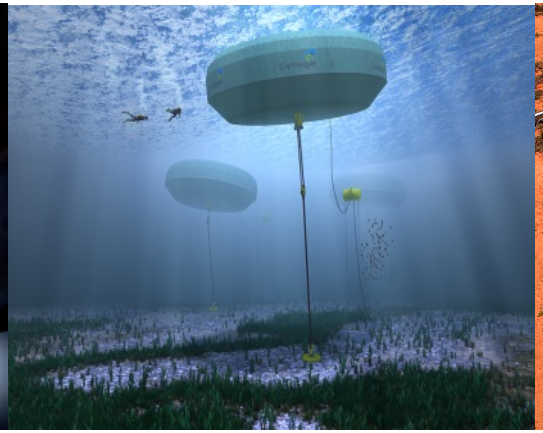
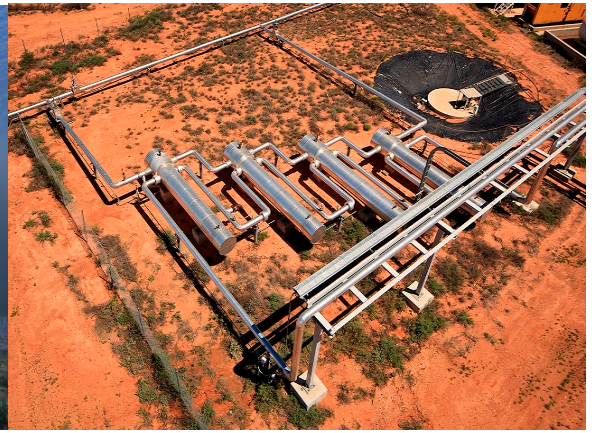



ASTRI 2015 – Objectives of Today

ARENA and Government CST Agenda

Louise Vickery 11 February 2015

ARENA

Objectives of Today

- To better understand the **research drivers**
  - research being undertaken by ASTRI, and by other Australian and international organisations?
  - energy challenges that the research is trying to solve (cost, efficiency, capacity, scalability, storage, chemistry, integration, risk)?
  - areas of complementarity/collaboration to deliver better outcomes.
- To better understand the **commercial drivers**:
  - the opportunities and market pull through for CST here in Australia and internationally.
  - enhancing the business case for commercial investment and uptake.
- To better understand the **political drivers**:
  - supporting the Governments energy policy objectives - reliable, low-cost, secure and sustainable energy now and into the future
  - supporting ARENA's objectives to improve the awareness, investment, commercialisation and uptake of renewable energy.

Outcome : Research dollars improve the competitiveness and take up of CST

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Australian Government Policy Objectives

Energy White Paper

- reliable, low-cost, secure and sustainable energy
- alignment and balance between energy and environmental policy
- technology neutrality - to support new energy sources and allow for change, innovation and transformative technologies
- focus on energy productivity – getting the best outcome for the energy used
- addressing gas supply issues and rising gas prices
- energy market reform – cost reflective pricing & greater consumer engagement

Science Innovation and Growth

- Focus our R&D effort and increase the return to Australia from our research $ by
  - solving real world problems
  - building on what we do well
  - increasing the commercial application and return on investment

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ARENA's Objectives & CST

ARENA's objective: to improve the awareness, competitiveness and take up of renewables by investing in research and development to demonstration and early pre commercial deployment.

For CST this means research expenditure should be focused on opportunities to commercialise and deploy in the short to medium to long term :

- getting the cost below that of the competition
- industry engaged and willing to invest
- solving real world energy problems

Ideally we want our Strategic research initiatives to facilitate

- understanding of international and national trends and opportunities
- collaboration between Australian & international researchers, research and industry
- to create market pull through more targeted real-world applications

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Opportunities

- Energy Market Reform – cost reflective pricing and government seeking to remove regulations and distortions that discourage competition –
- Hybrid, modular and scalable for energy growth regions - Fringe of grid & off-grid
- Rising gas prices and regional security issues – replace gas for heating or chemical processes (industrial / commercial)
- Solar resources for Solar fuels – Hydrogen etc.
- Countries with low / or lowering energy security looking for solar resources
  - China, India, Middle East, Africa, Chile

Future energy intensive industry will be based in countries with best renewable energy resources

