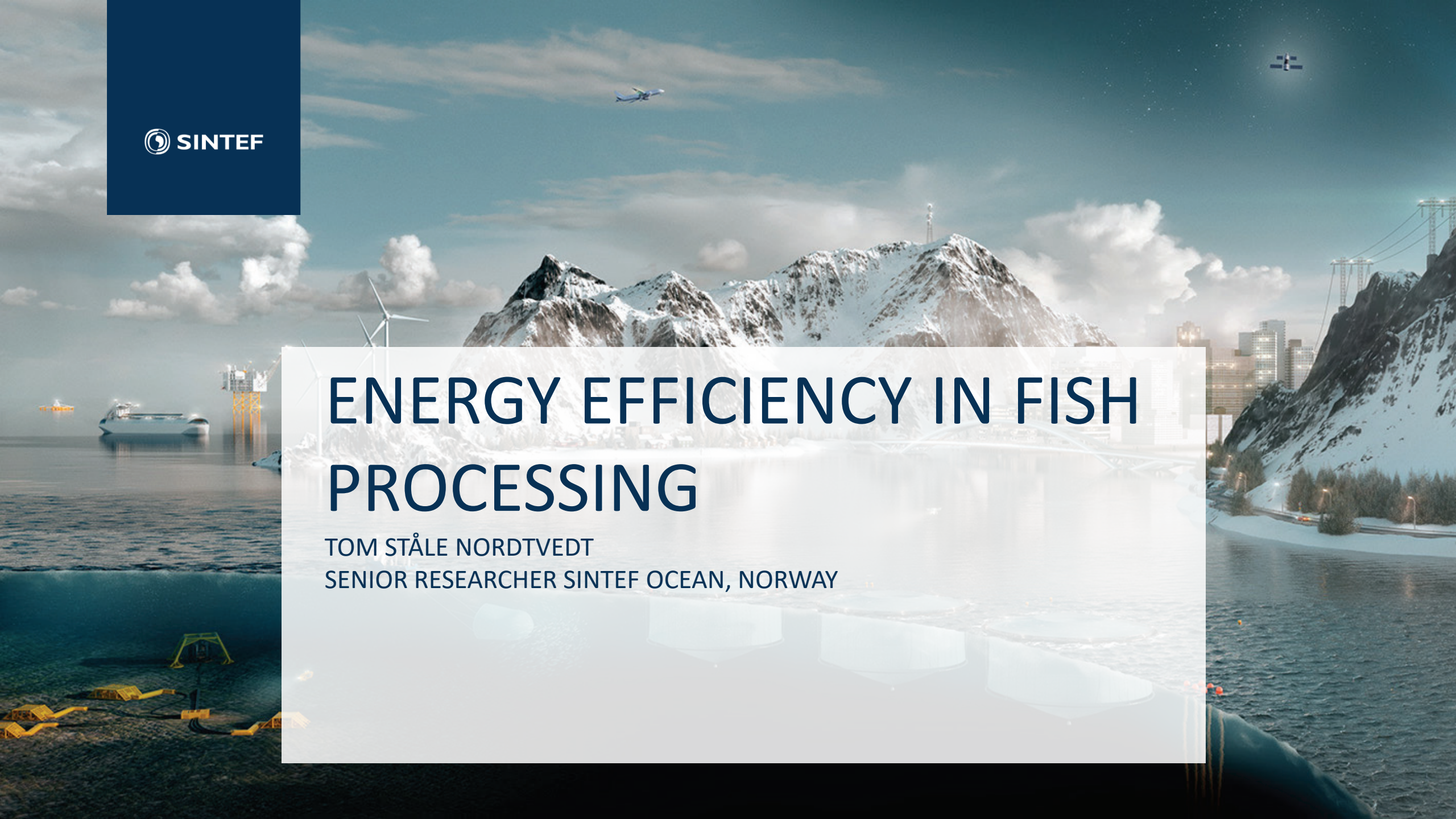

ENERGY EFFICIENCY IN FISH PROCESSING

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Content

- Fish processing
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- At land
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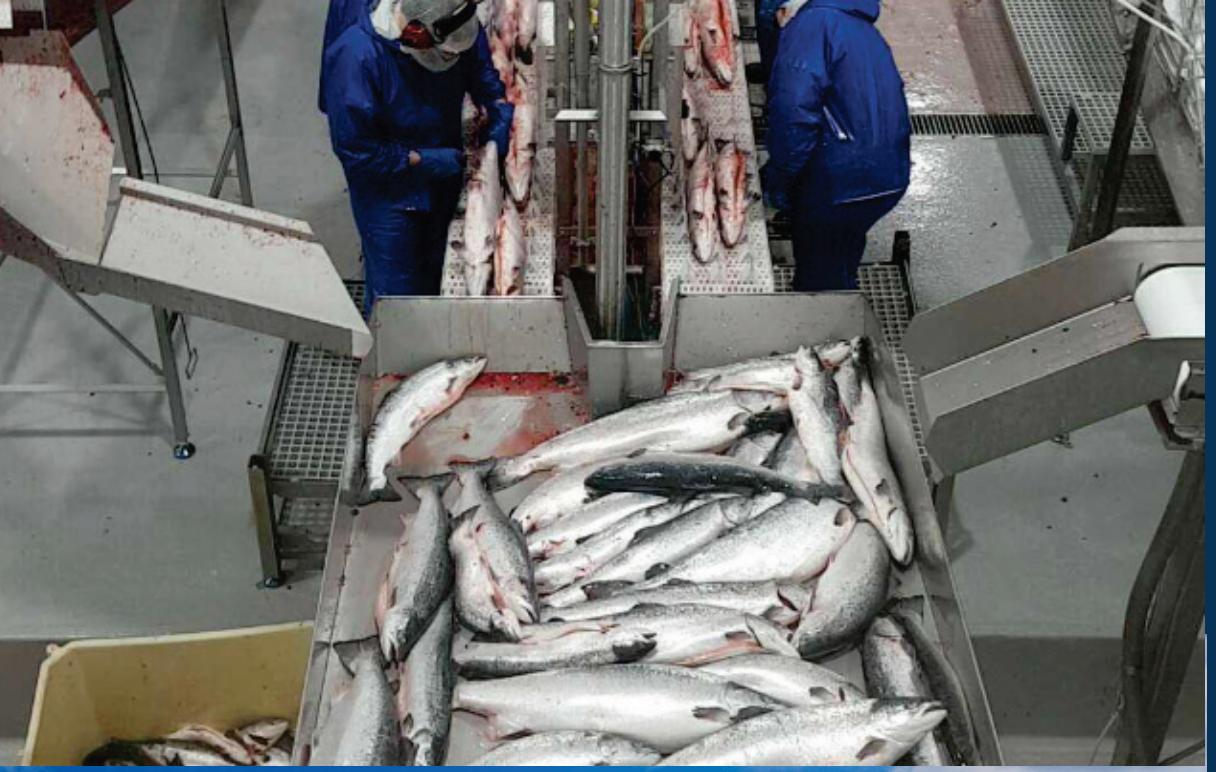

Fish processing

- Many opportunities for energy efficiencies
- Correct dimensioning
- Use of excess heat

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Fish processing

- Refrigerated seawater (RSW) tanks for chilling
- Tunnel freezers for large batch freezing
- Plate freezers for consumer packages of seafood
- Impingement freezers for individual quick freezing, ready-made products and the like
- Ice machines for chilling fresh seafood during distribution
- Equipment for super chilling
- Cold storage chillers and freezers
- Drying systems for processing and storage of seafood

Aquculture

Inputs	Amount
Live-weight salmon	1000 kilos
Electricity	81 kWh
Water	3500 litres
Refrigerant R22	0,45 g
Refirgerant NH3	7,4 g
Ice	207 kg
Salmon, head-on, gutted	822 kilos

Fishing fleet

- Different needs
