

Session 4: Unlocking Hydrocarbon Resources in Queensland

Sustainable Gas / Energy

Prof. Andrew (Alf) Garnett

- Director UQ Centre for Natural Gas
- Director UQ Carbon Capture and Storage (CCS) Program
- Non-Exec Director National Energy Resource Australia (NERA)

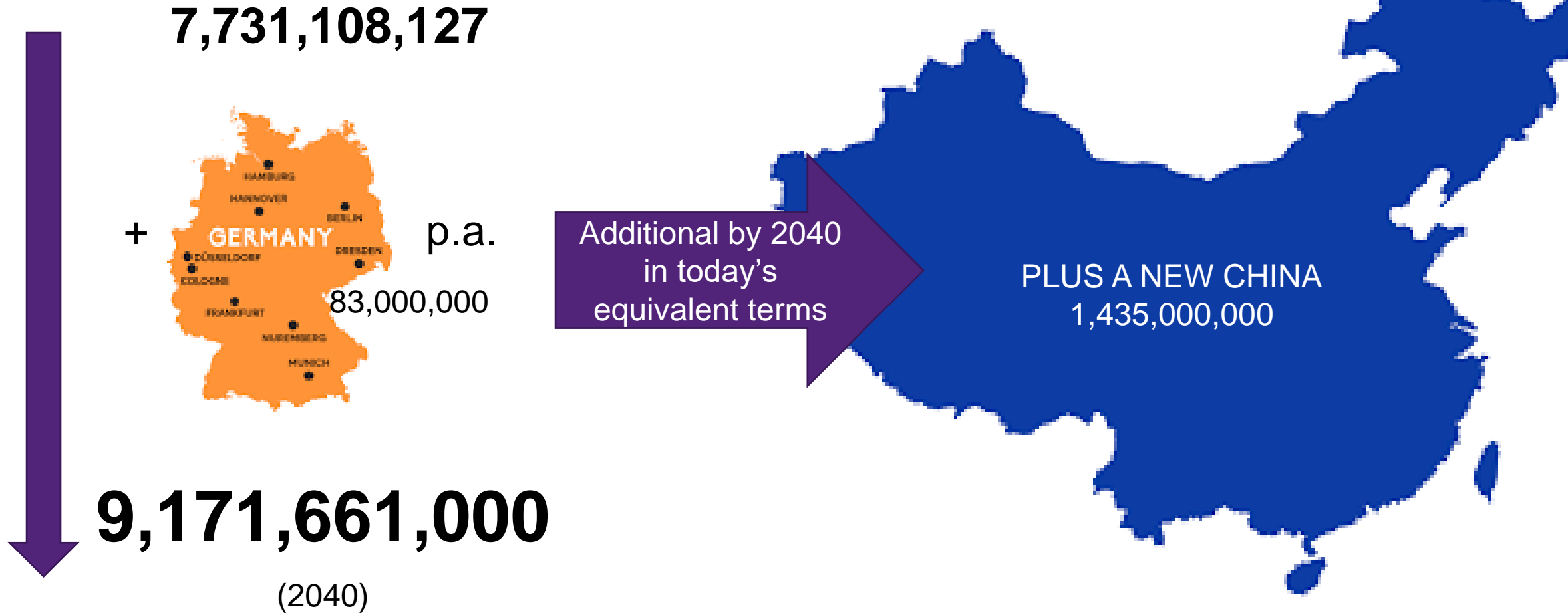
Discloser and Disclaimer

- The Centre for Natural Gas is funded by UQ, APLNG, Arrow Energy and Santos and also receives significant funding via State and Federal competitive research grant schemes.
- Centre research is conducted under UQ's research ethics policies and guidelines and the Australian Guidelines for Responsible Research
- The views discussed today are my own and do not represent those of UQ, members of the Centre for Natural Gas or any other person or body

Initial ramblings

- We live and grow (or not) in a global, **competitive** context and a **fraught** political one
- Climate action is a key driver and energy supply impacts many of the other 16 UN SDGs
- **Energy demand is at the heart of it**: the long-range outlook for Queensland's natural gas **could be excellent** ... we can do a lot of good, but only if we don't screw it up
- Unlocking Queensland's (gas) resources is going to be challenging – we *must* have
 - **Coherent** policy settings across government departments (and between State and Feds)
 - **Technology** deployment/development – *we're not in Kansas anymore*

The Root of the Energy Issue



Internationally – where might demand be heading ...

International Energy Agency Scenarios (WEO 2019)...

