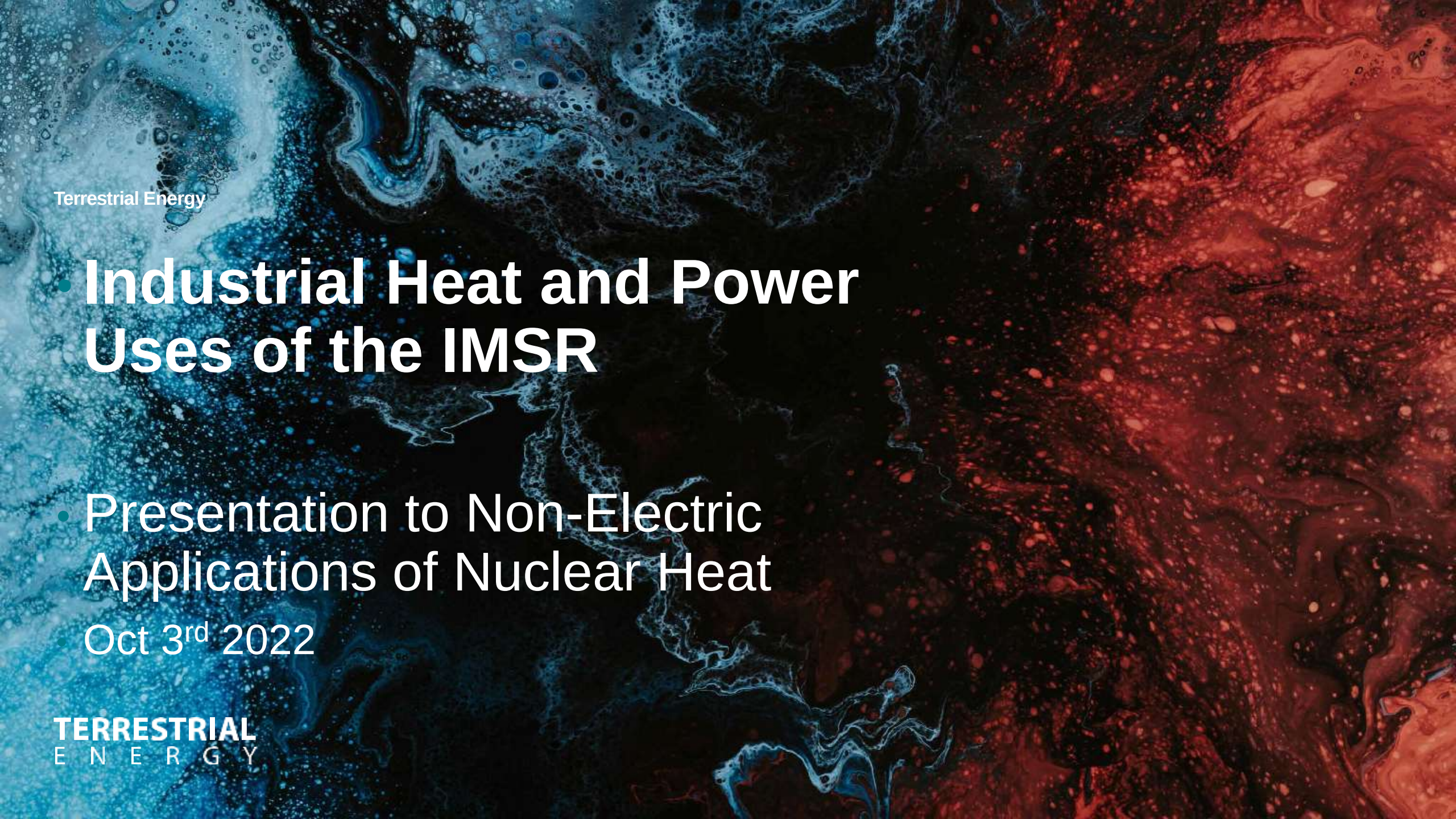

Terrestrial Energy
Industrial Heat and Power Uses of the IMSR
Presentation to Non-Electric Applications of Nuclear Heat
Oct 3rd 2022
TERRESTRIAL ENERGY

IMSR technology and design choices give high commercial readiness

- Based closely on molten salt technology demonstrated at the Oak Ridge National Laboratory (ORNL)
- Builds on 60 years of ORNL reactor design work and on many other demonstrated technologies
- IMSR is a molten salt reactor system that uses:
  - *Fluoride chemistry*
  - *Under 5% LEU once-through fuel cycle*
  - *Thermal spectrum*
  - *Graphite moderator*
  - *Integral core architecture*

