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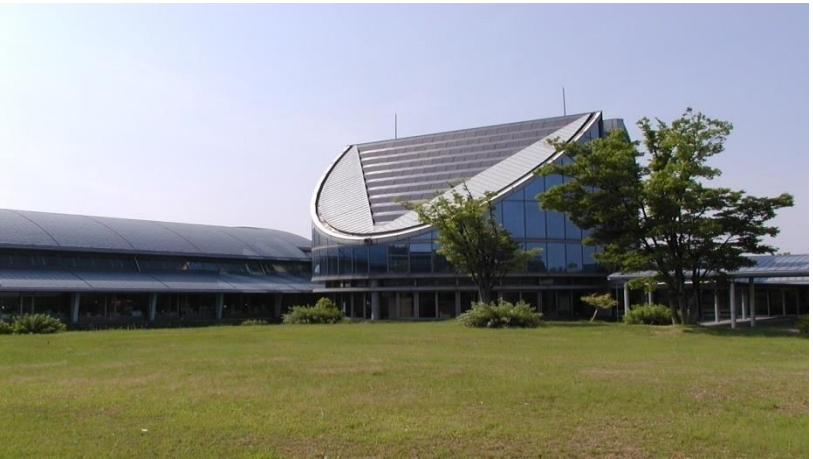
Session 2B: RD&D priorities for CO_2 storage and cross-cutting aspects of CCUS

CO_2 Storage R&D Priorities in Japan

November 28, 2018



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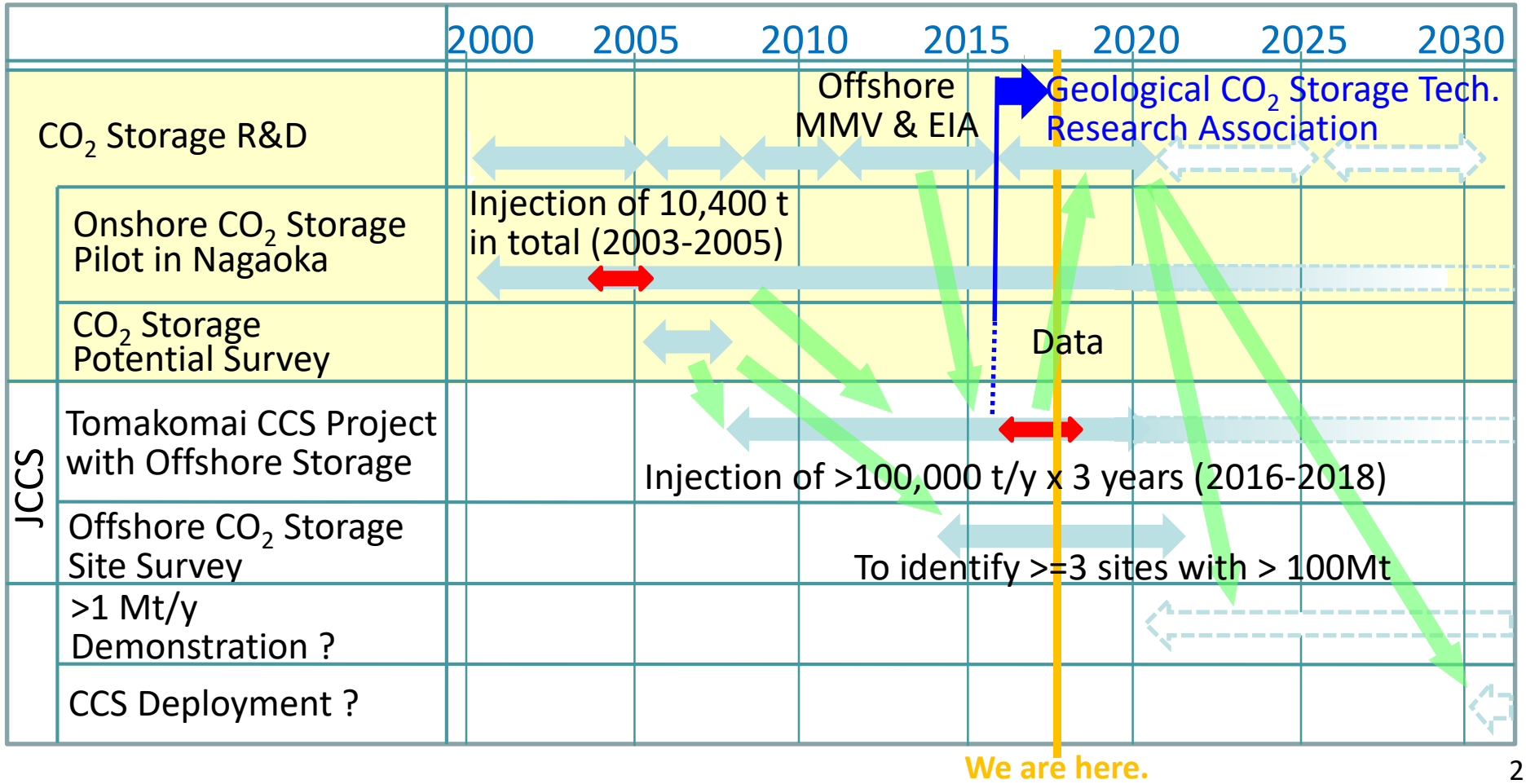
CO_2 Storage Research Group