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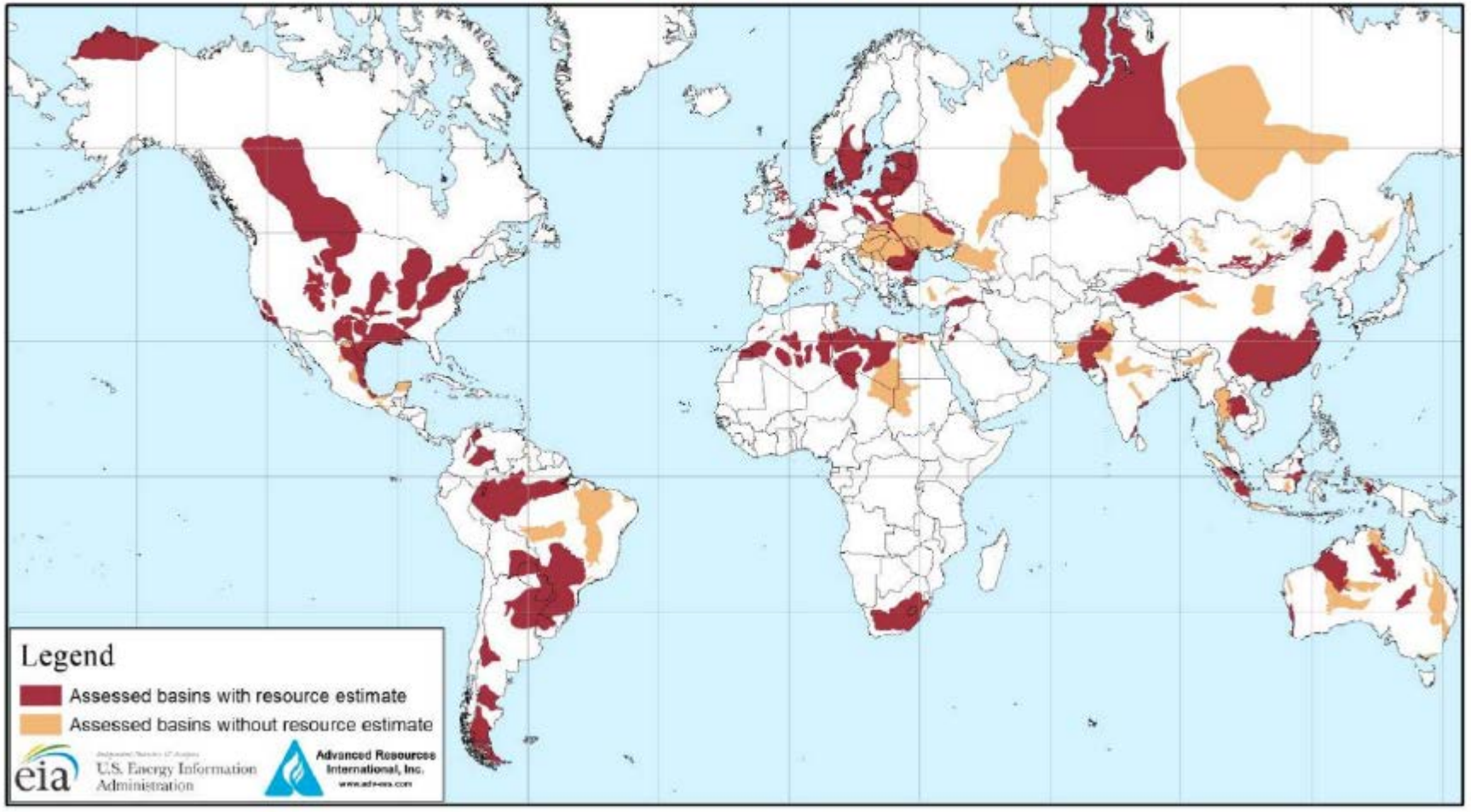
Will we run out of oil and natural gas?

"Our ability to find and extract fossil fuels continues to improve, and economically recoverable reservoirs around the world are likely to keep pace with the rising demand for decades."

Steven Chu and Arun Majumdar, *Nature* (2012)

Potential shale gas and tight oil reservoirs can change the energy landscape of the Americas, Asia and Europe.

The rest of the world may have 10 times more tight oil and shale gas than the U.S.



Source: United States basins from U.S. Energy Information Administration and United States Geological Survey; other basins

"The Stone Age came to an end not for a lack of stones and the oil age will end, but not for a lack of oil."

- Sheik Ahmed Zaki Yamani, former Saudi Oil Minister

We transitioned to better solutions.

If we do not find better solutions, the oil, gas and coal *will* be used.

