GEOTHERMAL
THE NEXT GENERATION

DR ISABELLE CHAMBEFORT

2019 NEW ZEALAND GEOTHERMAL WORKSHOP

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

GNS SCIENCE
TE PŪ AO

OUR

VISION

New Zealand 2018 electricity generation 43,041 GWh – 5M home-equivalent

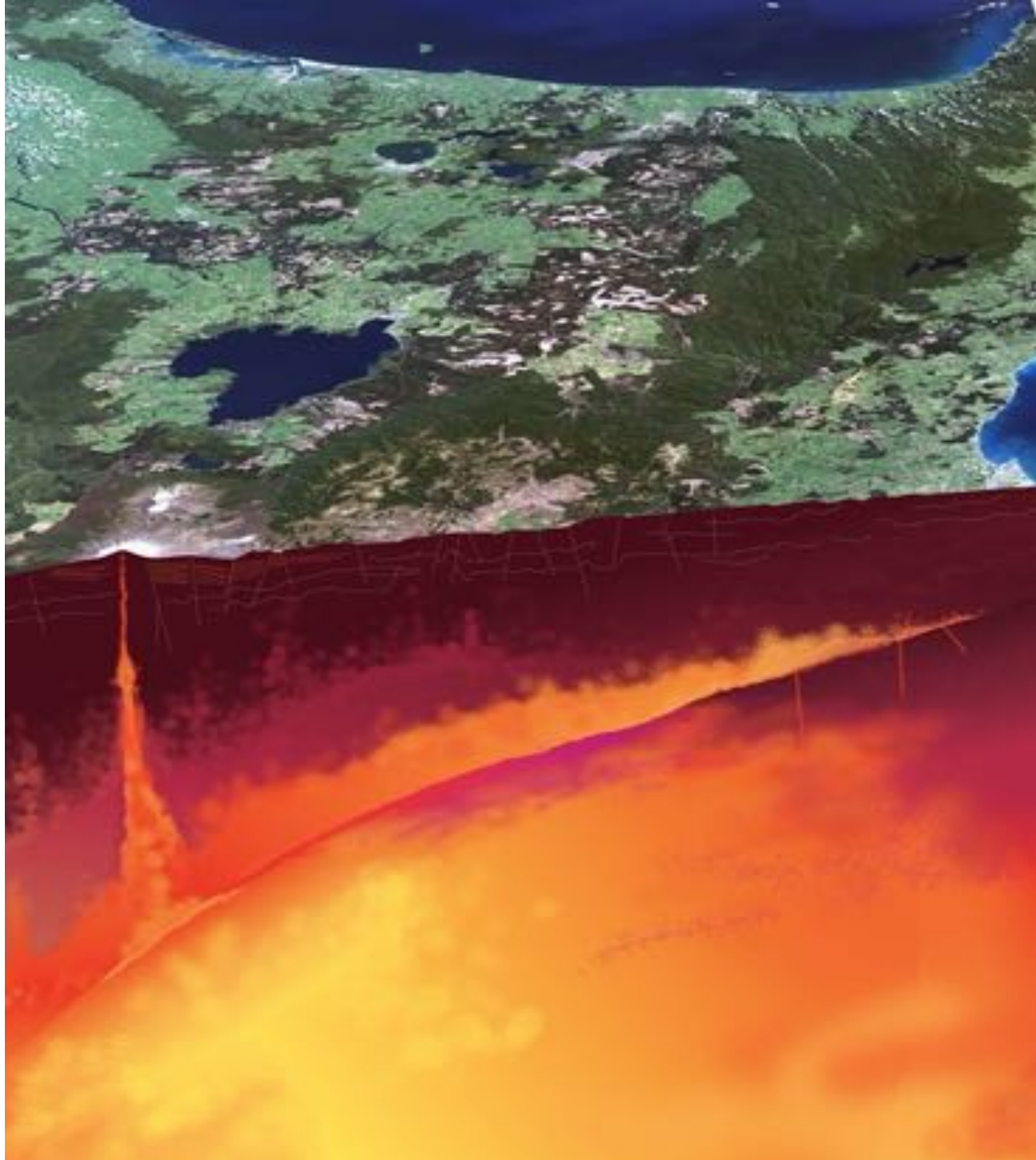
7,373 GWh from geothermal, 17.1 % of total generation

To replace all greenhouse gas emitting energy requires - more than 3x TOTAL CURRENT GENERATION