I - “Current Policies”

No change in policies from today (assumes they all work)

II - “Stated Policies”

Includes policies and targets *announced* (not necessarily implemented) by governments (includes Paris)

III – SDG “Sustainable Development” – *(my view) we don’t know how to do this*

Accelerated clean energy transitions put the world on track to meet goals related to climate change *and* universal access *and* clean air *and* economic development *and* feed people ...
there are 17 SDGs in total, many require us to get the energy mix over time right

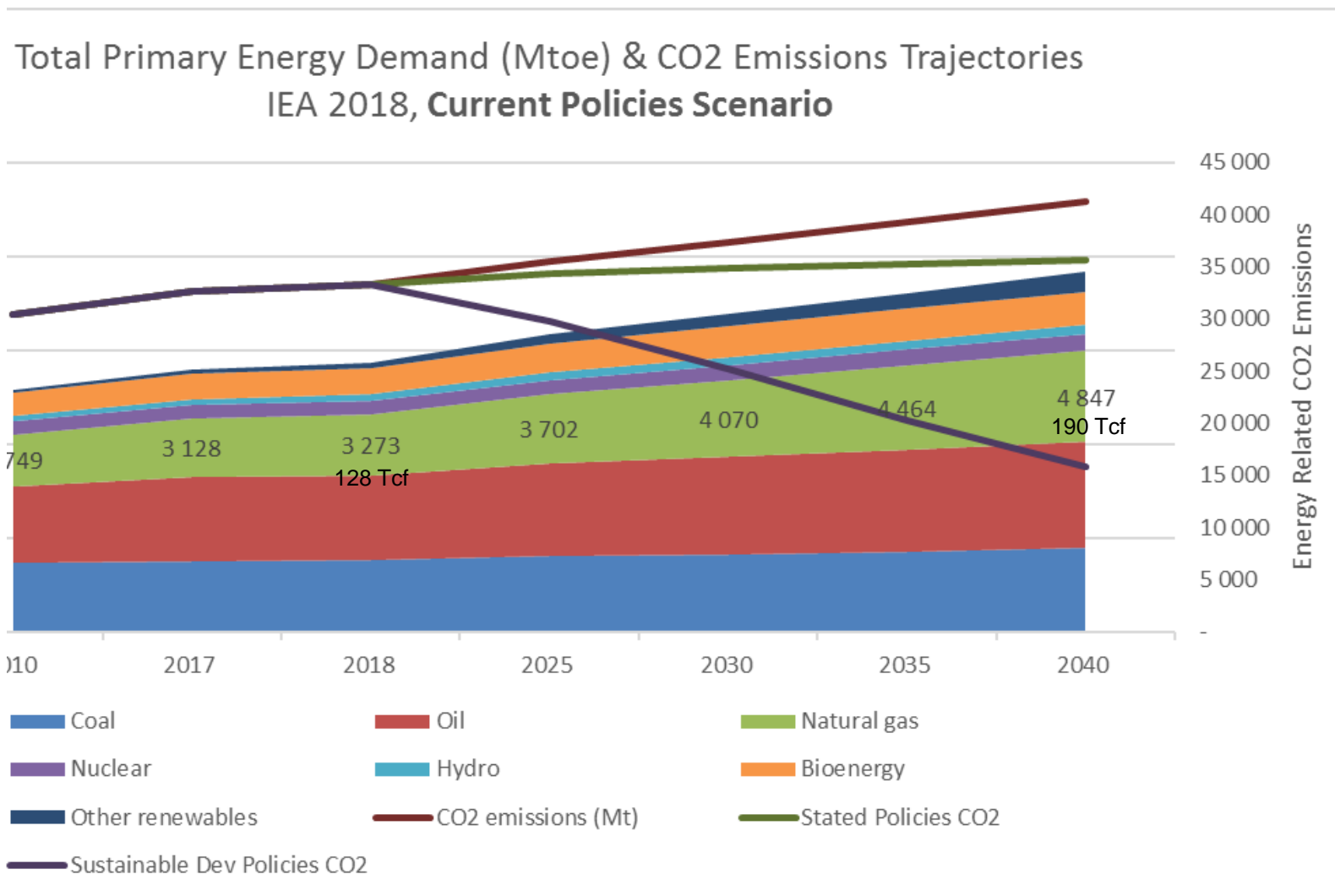
One energy demand forecast with current policy settings

Some grounding notes

- CO₂ rise correlates with Energy Supply ($r^2 \sim 0.998$) & with Population ($r^2 \sim 0.97$)
- Possible minor decoupling from 2013 but in 2018 CO₂ rose again
- Carbon intensity per capita also rising
- Energy supply increased 57% from 2000 to 2016, vast majority was fossil

Update

- 2018 was highest year ever for CO₂ emissions; and,
- 2018 was the first year in decades in which fewer than 1 Billion people were without access to electricity