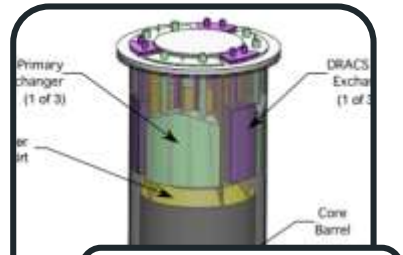
MSRE:	*Molten Salt Reactor Experiment*
DMSR:	*Denatured Molten Salt Reactor*
Sm-AHTR:	*Small Modular – Advanced High Temperature Reactor*

MSRE

- ORNL: 1964-1969
- Molten Salt Reactor
- Built and operated for 18,000 hours

DMSR

- ORNL: 1980
- Denatured Molten Salt Reactor
- Conceptual Design
- LEU fueled with once-through fuel cycle



Sm-AHTR

- ORNL: 2010
- Pre-conceptual design
- Solid fueled – salt cooled
- Cartridge core design

IMSR

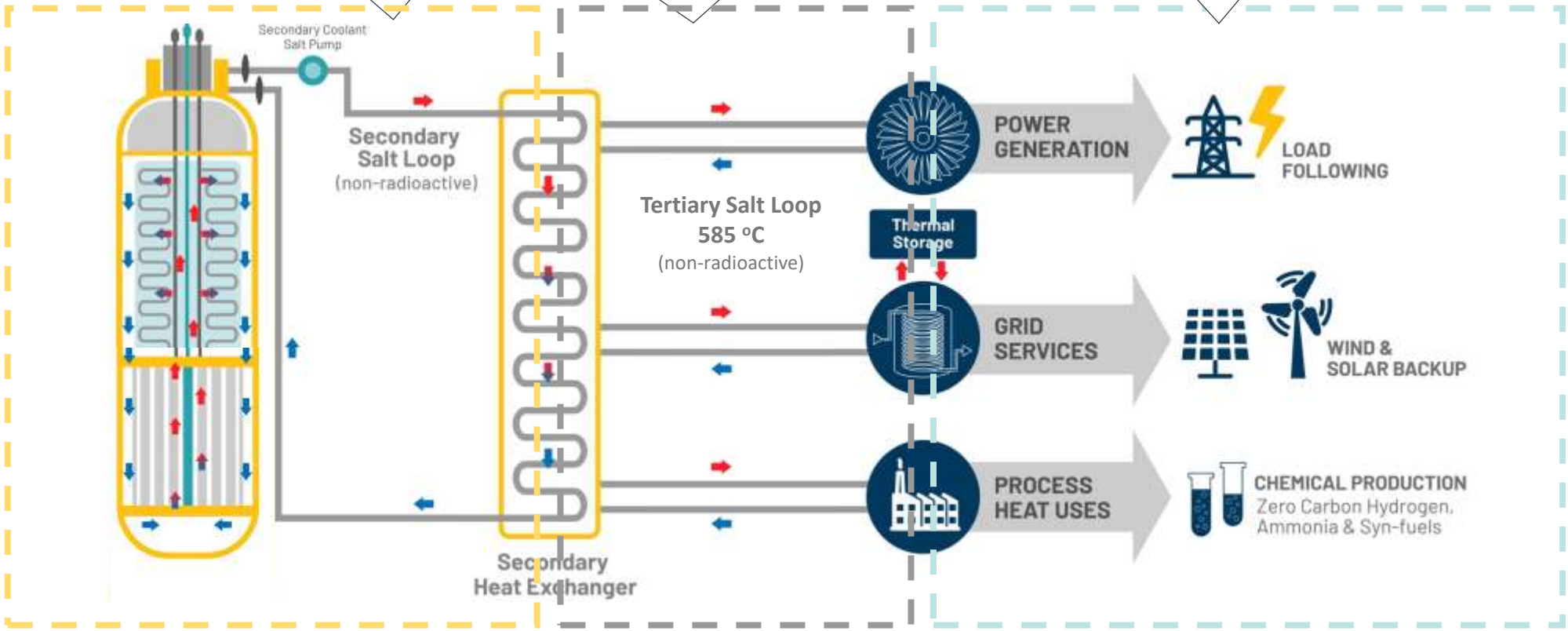
- Terrestrial Energy 2020: Engineering and regulator activities in progress
- LEU fueled with once-through fuel cycle
- Integral core architecture