Research Institute of Innovative Technology for the Earth (RITE)

CO_2 Storage RD&D Projects in Japan



Research Directions in the Ongoing CO_2 Storage R&D

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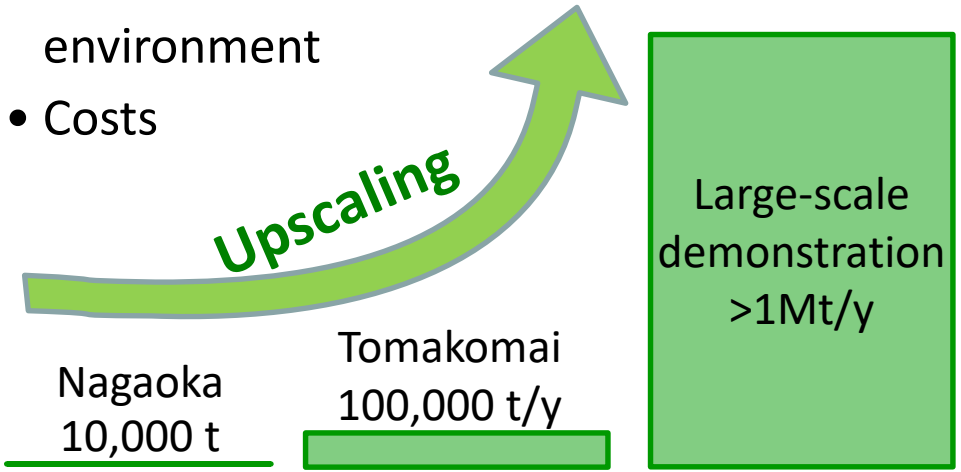
Traditional Challenge

- Heterogeneity
- Availability of geological data
- Seismicity
- Offshore environment
- Costs

New Challenge

• **Upscaling**



Our Research Directions

- **Upscaling**
  (modelling & simulations, pressure management, microbubble CO_2 injection)
- **Integration & downscaling**
  (Injection safety management, fiber-optics, offshore EIA)
- **Non-technical gaps**
  (PO, legal frameworks, IRP, risk management with US NRAP)