An energy demand forecast to meet UN Sust. Dev Goals

Some grounding notes

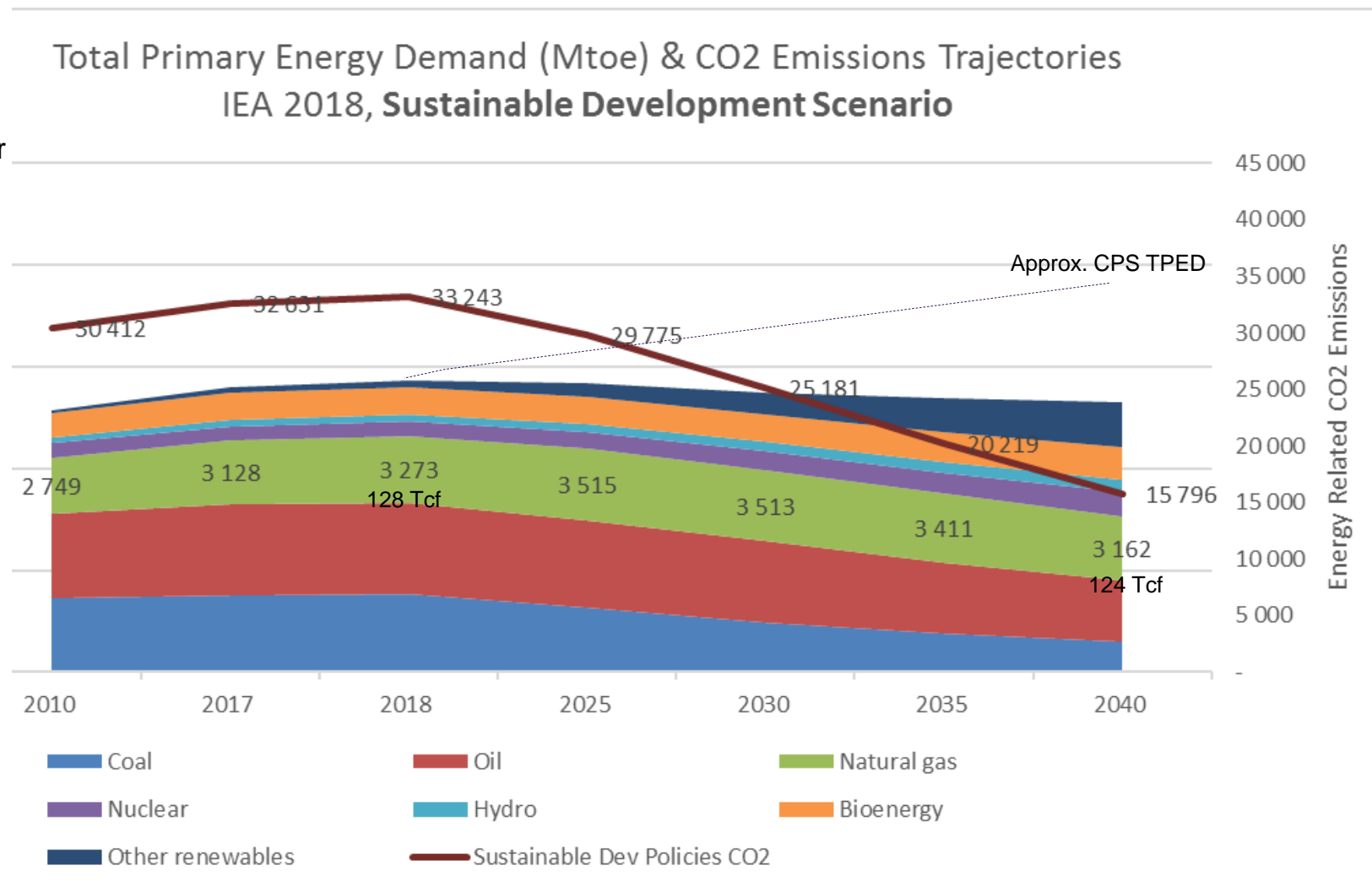
- Population rises from 7.7 to 9.1 billion
- All UN SDGs need to progress (air quality, poverty, development, clean water ... etc etc)

While

- Total energy demand needs to stay roughly constant
- And energy-related CO2 emissions to halve