How an IMSR Plant works

IMSR Nuclear Facility
Standardized and modular nuclear-grade systems

IMSR Thermal and Electric Facility
Customized systems and modular industrial-grade (non-nuclear) systems supply thermal and electric power

Industrial user
Site with thermal and electric power requirements

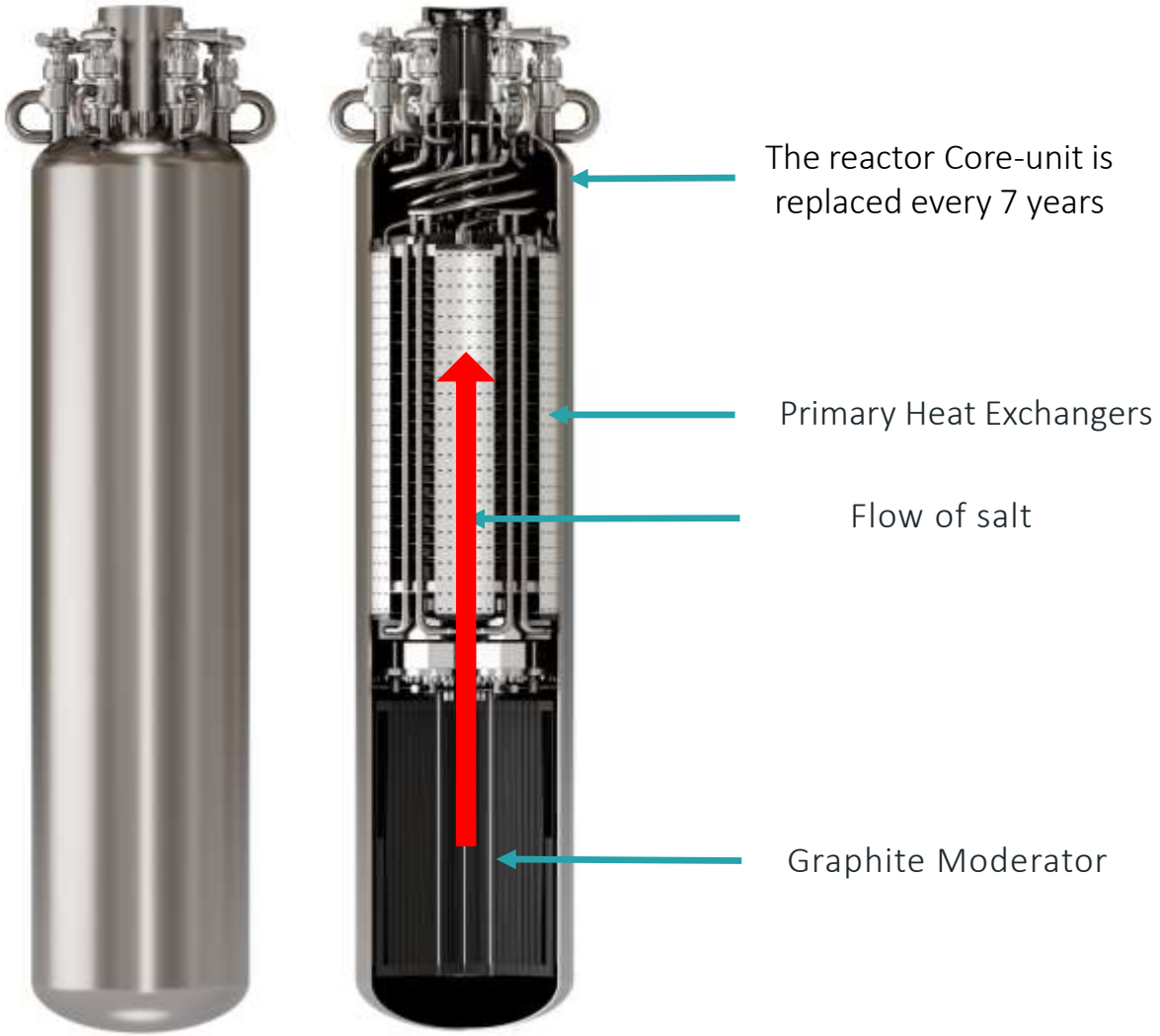


IMSR Thermal and Electric Facility is customized to heat duties that are site and application specific