Emphasizing on

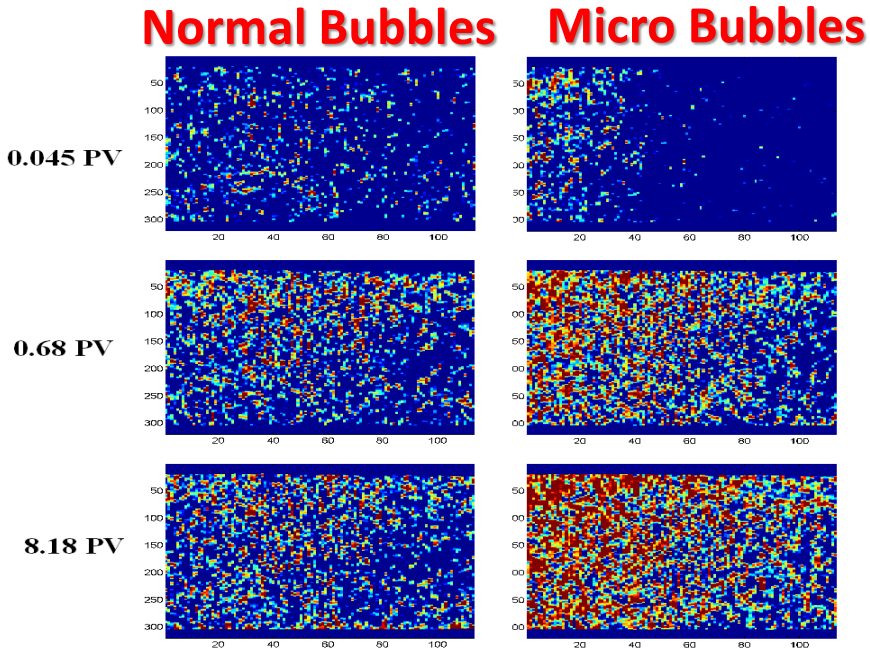
- Field tests & field data
- Collaboration with private sector
- International collaboration

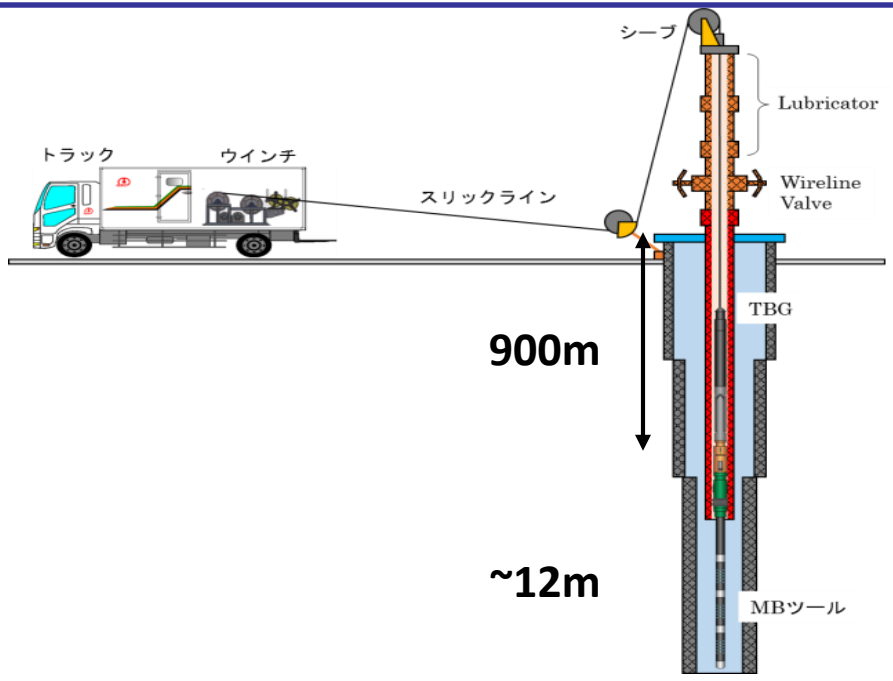
Microbubble CO_2 Injection

Microbubble CO_2: Small; High solubility; and Low buoyancy

Potential to

- Maximize pose space utilization,
- Make low-permeable formations applicable to storage, and
- Improve oil recovery rate in EOR.