Innovation in Stationary Energy Storage: Cost-based Discovery

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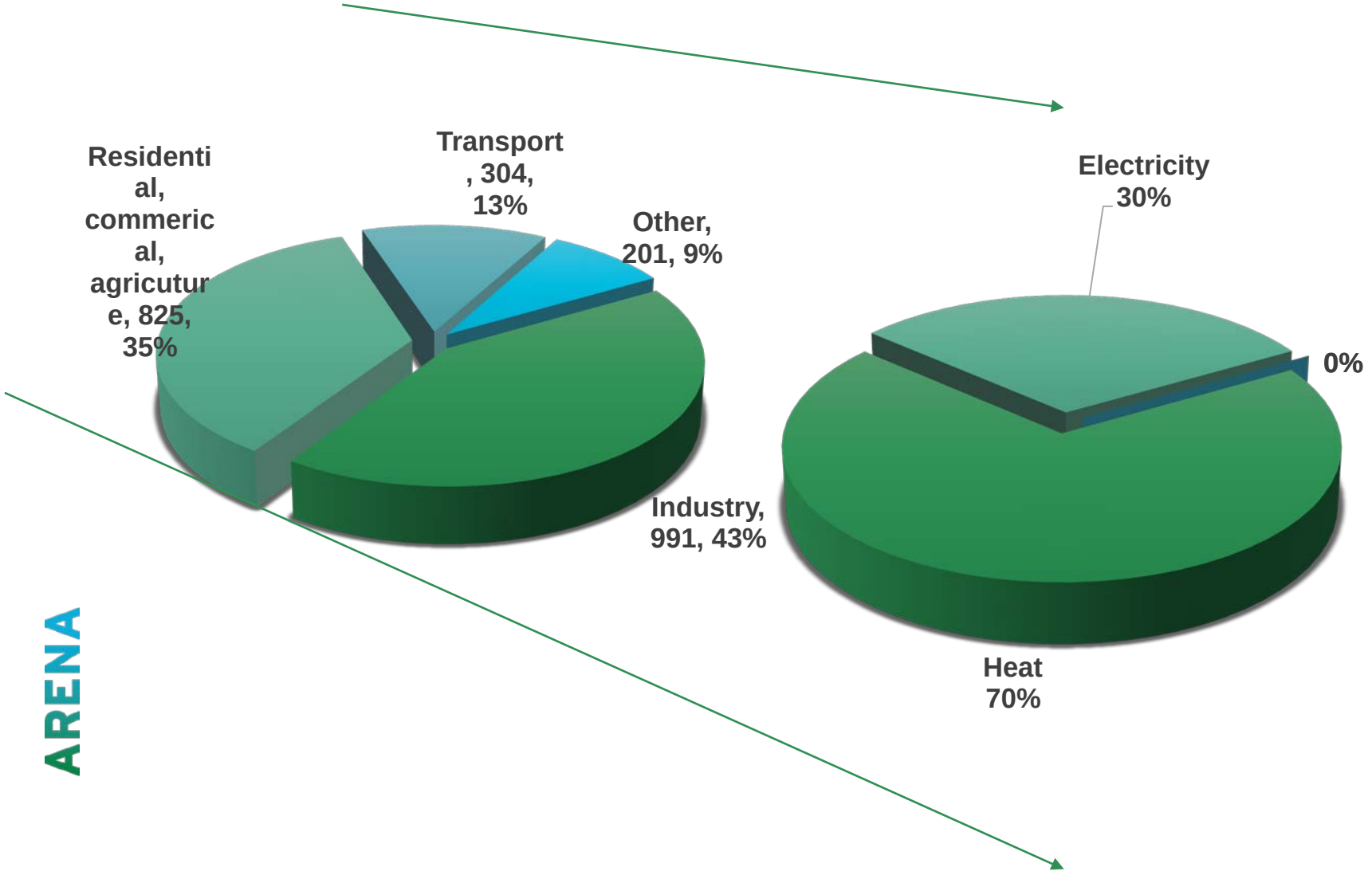
the path forward for storage

- for grid-level storage, battery vs combustion (diesel & natural gas) ☞ need to think differently
- today's Li-ion batteries fail badly: far too costly
- confine chemistry to earth-abundant elements
  ☞ to make it dirt cheap, make it out of dirt!
  preferably local dirt
- and make it easy to manufacture

Energy consumption (PJ) in Australia 2012 (IEA, BREE 2012)