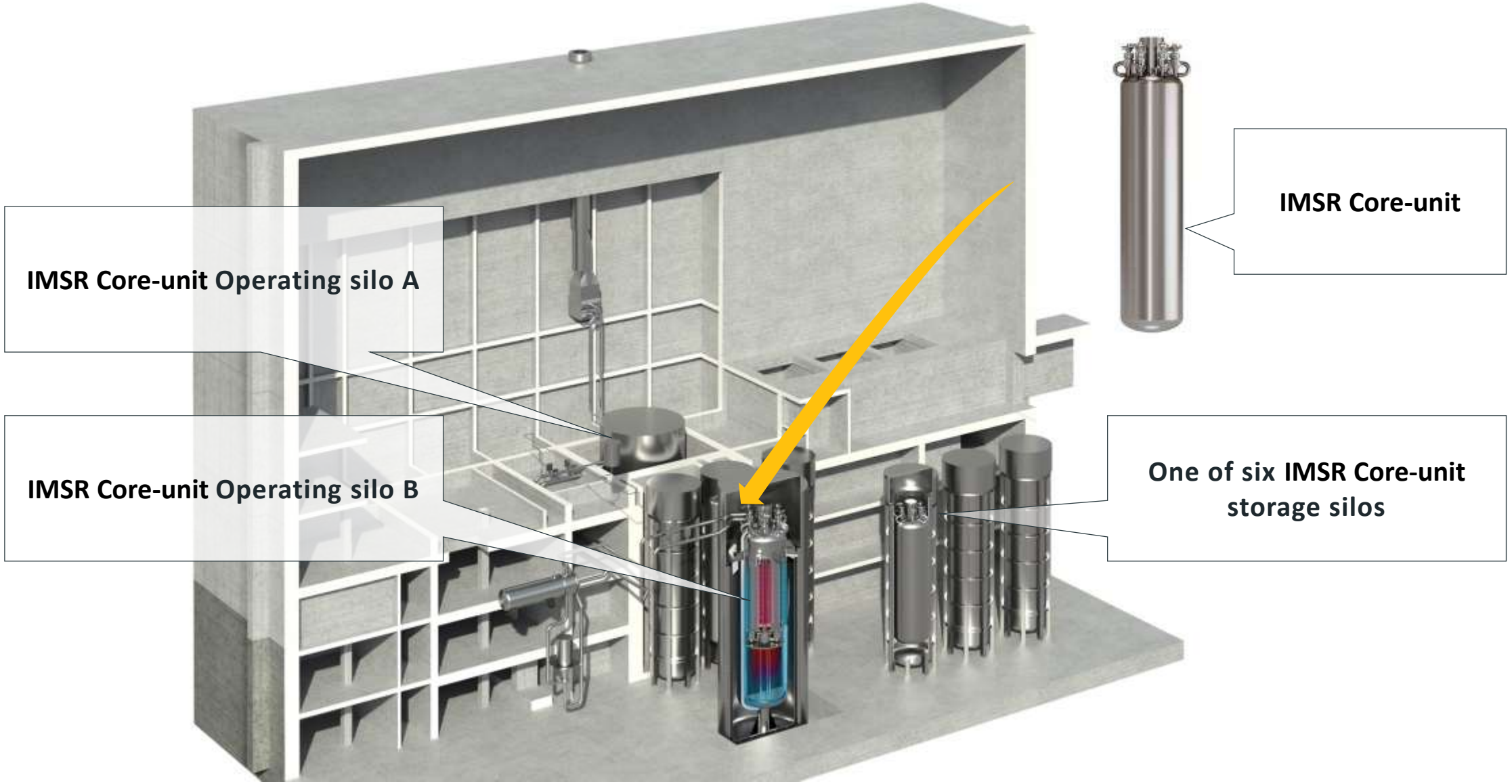
Key innovation – the sealed and replaceable IMSR Core-unit

- Key innovation is integration of primary reactor components
  - *Reactor core*
  - *Primary heat exchanger*
  - *Pumps*
- Into a sealed, compact and replaceable reactor vessel
  - *With a 7-year operating life*
- This “integral” design captures commercial value through
  - *High inherent safety*
  - *Operational simplicity*
  - *High capital efficiency*
- Patents pending and granted
  - *65 patents granted across 5 invention families*
  - *Portfolio of trade secretes*