So *this* case needs

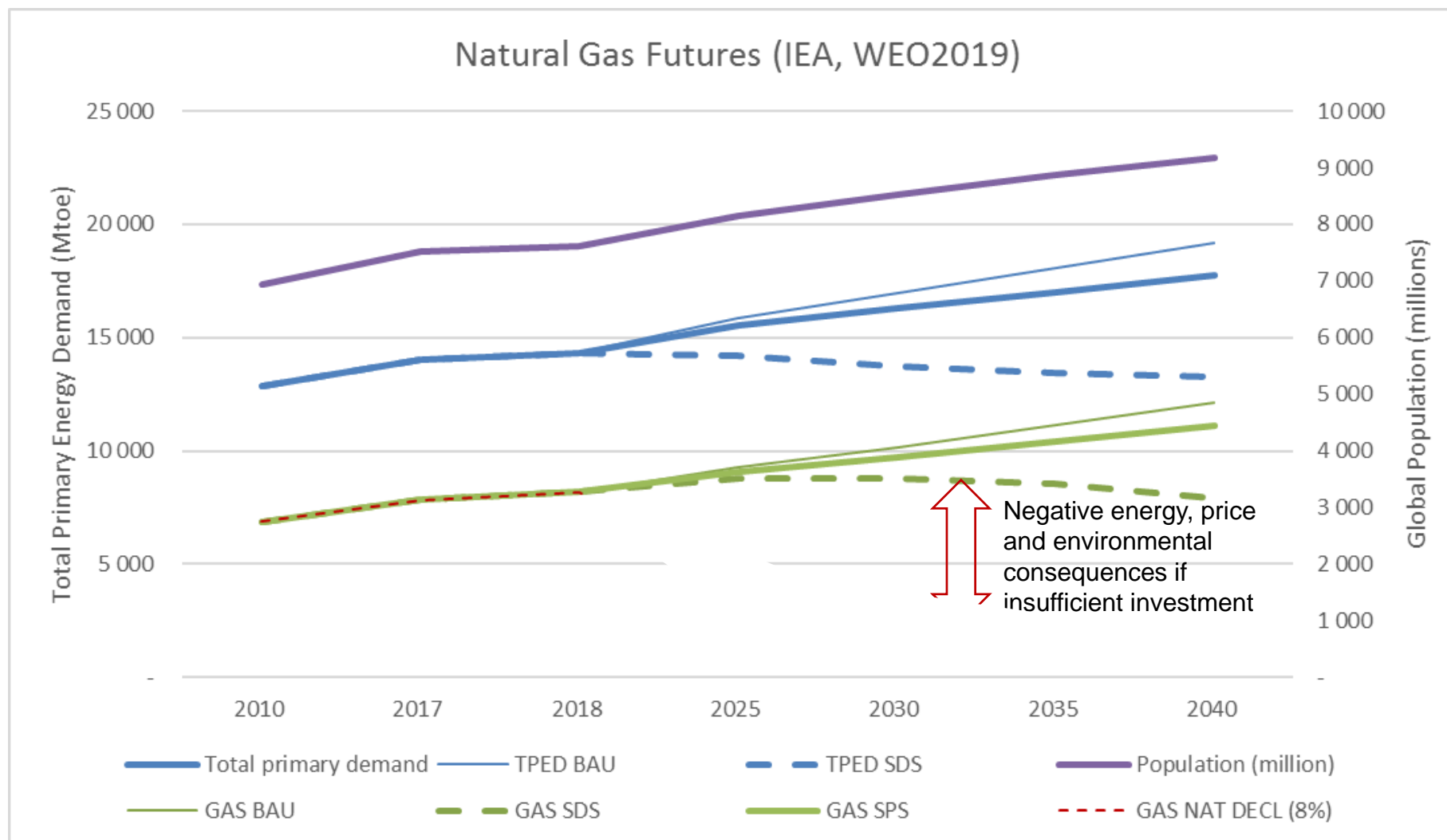
- Gas demand to grow to 2030 then reduce slightly today's levels
- MUCH greater energy efficiency
- MUCH lower energy demand per capita
- MUCH lower emissions intensity across the energy supply mix



The future roles for natural gas *incl.* in the Sust. Dev. Scenario

1. **Keep the lights on:** To enable deep penetration of renewables
2. **Reducing emissions intensity:** To substitute for coal in base load power
3. **Feeding people:** To provide fertilisers for a growing population
4. **Petrochemicals:** Basics for 9 billion plus people

In all futures (incl. the SDS) gas needs continued investment



Critical Success Factors

Roles

Keep the lights on: To essential to enable deep penetration of renewables

Reducing emissions intensity: To substitute for coal in base load power

Feeding people: To provide fertilises for a growing population

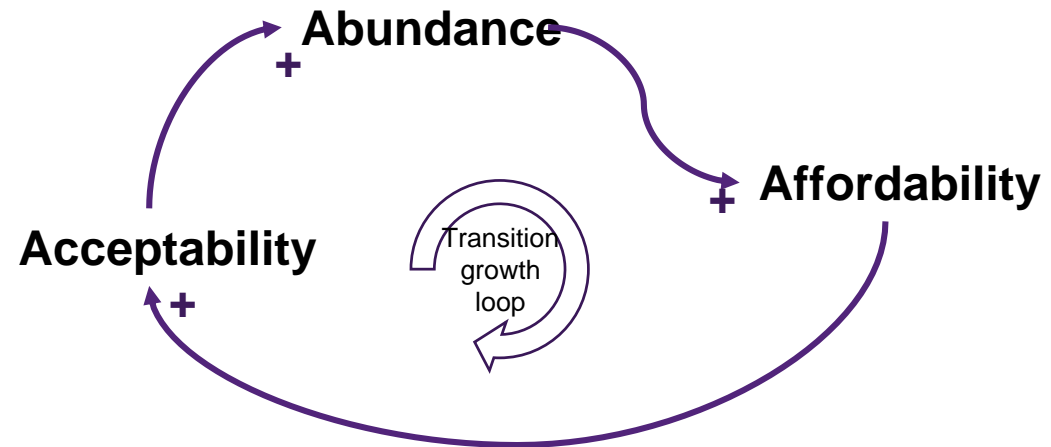
Manufacturing: To feed the growing demand for petrochemicals