- Main energy use is on the propulsion system
- Less attention on the auxiliary systems.

Future fleet

- LNG or LBG
- Hydrogen
- Ammonia
- Batteries
- Biodiesel

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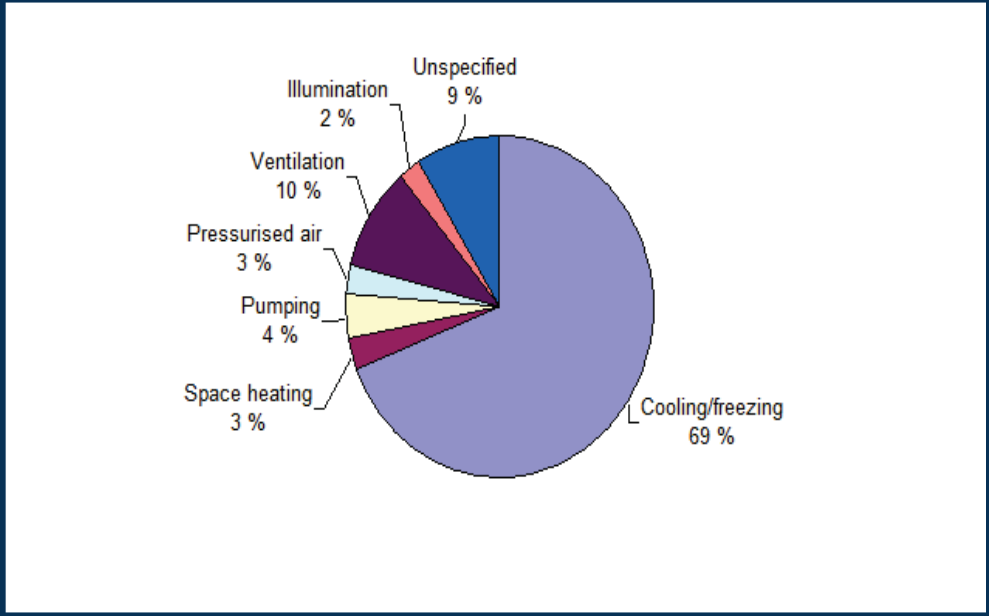
Processing at land

- good control and operation of compressors and frequency inverters
  - avoid part load operation
- avoid unnecessary use of fans inside freezing tunnels
  - fans use energy and add heat
- heat recovery from warm side of the refrigeration system
  - for heating of tap water and ventilation
- recycle cooling water
  - use filters and utilize already produced cooling
- high focus on energy efficient operation of the whole factory
  - turn off equipment, make everyone aware

Processing at land



Energy use (kWh/tonne product)	Total	Filleting	Freezing
Whitefish plant	794	661	133
Salmon plant	701	568	133
Average	748	615	133

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Summary

- New propulsion systems (LNG, Hybrid, Batteries)
- Surplus heat usage from the refrigeration system
- Use the whole fish
- Transportation
  - Frozen is best

Technology for a better society