IMSR Core-unit and in cross-section

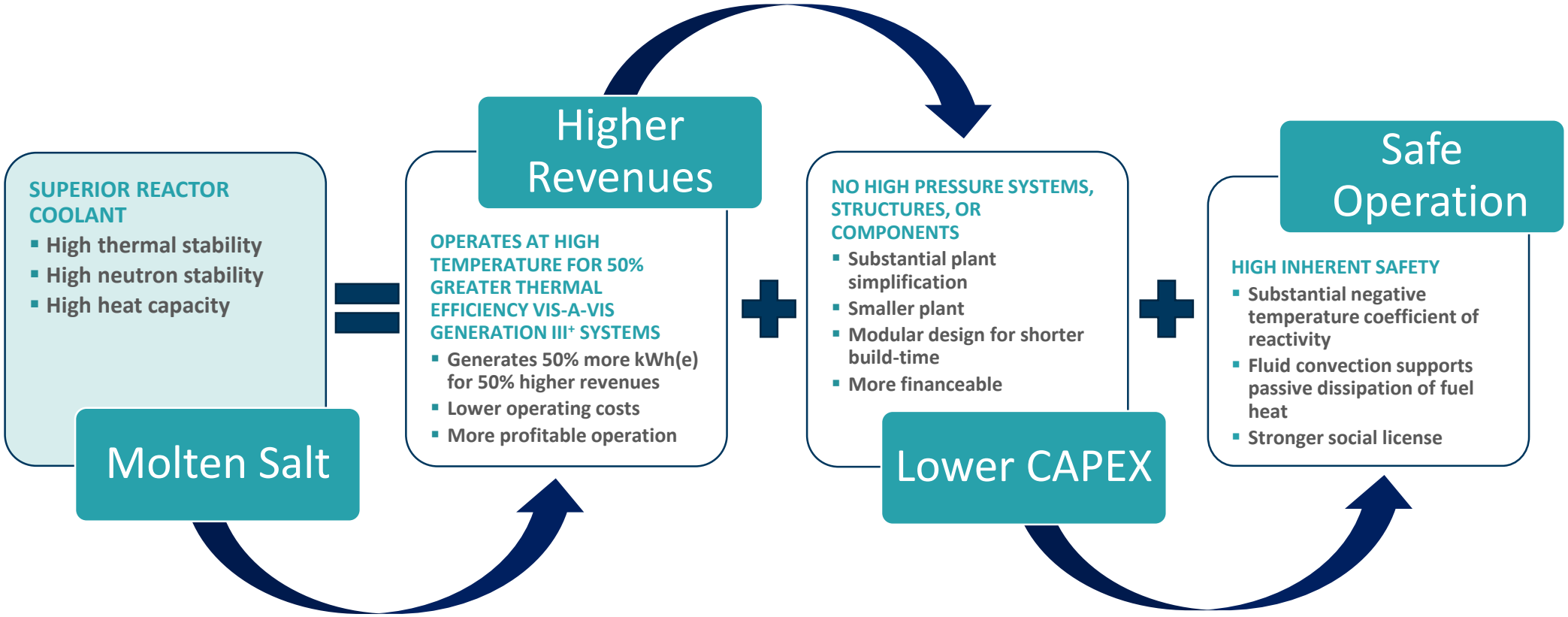


IMSR Plant design with replacement IMSR Core-unit



IMSR technology and design choices drive economics and uses

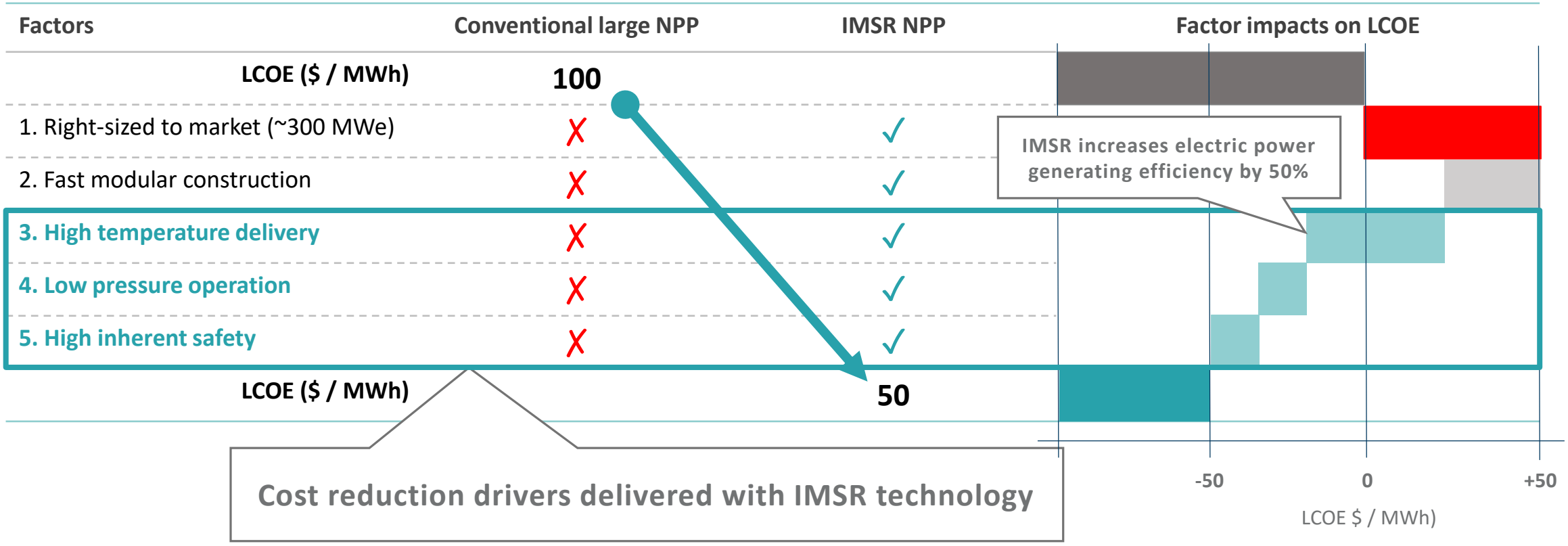
High operating temperature and low operating pressure are essential