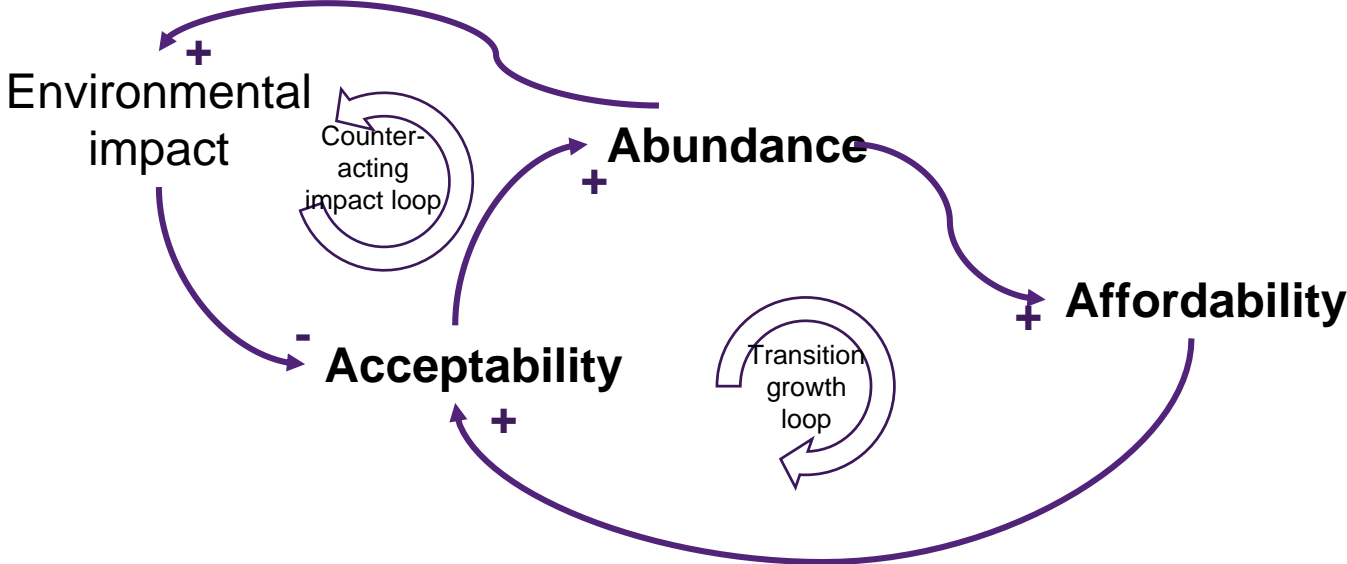
For it to serve this role, gas must be

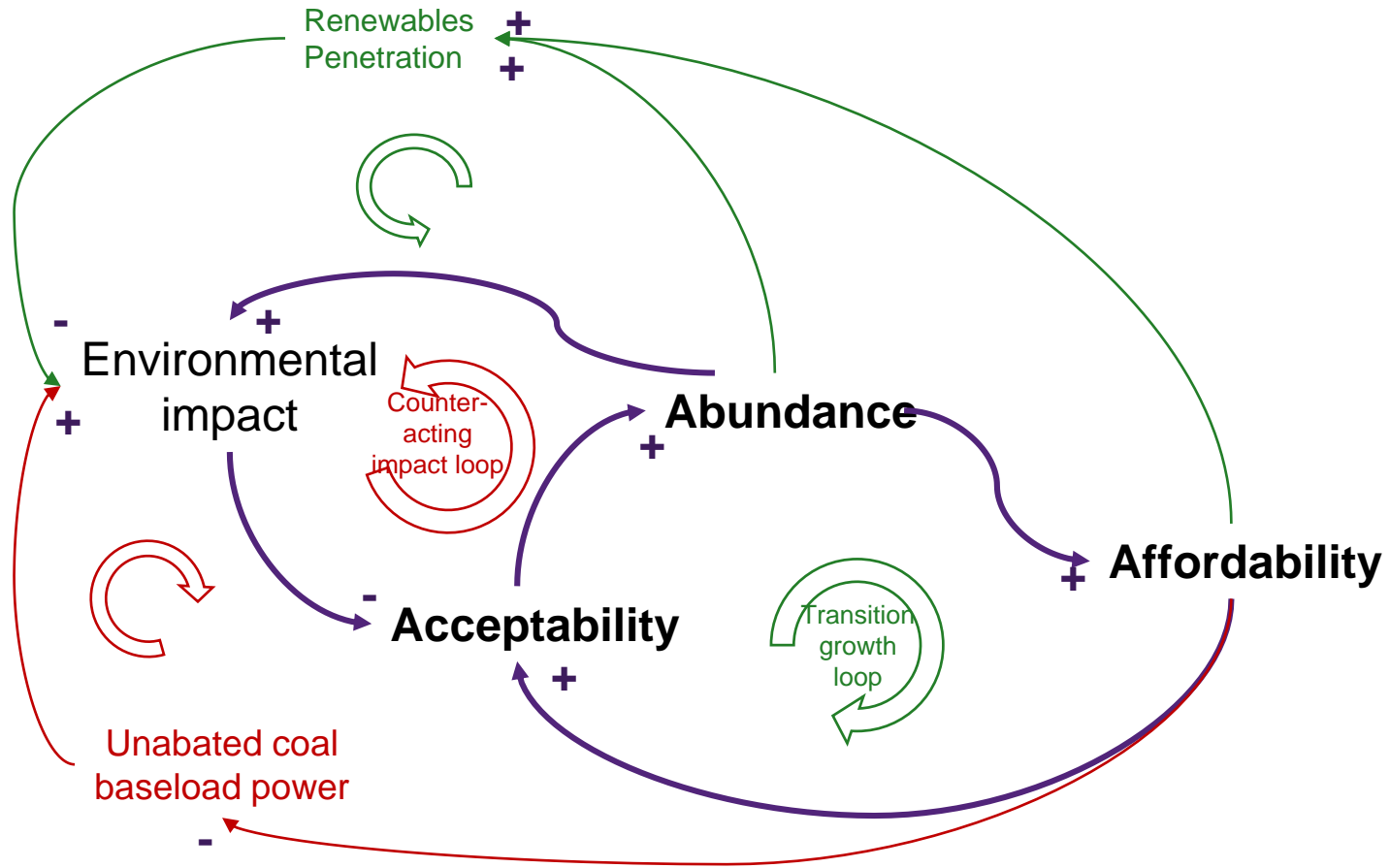
A. Abundant