Injection Safety Management (OBC/ATLS)

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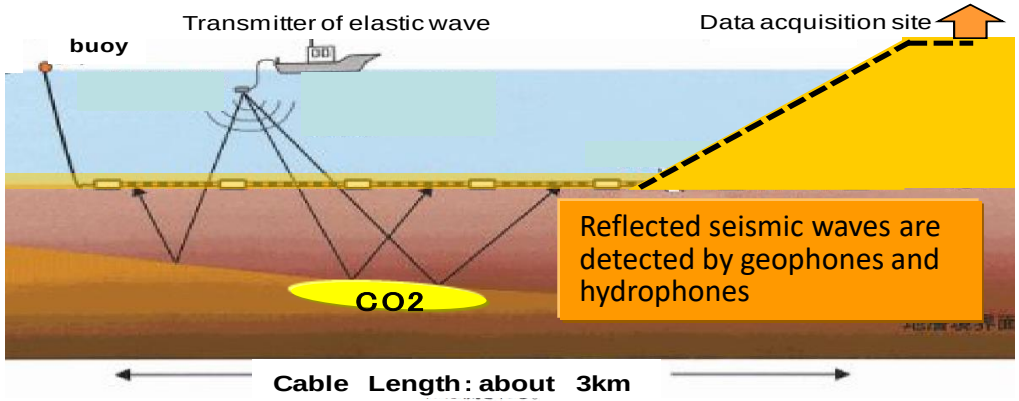
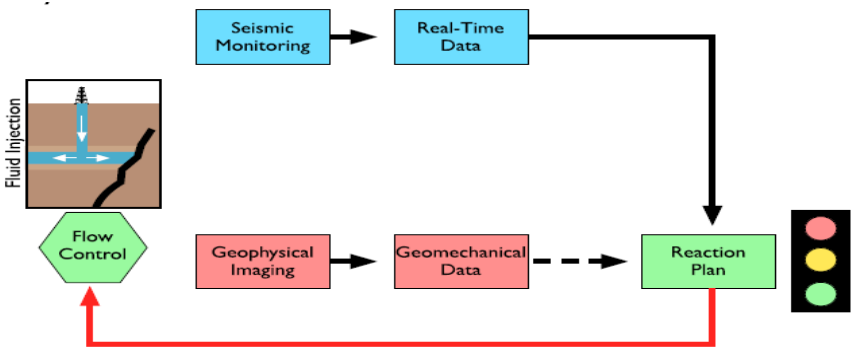
Ocean Bottom Cable (OBC)

- High-accuracy & economical 2D/3D seismic survey,
- Continuous seismic monitoring

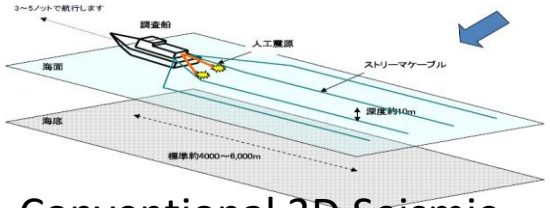
Advanced Traffic Light Systems (ATLS)

- Injection safety management system based on analyses of **big data**, including OBC data





Grigoli et al. (2016)