A molten salt coolant has high thermal stability and delivers a potential to transform economics and uses

Fission technology and design choices have fundamental economic impacts

5 factors drive Nuclear Power Plant (NPP) economics



IMSR technology and design choices have transformative economic and use-case impacts

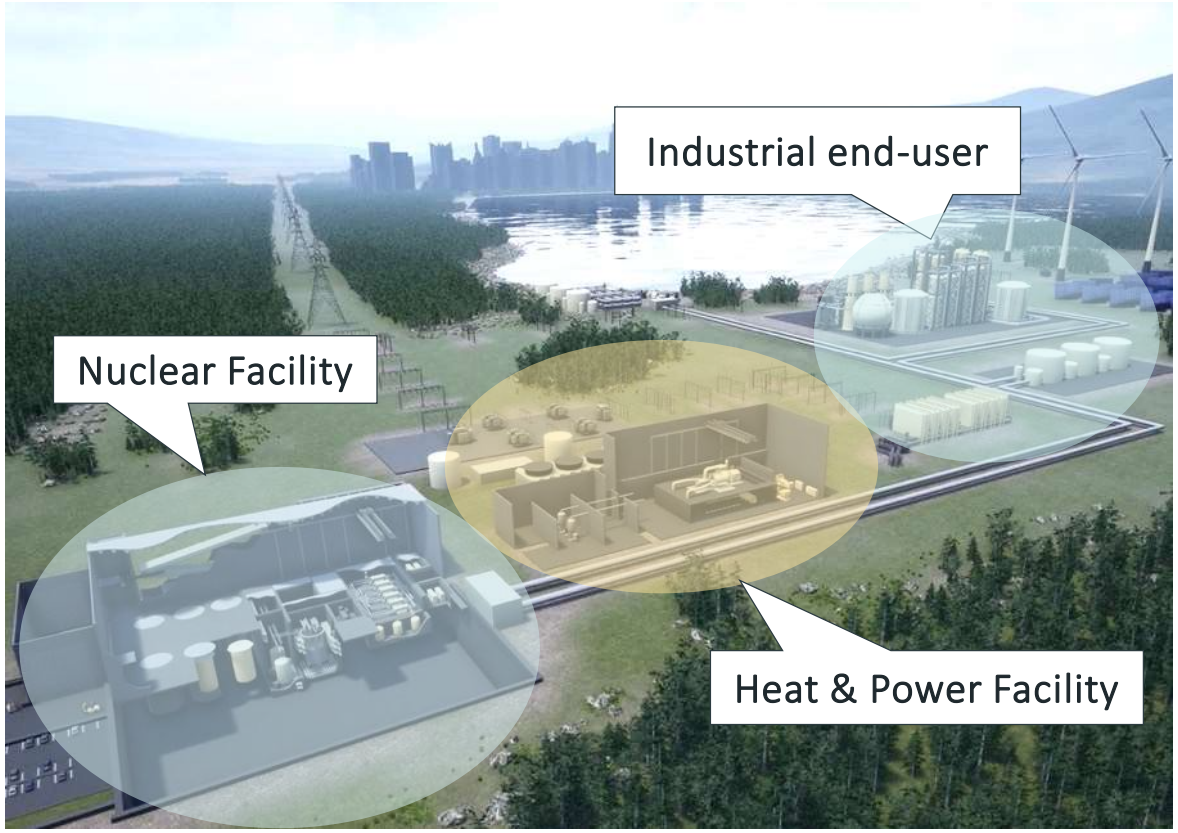
IMSR Plant consists of two parts for efficient industrial use