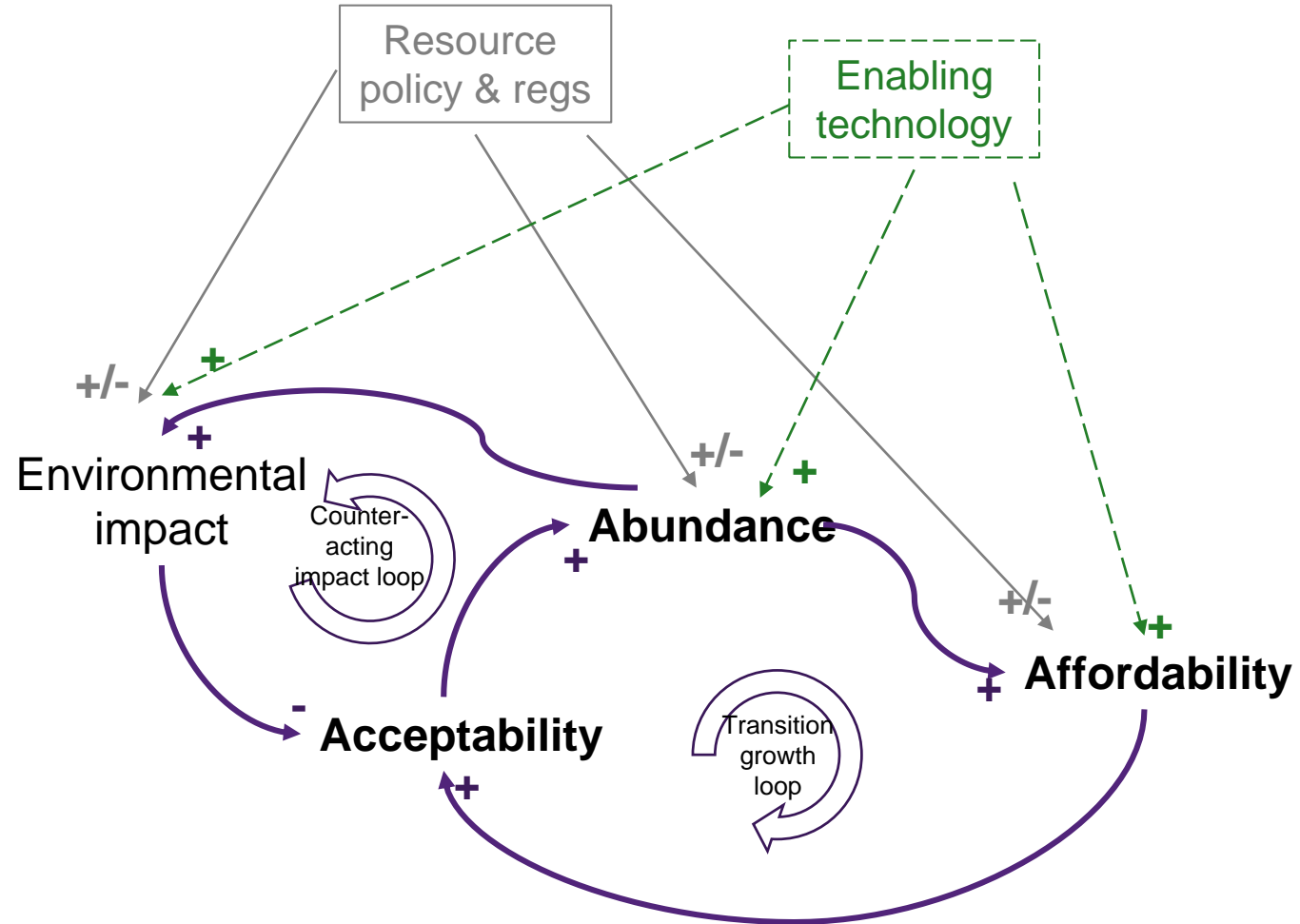
B. Affordable: Especially cost competitive with coal (for power in the wider region)