A NATIONAL GIFT

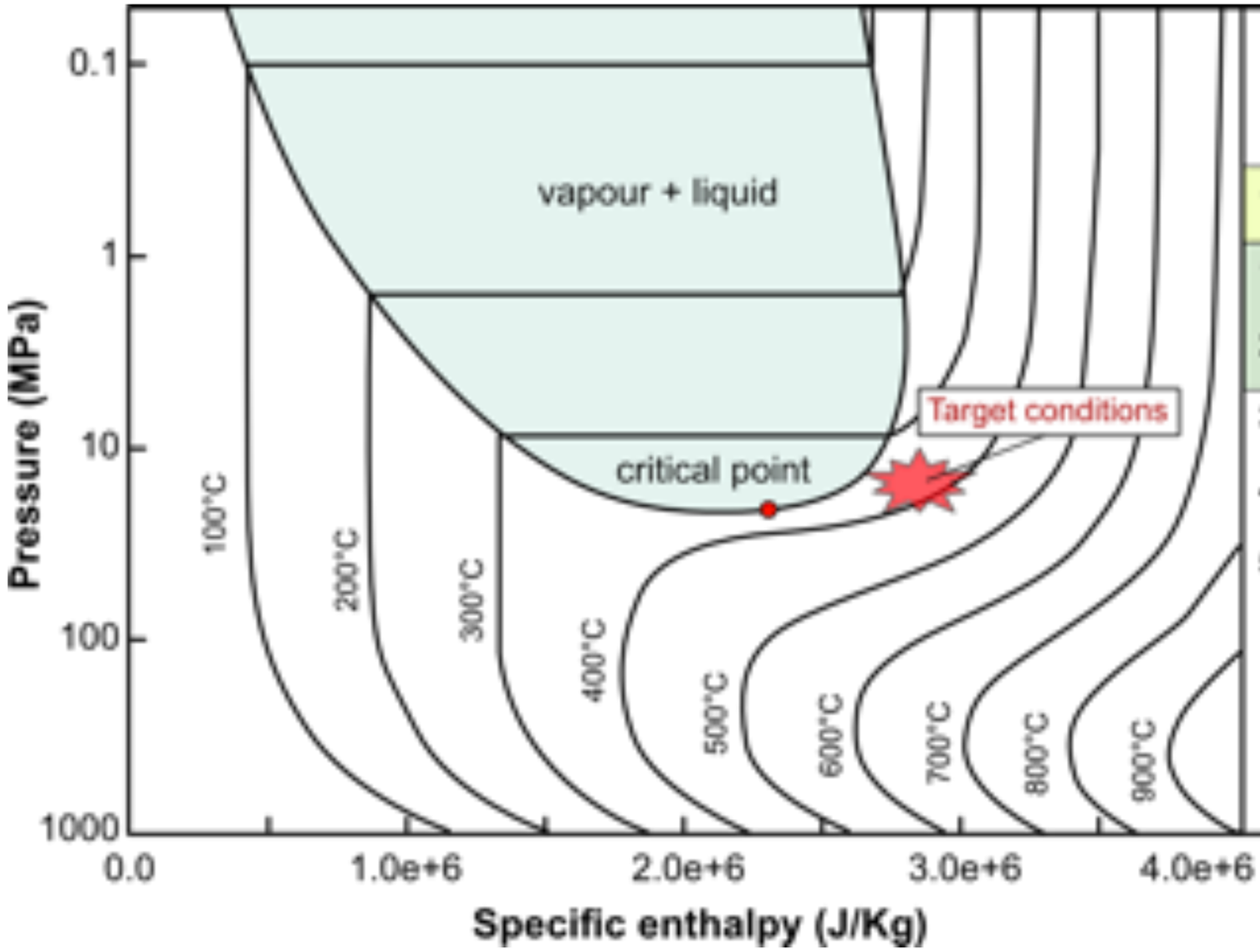
THE TAUPŌ VOLCANIC ZONE

The heat content of the deep TVZ (3-7km) could provide > 5,000 MW that lasts ~1,000 years.



