SIEMENS

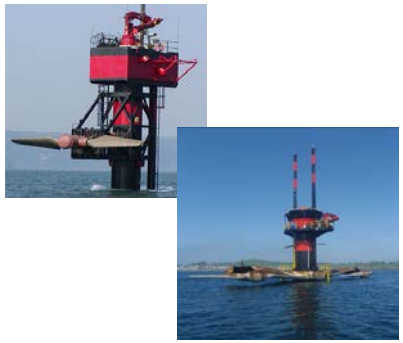
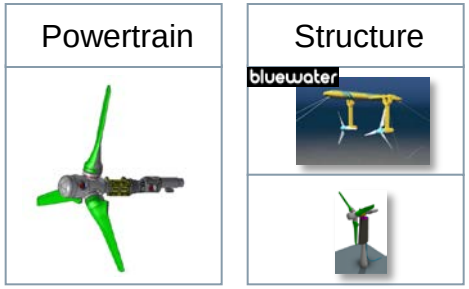
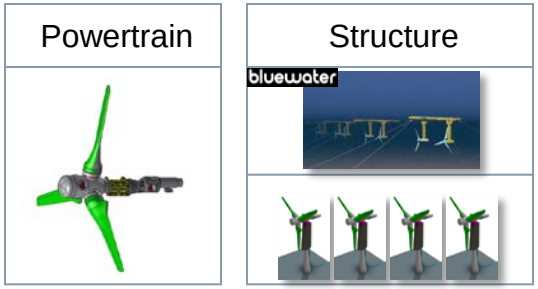
Marine Current Turbines

ICOE 2014 Halifax, Kai Kölmel

siemens.com/answers

MCT has long-term experience in tidal power, developing a technology portfolio

SIEMENS

	1 Proof of technology	2 Prototype	3 Commercial Generation I
			
Name	SeaFlow/SeaGenS (surface-piercing)	SeaGenU (submerged) SeaGenF (floating)	SeaGenU (submerged) SeaGenF (floating)
Year	2003/2008	2016/17	2018+
Facts	Single device SeaGenS ▪ 2 powertrains á 0.6MW ▪ Full scope by MCT ▪ Has generated ~10 GWh of electricity	▪ Single device or small scale arrays ▪ Uprated powertrain (1MW)	▪ From small scale to large scale arrays ▪ Further uprating of powertrain
Project size	0.3MW/1.2MW	2-6MW	10-50MW

One Generic power train - HALT tested

Universal Power Train & Energy Conversion

SeaGenS-2MW

- Rotor Diameter – **20 m** (up to 24 m)
- Tip Speed – **12 m/s** (up to 14.4 m/s)
- Blade pitch capability – **270 degrees**
- Nominal rated rotor thrust – approx. **900 kN**
- Power to the grid – approx. **7 to 14 MWh/day***
- Rotor speed – **11.5 RPM**
- Rated power – Each power train has a **rated power of**
- **1** or **1.02 MW**** (combined power output of 2 MW per turbine) at a current velocity

Spotlight: Testing & Qualification

MCT's powertrain is suitable for different structures to achieve cost-optimal solution for customers

SIEMENS

Marine Current Turbines
A Siemens Business

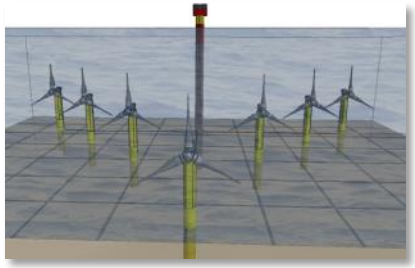
Powertrain & Electrical Equipment

Core competence: Reliable, efficient multi-structure energy conversion chain

- Main components: powertrain (blades, gearbox, generator), electrical equipment (frequency converter, transformer, switchgear)
- New 1MW-powertrain successfully completed highly accelerated lifetime onshore test, simulating 18 years of operations

bluewater

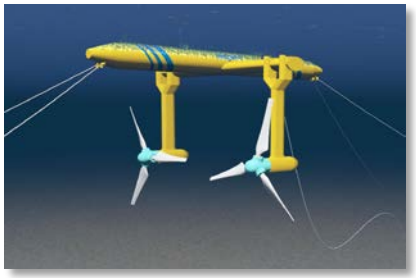
SeaGenU (submerged)



Submerged structure to reduce costs & exploit full market potential

- 6-10 powertrains per tower
- Easy access to electrical equipment in tower
- Long-term: electrical equipment also submersible
- Low visual impact

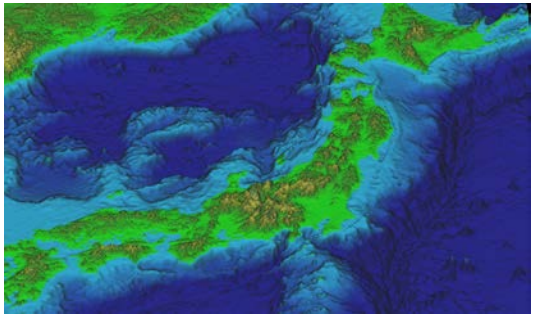
SeaGenF (floating)



Floating structure for deep sites and minimized installation costs

- 2 powertrains per floating structure
- Low installation costs (only mooring)
- Deep sites addressable (up to 200m)
- O&M optimized access & towing

Why floating devices in Japan?



Map of Japan
Source: UNAVCO

Bathymetry of Islands of Japan

- Significant water depths (partly 5000m+)
- Japan's bathymetry drops quickly

Consequences

- Limited space for offshore wind
- Favours densely packed renewable energy sources

Why floating

- Flexible mooring solution allows deeper waters
- Mitigates challenging bathymetry
- Standardisation of turbines