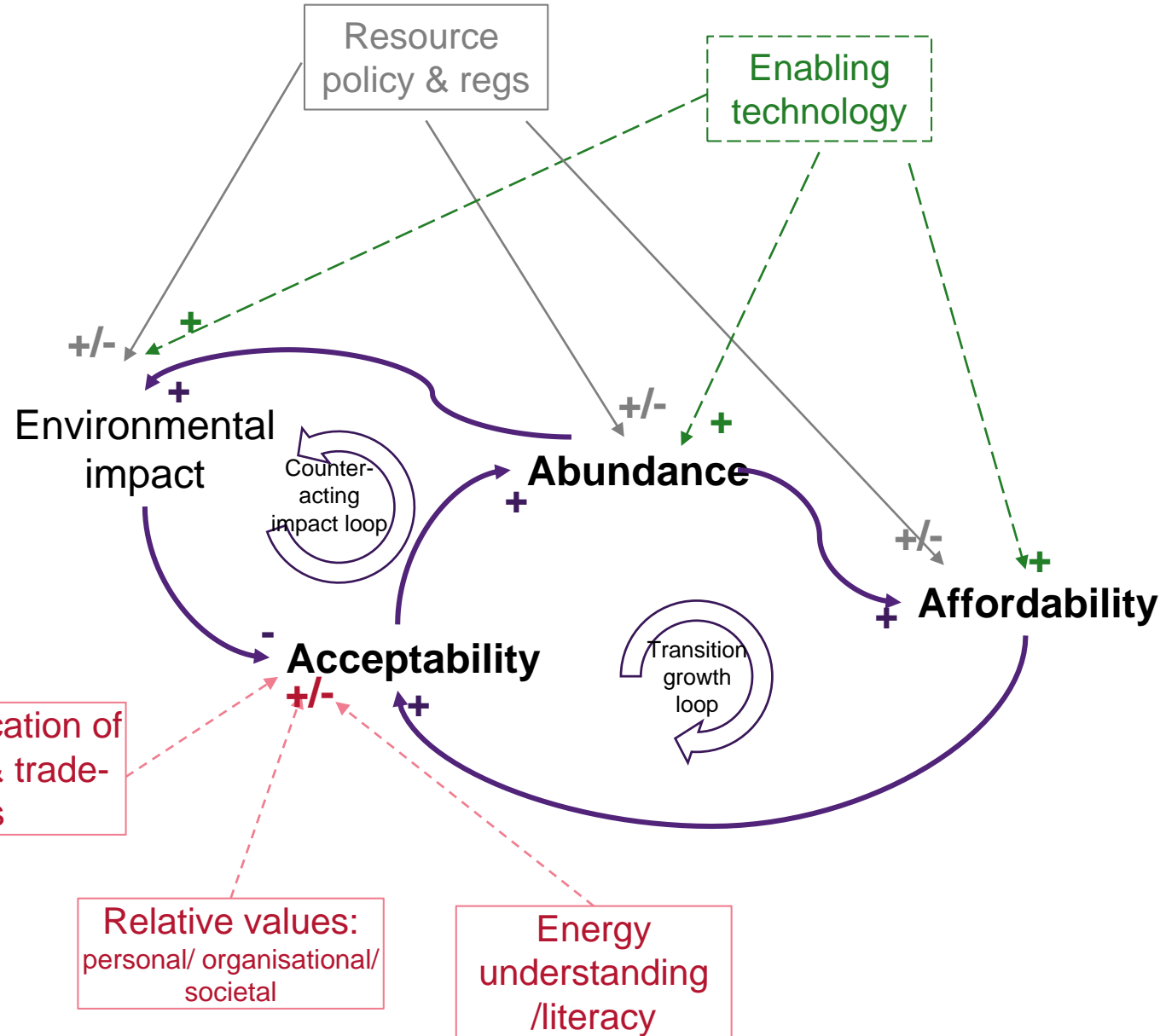
C. Acceptable: local environmental impact must be low (water) and fugitive emissions must be minimised and carbon intensity low.











Unlocking requires progress in many fronts

- ✓ Government internal policy alignment
- ✓ Government and industry in 'partnership' to develop critical future resources
- ✓ Explaining complex stuff
- ✓ Transparency and trust
- ✓ TECHNOLOGY

Recap – policy environment?

Espoused policy objectives

- Downward pressure on prices; and,
- Material emissions reductions (at home and abroad)
- So, we want more gas supply
- So, we want to attract more exploration investment