OUR

VISION A DEEP SOLUTION



P, T(bar, °C)	Enthalpy (KJ/kg	Dynamic Viscosity (10^{-5} Pa.s) (KJ/kg	Ratio (Enthalpy/ viscosity)	Ratio to base case
100, 250	1086	10.0	108.8	1.0
100, 400	3100	2.45	1265	11.6
200, 400	2820	2.60	1085	10.0
300, 400	2162	4.34	498	4.6
400, 400	1934	6.13	315	2.9
500, 400	1878	6.79	277	2.5

Relative ease of extracting energy from a kg of fluid at 400°C. Yellow cells are conventional reservoir conditions. Green cells represent the targeted conditions (100 to 200 bars for 400°C) assuming similar permeability.

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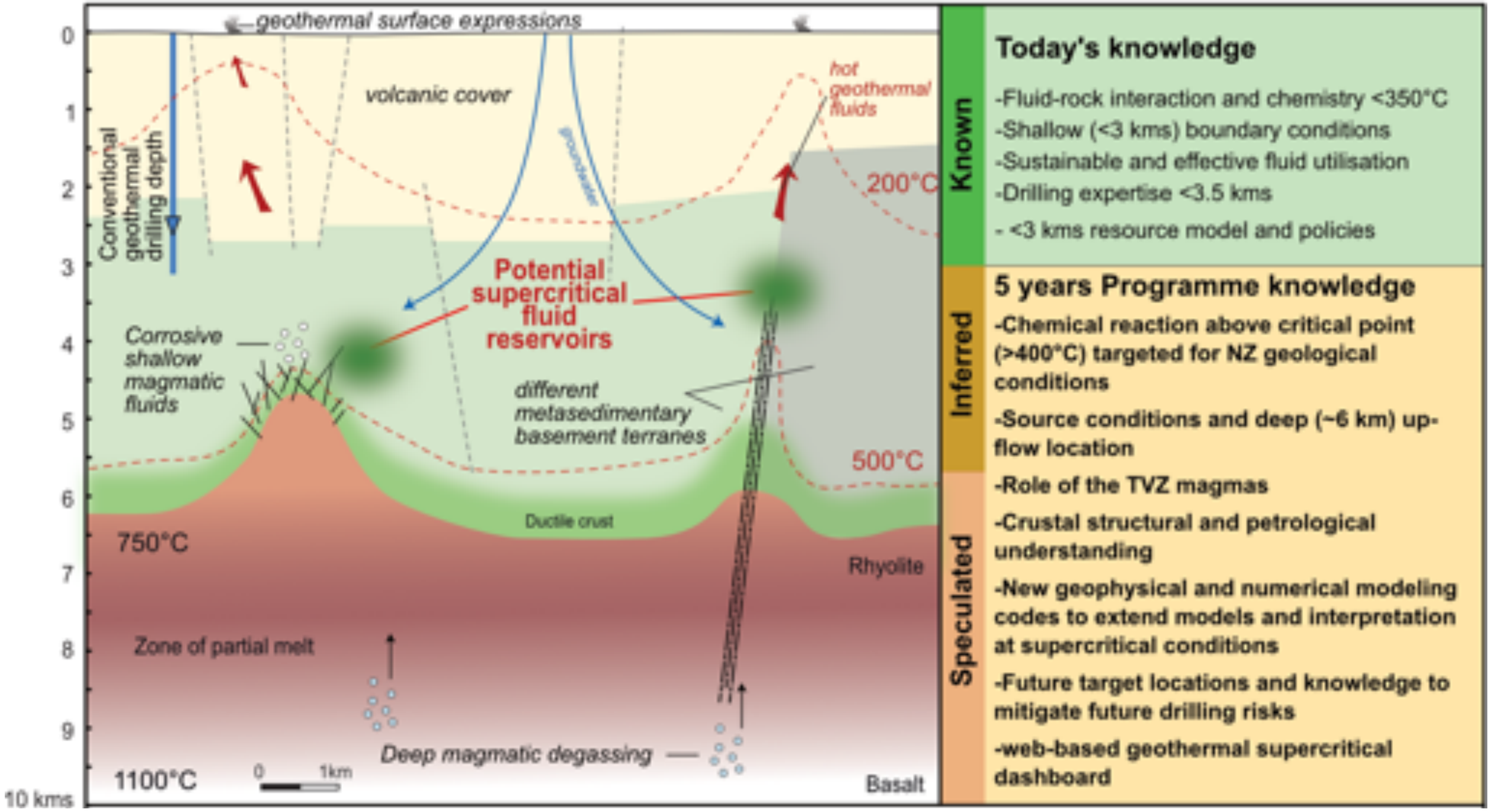
VISION A DEEP SOLUTION