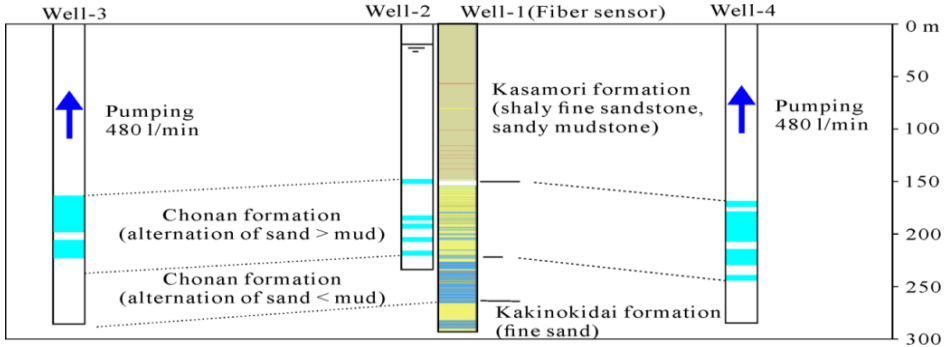


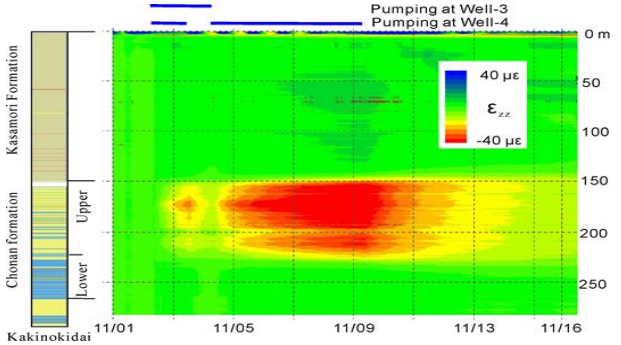
Conventional 3D Seismic with hydrophones

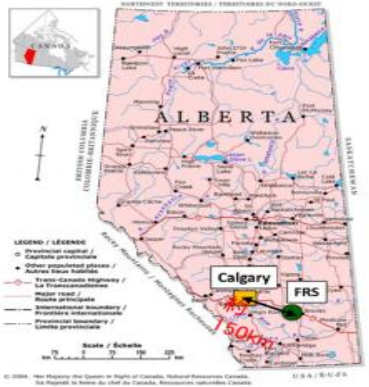
2007-2009:
Preliminary Test at a pond
2010-2012:
Offshore Field Test
2013- :
Operational in Tomakomai

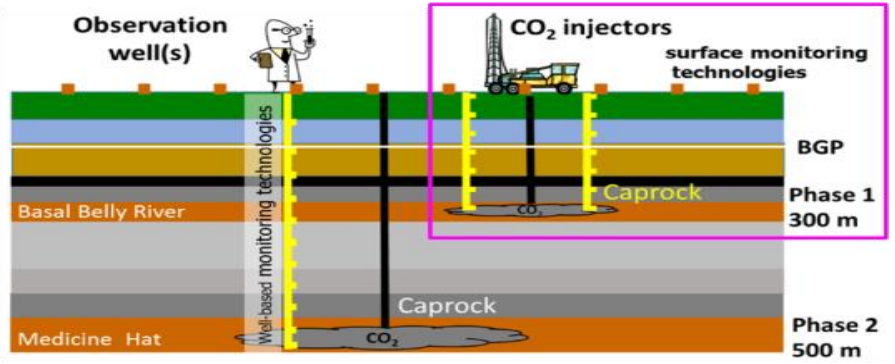
Fiber Optic Sensing

- Conventional pressure and temperature measurement
- Economical seismic survey - DAS/VSP
- Subsurface strain monitoring: formation stability & leak detection









Prioritized Research Directions in MI

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Prioritized Research Directions (PRDs) for CO_2 Storage			Upscaling	Integration & Downscaling	
			Micro-bubble	OBC/ ATLS	Fiber optics
Injectivity & Capacity	S-1	Advancing multiphysics and multiscale fluid flow to achieve gigatonne/year capacity	V		
	S-2	Understanding dynamic pressure limits for gigatonne-scale CO_2 injection			V
	S-3	Optimizing injection of CO_2 by control of the near-well environment	V	V	
MMV	S-4	Developing smart convergence monitoring to demonstrate containment and enable storage site closure			V
	S-5	Realizing smart monitoring to assess anomalies and provide assurance		V	V
Induced Seismicity	S-6	Improving characterization of fault and fracture systems		V	V
	S-7	Achieving next-generation seismic risk forecasting		V	V
Well Integrity	S-8	Locating, evaluating, and remediating existing and abandoned wells			V
	S-9	Establishing, demonstrating, and forecasting well integrity			V

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