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The Energy to Succeed

UBATTERY

Local Modular Energy

U-Battery Layout

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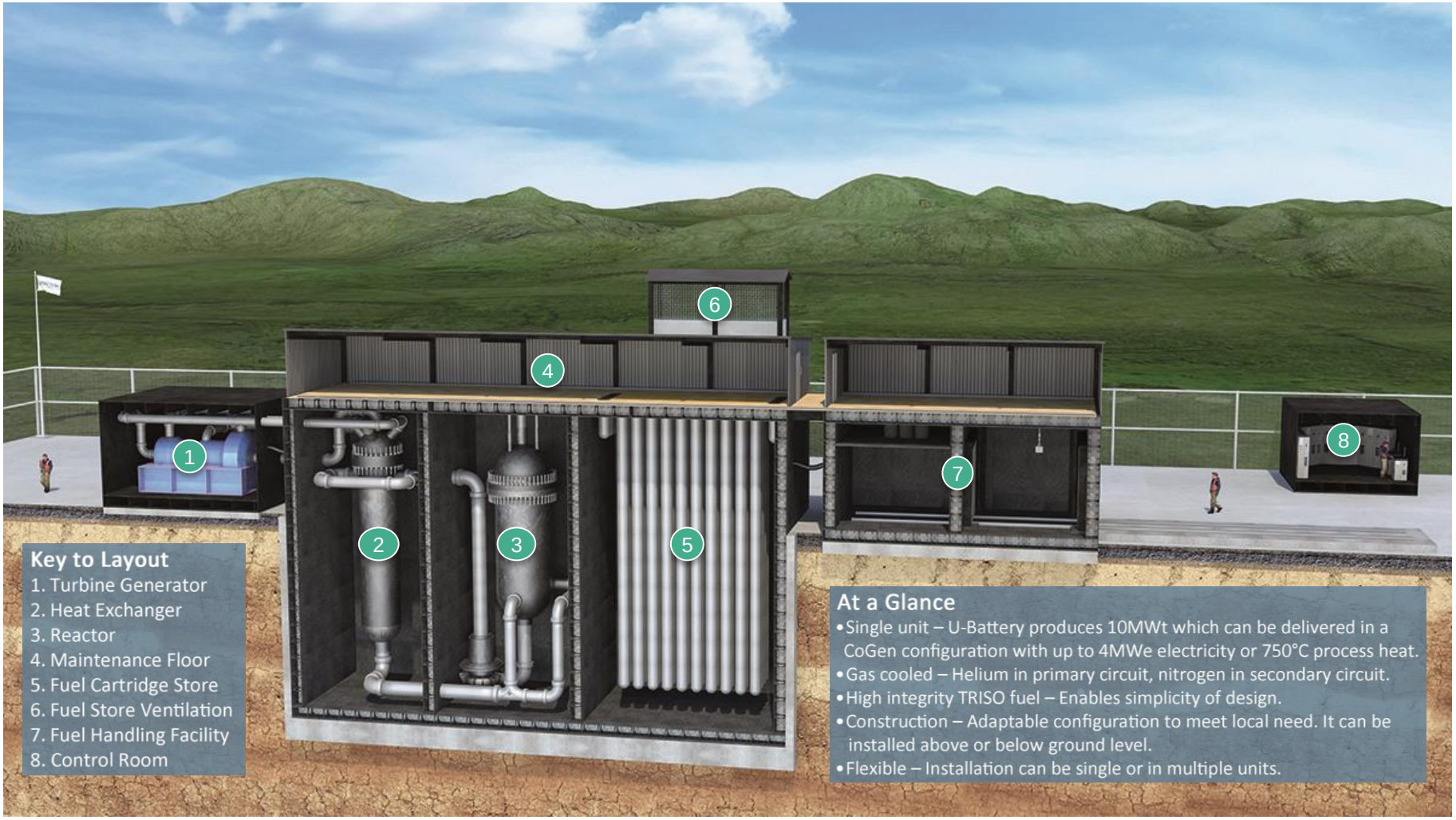


Canadian and UK early markets

Remote communities and mines

Oil sands

- Steam for SAGD and electricity for upgrading at **96 facilities**
- 210 MWe average size for both heat and power demands
- 5% replacement by SMRs between 2030 and 2040 could **provide** $350-450M **in value annually**

Remote communities and mines

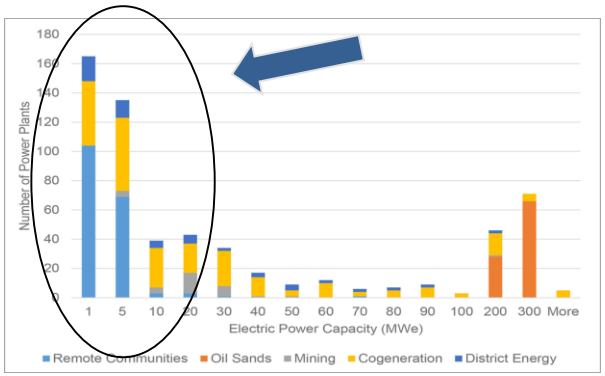
- 79 remote communities in Canada with energy needs > 1 MWe
- SMRs replacing costly diesel and heating oil could **reduce energy costs to the territorial government**
- **The high cost of energy from diesel is a barrier. SMRs could facilitate and enable new mining developments**
- 24 current and potential off-grid mines

High-temperature steam for heavy industry

- 85 heavy industry locations (e.g. chemicals, petroleum Refining)
- 25-50 MWe average size
- 5% replacement by SMRS between 2030 and 2040 could **provide** $46M **in value annually**

Replacing conventional coal-fired power:

- 29 units in Canada at 17 facilities
- 343 MWe average size
- 10% replacement by SMRs between 2030 and 2040 could **provide** $469M **in value annually**



Source: NRCan Roadmap Nov 2018

Energy Intensive Industries needing process heat

Alongside renewables, U-Battery can play a vital role in UK's transition to a clean energy future by providing process heat and electricity to Energy Intensive Industries.