OUR

CHALLENGES

- World wide interest but **NO ONE knows HOW**
- High risks - High uncertainties
- Complicated and no real data
- Need engineering development
- **Basic geosciences constraints to limit these uncertainties and lowering risks**

OUR RESEARCH AIMS TO PROVIDE THE FIRST STEPS OF THIS BASIC BUT VITAL` KNOWLEDGE

GEOTHERMAL

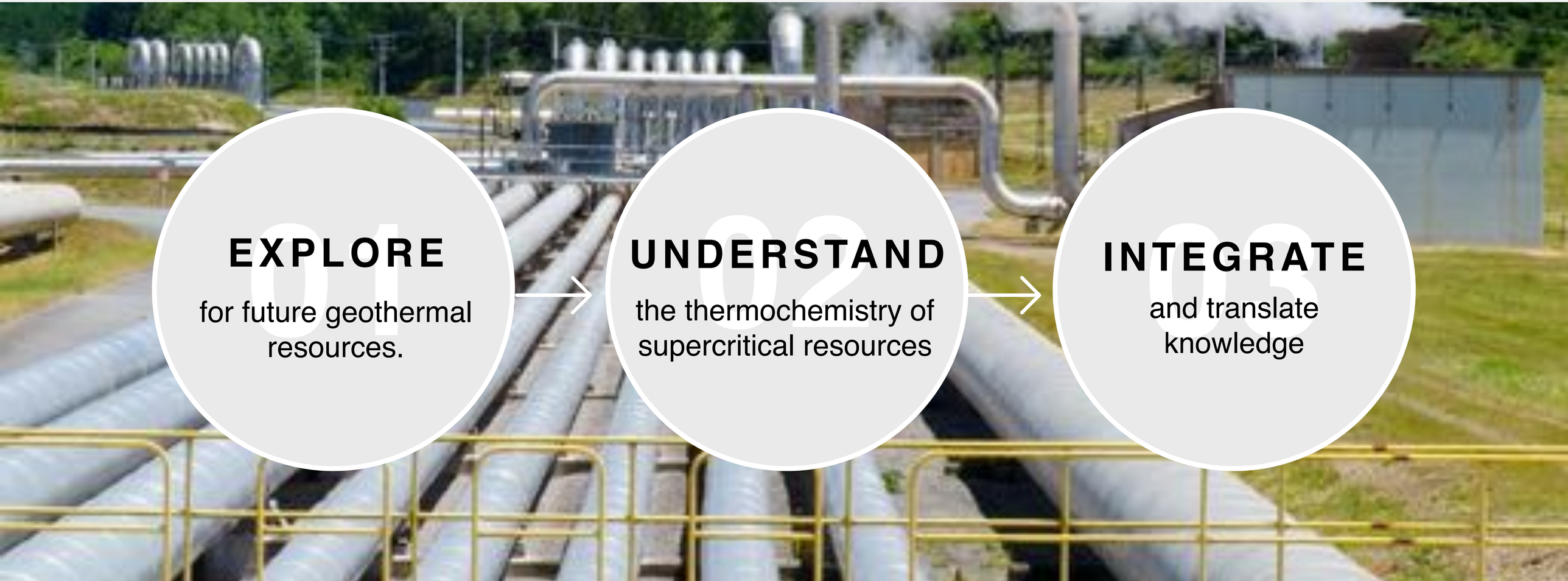
THE NEXT GENERATION

THE PROJECT

Targeted Areas

Fluid

Sustainabilit



01 EXPLORE

for future geothermal resources.