Global context

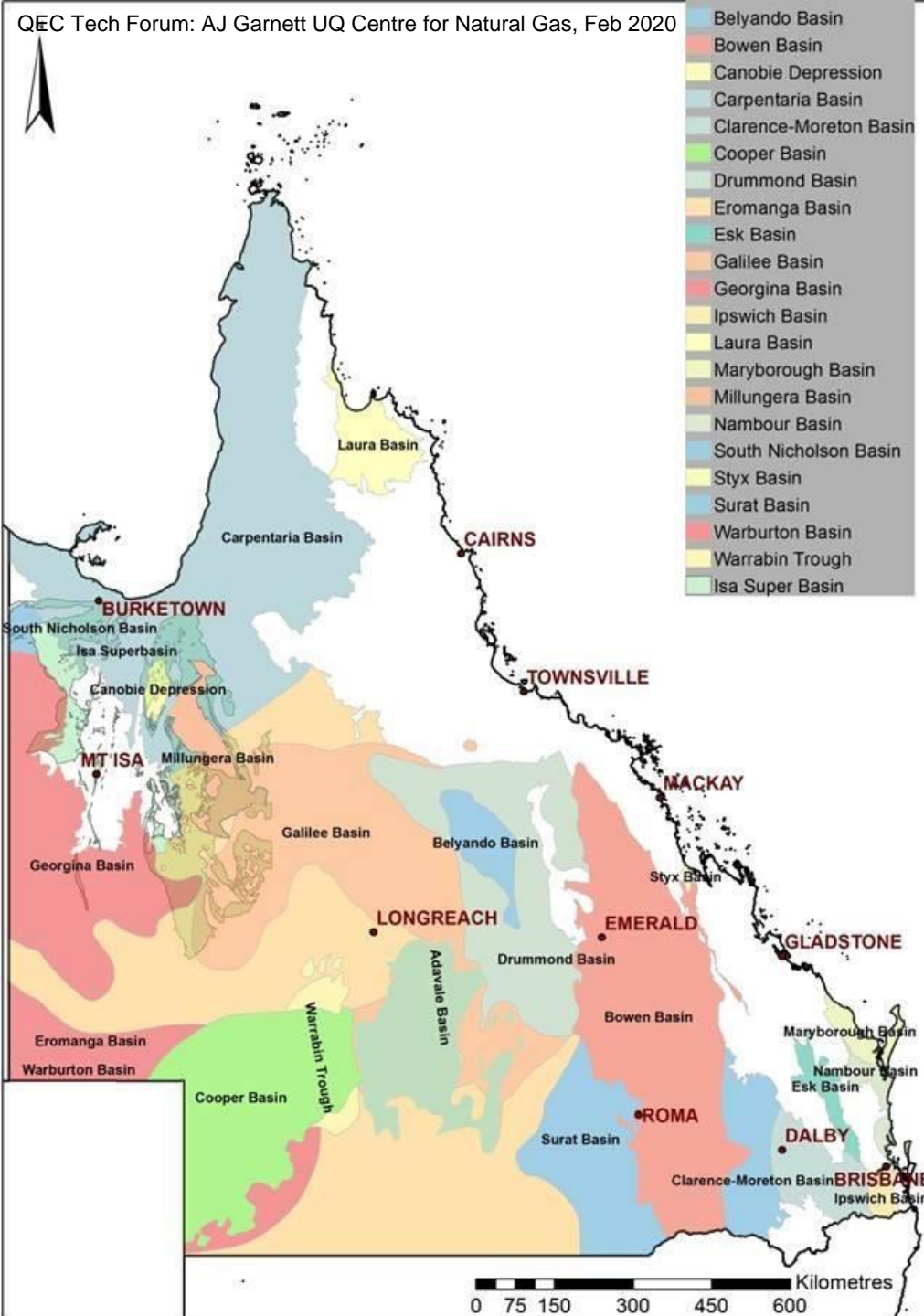
- Short term downturn in global economy -> sustained low global oil and gas prices
- Significant, lower cost providers bring major quantities of LNG onto the market
- Downward pressure on gas/LNG prices
- Exploration spend will be challenged again

Local context

- Large gas endowment, but
- High costs + remote + technically challenged + ...

The response?

Raise royalties, threat of domestic reservation, announce a review of PRRT, review all resource regulation, reduce access (some places) ... and, just for good measure, make R&D tax credits so unpredictable as to be almost a disincentive ...



Increase supply?

.... Some work to do – we’re not short of TCFs endowment

- Milk the working Surat and Bowen CSG plays – leverage existing infrastructure, manage depletion, bring forward near-field, contingent resources, minimise opex
- Make the northern Bowen work – productivity, new tech, gov pipeline support?
- Rejuvenate the Dennison – new tech, lower cost
- Explore the deep (tight) Bowen – stimulate, tie back to the new infrastructure?
- Push out to the Galilee – basin proving stuff
- The Cooper’s not done yet
- Go west, go old and/or go deep
- ... and the rest

*“**New exploration**” will need to be very **production technology led** and inherently experimental ... there are common technical capabilities which grow out of recent R&D work and field experience, but there is no substitute for high levels of investment and activity*

UQ Centre for Natural Gas *Technical* Research Streams

IRC #1:

Reducing operating expenditure: Reduction in work-over costs and/or frequency with an initial focus on current well stock and improved ‘management’ of solids and use of modern data science

IRC #2

Modelling complex heterogeneous systems: understanding how the gas resource connects to the aquifer water resources through improved **modelling of heterogeneity & connectivity**

IRC#3

Converting contingent resources to commercially recoverable resources: initial focus on stimulating and producing very ‘low perm’ formations
... emerging focus (i) drilling and completing depleted coals; (ii) managing ultra-low line pressures in complex networks?

Some cool technology stuff to follow ...

There is excellent work ongoing around Queensland, in the small and large companies, in the government (DNRME, OGIA, GSQ) and in research institutions (QUT, CSIRO/GISERA, UQ ... etc.) ..

Next up ... remember “new exploration” has to be production technology led

Ray Johnson - Developments in hydraulic fracturing

Mahshid Firouzi - What can we do with modern data?

Chris Leonardi - Better stimulation and enhancing (tight) CSG production



Thank you

Prof AJ Garnett
University of Queensland
Director UQ Centre for Natural Gas
a.garnett@uq.edu.au

Energy Transition ?

It's an "**AND**" story ...

we want to reduce emissions and increase energy access and keep the lights on and maintain stability, security and affordability and win social acceptance and feed the world *and (all the other UN SDGs) ...*

And ... unless we mess it up (policies &/or SLtO) Queensland gas should be a great opportunity for years to come