IMSR Heat & Power Facility (non-nuclear systems)

- *Supplies heat and power for industrial end-user as a standalone facility*
- *Engineered to pair with the Nuclear Facility*
- *Initially supplied with natural gas and grid electric power*
  - Including Wind and Solar Generation
- *Flexibility in design as regulated by industry construction codes and standards*

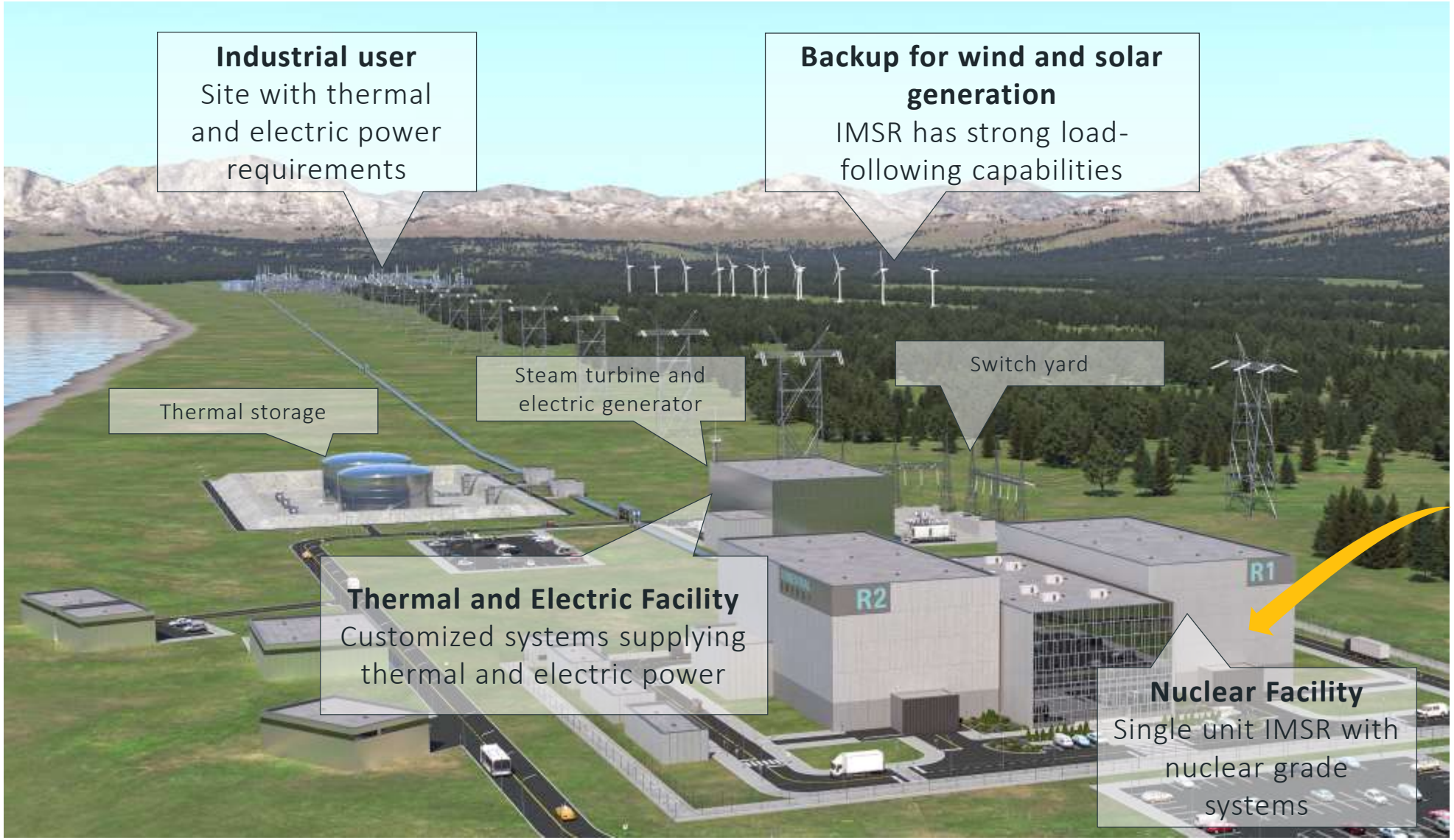
IMSR Nuclear Facility (nuclear systems)