02 UNDERSTAND

the thermochemistry of supercritical resources

03 INTEGRATE

and translate knowledge

MEET

OUR TEAM

ISABELLE CHAMBEFORT

PROGRAM LEADER

EXPLORE

SARAH MILICICH

PROJECT LEADER

UNDERSTAND

BRUCE MOUNTAIN

PROJECT LEADER

INTEGRATE

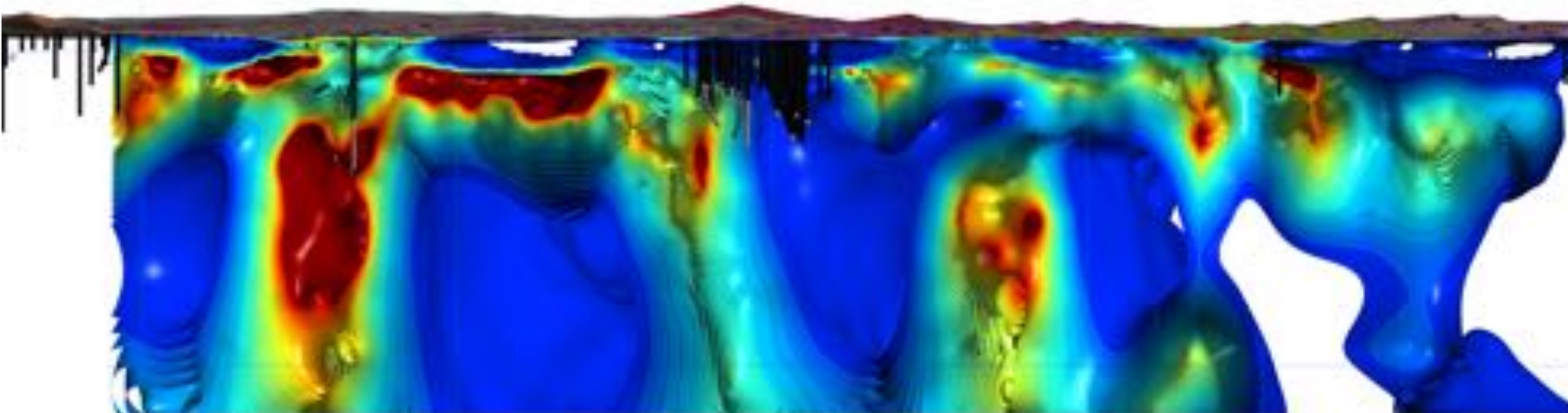
BRIAN CAREY

PROJECT LEADER

FOR FUTURE
GEOTHERMAL
RESOURCES

EXPLORE

Imaging the crust



FOR FUTURE
GEOTHERMAL
RESOURCES

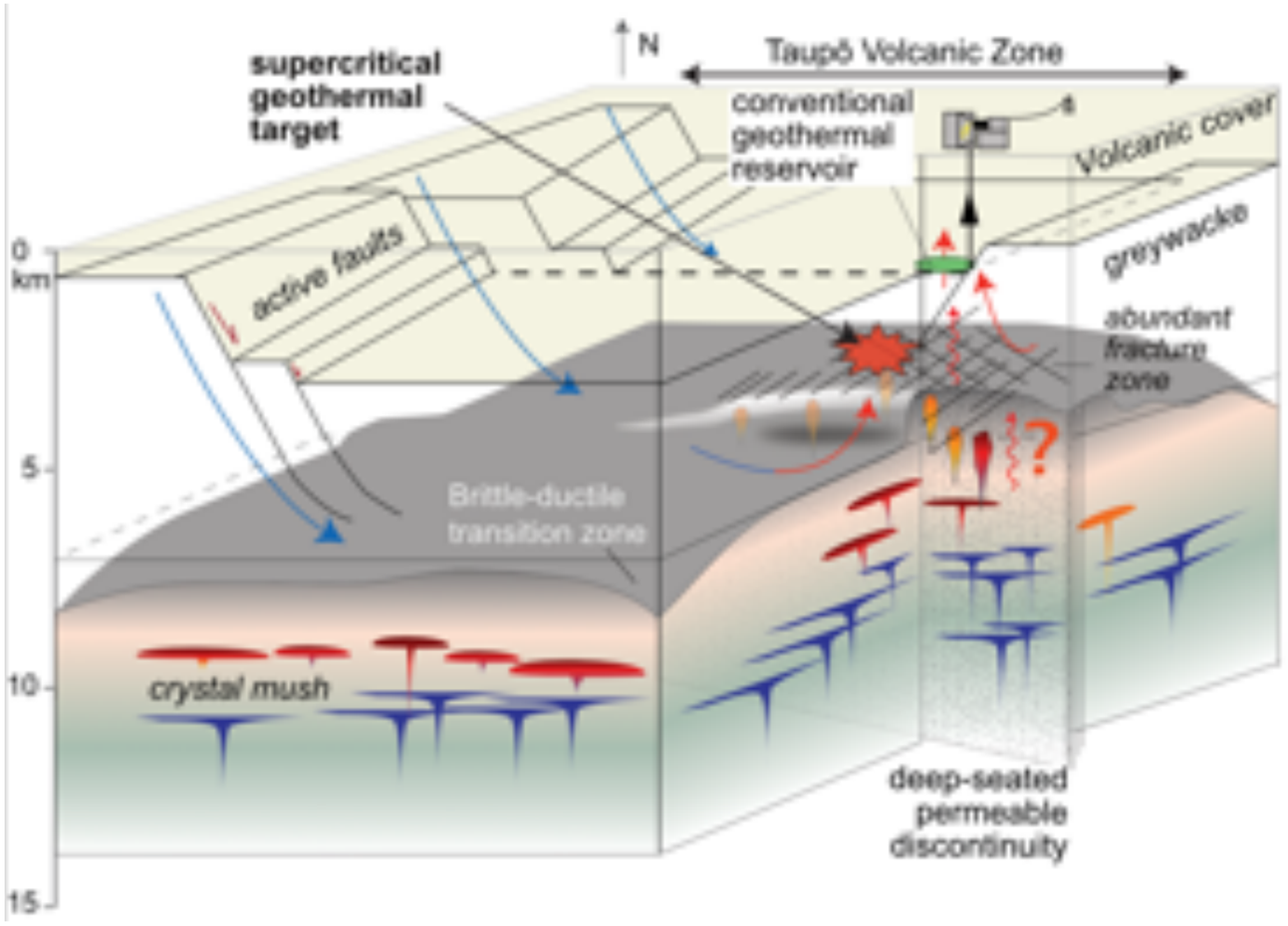
EXPLORE