Sector	No. of U-Batteries	Use
Glass	14	Heating raw materials and annealing
Paper	20	Drying paper
Steel	20	Less likely – very sensitive to price
Ceramics	50	Process heat need 220-650^{O}C for drying and spray drying.
Minerals	10	Cement production
Chemicals	Large and varied	Heating fluids at 450^{O}C

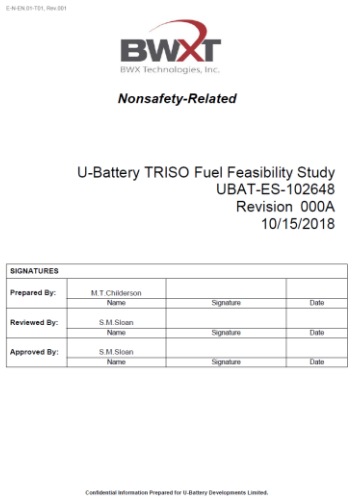
Source: University of Manchester Report – October 2018

Two Pillars of Safety

Highly Accident-Tolerant Fuel

TRISO coated particle fuel : demonstrated to retain all significant fission products to temperatures > 1600ºC for at least 500 hours

Structural integrity retained to at least 2000ºC


BWXT
BWX Technologies, Inc.

Nonsafety-Related

U-Battery TRISO Fuel Feasibility Study
UBAT-ES-102648
Revision 000A
10/15/2018

SIGNATURES			
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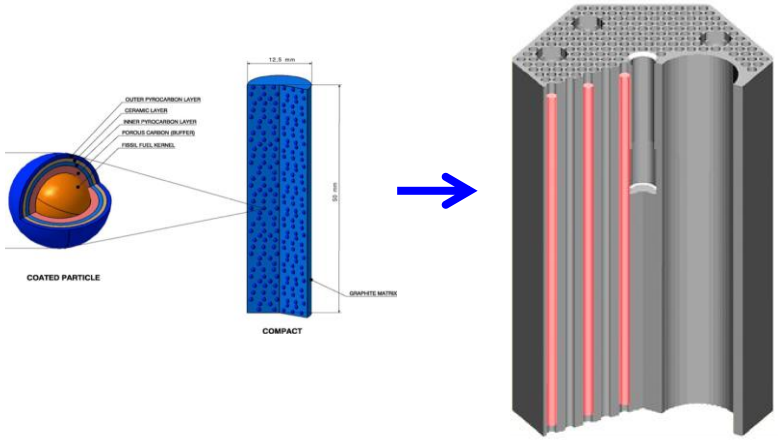


Inherently Safe Plant Design

Small thermal power output (10 MWt)

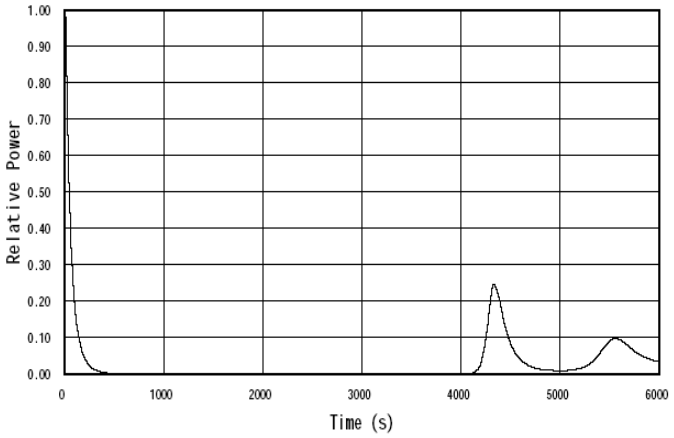
Low power density (~6 W/cm^3 cf. 100 W/cm^3 for LWRs)

High thermal capacity of graphite structures

Strongly negative temperature coefficient of reactivity

Refractory core structural materials

Beyond Design Basis Accident



Next generation fuel pathways

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Gen-III
Reactor uprates

Test & research
reactors

Existing UO2 fuel pellets
- ~5.95% enrichment

SMRs

ATF cladding systems
- Chromium coating
- Silicon-carbide cladding

Micro-SMRs

Reactor Types

Enrichment
LEU+ Plus (5~10%)

ATF high density fuel pellets
- U-Silicide
- U-Nitride
- Chromium doped U02
- FCM ceramic fuel

Higher enrichment
HA-LEU ~19.75%

Fuel Type

HTRs

Deconversion/H2M
- U-metal
- U-oxides
- U-salts

Fast breeder
reactors

DOE programme
accident tolerant fuel

Supply Chain

TRISO fuel
- UCO
- U02
- Uranium nitride
- Uranium silicide

Molten salt
reactors

Site licensing
cat-II facility

Fabricated TRISO
- Prismatic block
- Pebble bed

Lead cooled
reactors

Government Licensing & Regulation

Fuel fabrication

Metallic fuel
- Lightbridge Zr-U Alloy
- U-Molybdenum

Sodium fast
reactors

LWR fuels
LEU-UO_2-ZircAlloy

Storage & transport
- Cylinders
- Overpacks
- Class 7 shipping
- Insurance

Liquid fuels
- Molten salts
- Aqueous uranyl salt solutions

Operational
criticality & safety

RepU

National
regulator(s)