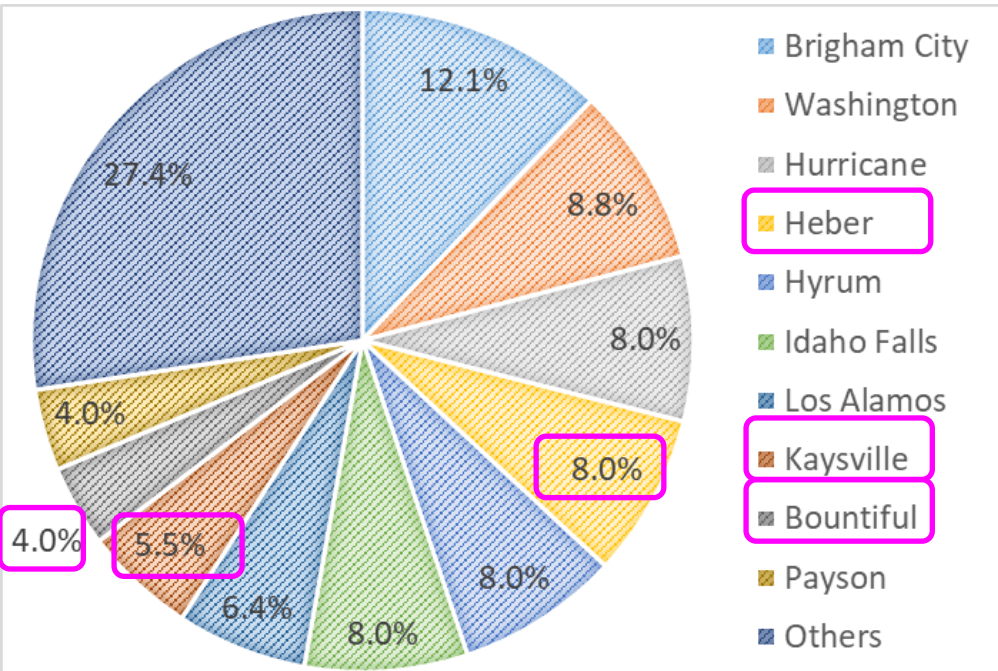
*1 UAMPS: Utah Associated Municipal Power Systems

*2 CFPP: Carbon Free Power Project (UAMPS' carbon-free power system project)

*3 JUMP: The Joint Use Modular Plant

Outside Japan (4) NuScale's SMR Construction Plan (2/2)

- The funding for this project is as follows:



 Municipalities that announced withdrawal in 2020

Source: INL website, UAMPS website, etc.

The NPM costs have increased from \$4.2 billion to \$6.1 billion (without any design change). How many municipalities will be remaining by December 2021?