Understanding the role of
buried structures

FOR FUTURE
GEOTHERMAL
RESOURCES

EXPLORE

Model the magmatic hydrothermal transition



THE THERMOCHEMISTRY OF SUPERCRITICAL RESOURCES

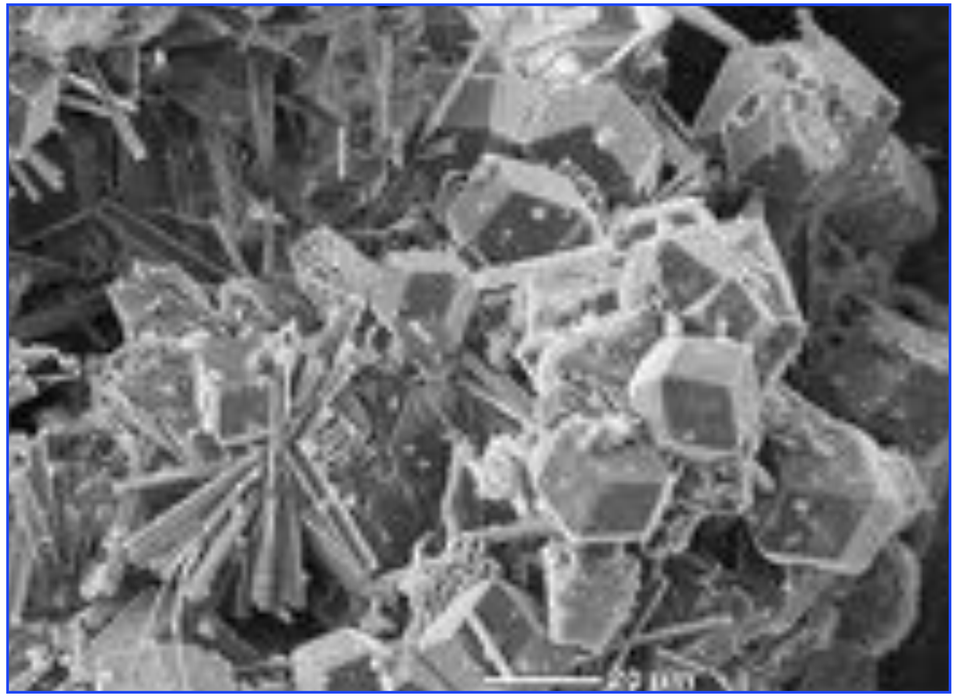
UNDERSTAND

Development of New Zealand's existing geothermal resources has depended in large part on laboratory research to determine the chemical behaviour of geothermal fluids, the effects of fluid-rock interaction, and predicted changes in rock properties