- *Generates high-quality heat from nuclear fission*
  - In operation relegates natural gas and grid electric supply to back-up role for Heat and Power Facility
- *Transfers heat to the Heat and Power Facility*
- *Modular and standardized design as regulated by nuclear codes and standards*



In full operation IMSR Plant supplies thermal and electric energy from nuclear fission with back-up from electric grid and natural gas

IMSR Plant supplies “high-quality” industrial heat and electric power



***Thermal and Electric Facility** is customized to the cogeneration requirements of an industrial plant*

IMSR Cogeneration plant by numbers

822 MWt	Net IMSR Plant capacity. Equivalent to 390 MWe when configured for 100% electric power generation
585 °C	IMSR generates “high-quality” heat essential for industrial Cogeneration and net-zero
< $6 MMBTU	Levelized cost of “in-furnace” thermal energy generated from IMSR operation
44% (net)	Thermal efficiency of electricity generation. This is ~50% higher compared to water-cooled-water-moderated (conventional) nuclear power plants
< $50 per MWh	IMSR levelized cost of electric power generation from IMSR operation
< 5 grams CO_2e	Full life-cycle grams of CO_2-equivalent per kilowatt-hour of electricity versus 825 for coal and 475 for natural gas.
~7 hectares	300 m x 200 m plant footprint delivers 390 MW of electric power
< 5% enriched LEU	Standard nuclear fuel has higher international acceptance and is available today

IMSR thermal and electric power enables the energy efficient methods of carbon-free hydrogen production

Strong contracted parties for components and services

Blue chip partnerships and component providers

Contracted program for components and services supply supporting near-term deployment

Supporting near-term deployment of IMSR Plant

Market leading regulatory engagement

- Terrestrial Energy's regulatory program started early and in 2015 with CNSC's phased Vendor Design Review (VDR) process
- CNSC's VDR scope covers all aspects of IMSR Plant construction, operation and decommissioning
  - *Terrestrial Energy successfully completed VDR Phase 1 in 2017, an industry first*
  - *VDR Phase II and final phase is on schedule to be completed 2022 and expected to be another industry first*
- Terrestrial Energy commenced USNRC regulatory engagement in 2017
  - *Strategy is a 10CFR Part 52 Standard Design Approval of the IMSR® Core-unit*
    - This is a prerequisite to 10CFR Part 50 Construction Permit Application
- Terrestrial Energy has participated in a joint agency (CNSC/USNRC) collaborative regulatory review of IMSR
- Terrestrial Energy commenced International Atomic Energy Agency (IAEA) engagement in 2020
  - *Review of IMSR® security and safeguards underway with Canadian Nuclear Laboratories*

Terrestrial Energy has a track record of regulatory engagement and clear progress

Recent developments

- Terrestrial Energy and DL E&C Sign MOU to Drive IMSR Cogeneration Plant Deployment
  - *https://www.terrestrialenergy.com/2022/07/19/terrestrial-energy-and-dl-ec-sign-mou-to-drive-imsr-cogeneration-plant-deployment/*
- KBR and Terrestrial Energy Agree to Collaborate on the Application of Zero-Emissions Thermal Energy for Green Hydrogen and Ammonia Production
  - *https://www.terrestrialenergy.com/2022/06/09/kbr-and-terrestrial-energy-agree-to-collaborate-on-the-application-of-zero-emissions-thermal-energy-for-green-hydrogen-and-ammonia-production/*
- US and Canadian Regulators Complete Joint Technical Review of IMSR
  - *https://www.terrestrialenergy.com/2022/06/07/us-and-canadian-regulators-complete-joint-technical-review-of-imsr/*
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Hydrogen Production with IMSR: Water and/or Methane

- A brief comparison of H2 production estimates for a IMSR400 Facility of 884 MWth (390 Mwe)
- Conventional Electrolysis of water
  - 179 tonnes per day H2
- High Temperature Steam Electrolysis of water (HTSE)
  - 235 tonnes per day H2
  - 1/3rd improvement in output, 12% as heat, 88% as electrical
- Thermochemical splitting of water (Copper-Chloride cycle at 400-550 C)
  - ~50% thermal efficiency (heat to hydrogen eff)
  - 265 tonnes per day H2
- Nuclear Assisted Steam Methane Reforming
  - 1800 tonnes per day H2
  - No Flue Gasses, only a pure CO2 stream more economically compatible with CCS
- Methane Pyrolysis
  - 1500 – 2500 tonnes per day H2
  - Low TRL but no carbon capture needed and lowest ultimate potential H2 costs