THE THERMOCHEMISTRY OF SUPERCRITICAL RESOURCES

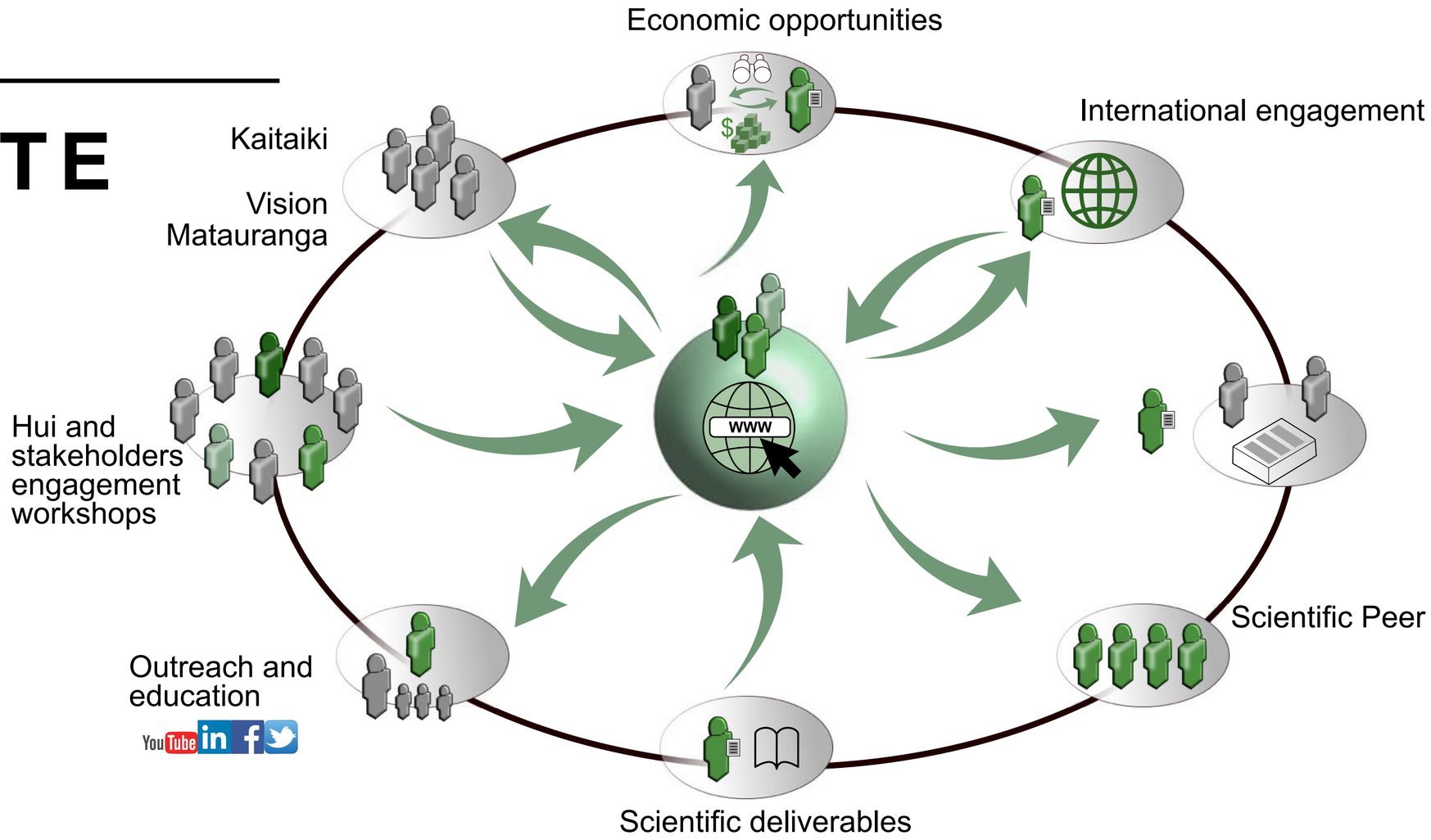
UNDERSTAND

- Understanding the interactions between magmatic fluids and rock
- Effect of reinfection at supercritical conditions
- Model geochemical reactions



AND TRANSLATE KNOWLEDGE

INTEGRATE



MAIN AIMS OF THE PROJECT

Adapt and advance global research-horizons to delineate Aotearoa’s supercritical resources, and characterise their fundamentally-unique chemical and fluid-dynamic properties.

OUR

PARTNERS

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

Upflow

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

UNSW SYDNEY

ETH Zürich

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

THANK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