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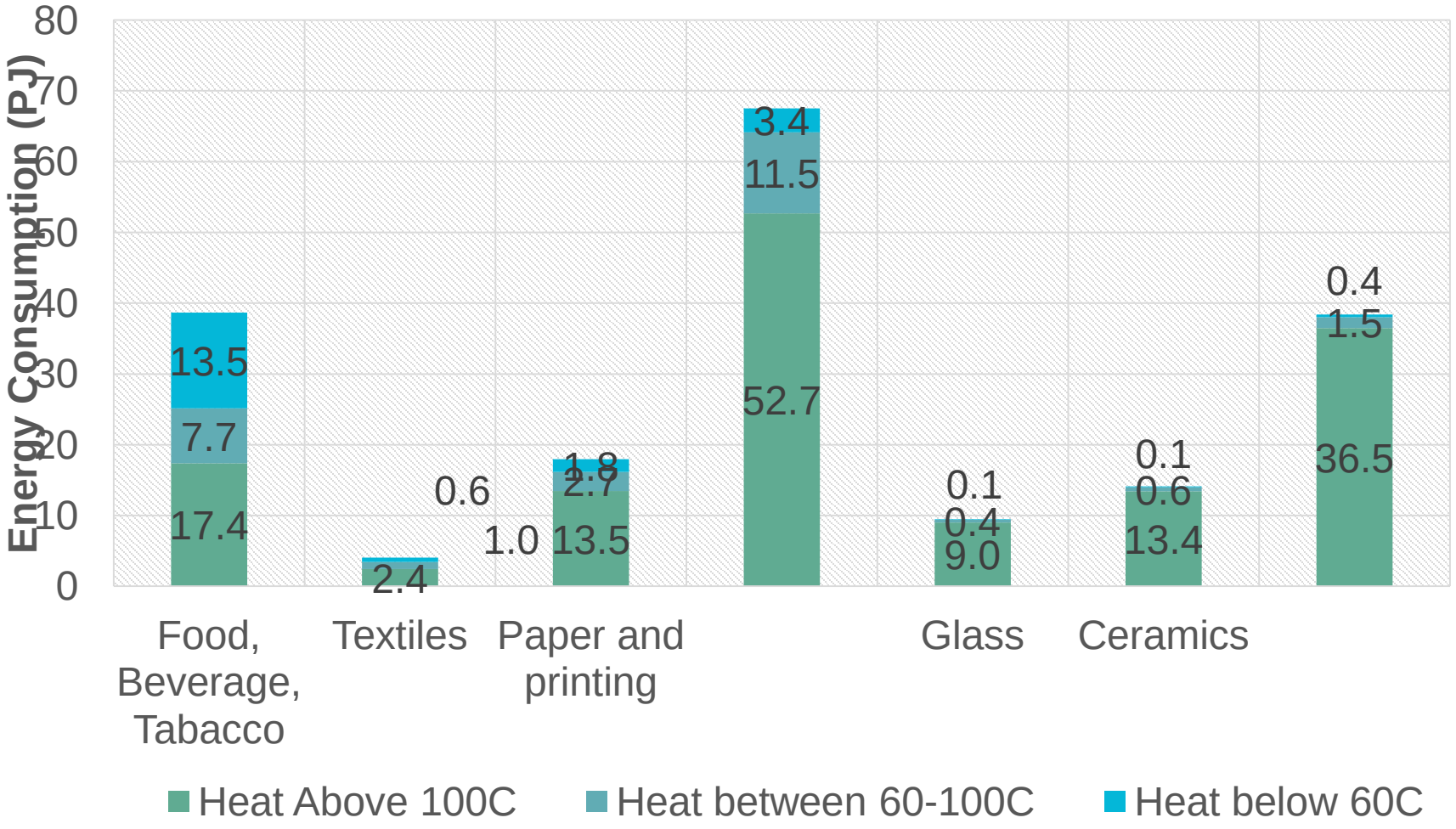
Heat use in Manufacturing

(BREE, IEA, UNID



Donald Sadoway (MIT) slide on the battery

- Target research at the problem you need to solve – how to get the cost of storage lower than a hydrocarbon energy solution
  - *try to find Donald's 'energy change history' slide*
- Lessons learnt
  - Has not aimed for next step battery development
    + build on existing technology. Not new chemistry / technology that is high cost and to be viable will require you to chase down the cost curve by making lots of product.
  - Use low cost locally sources materials – earth elements that are cheap and abundant rather than rare expensive metals
    + goal is to be cheaper than hydrocarbons
  - Use simple manufacturing techniques and factories that don't cost us a fortune
  - multi-disciplinary team – not experts – passionate talented individuals that challenge conventional thinking and look for smart 'outside of the box' solutions
  - technology – robust and scalable
- Lessons for CST – target research at problem you need to solve – having a lower cost than PV.

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Primary Energy Growth - 2035

- Clear long-run shift in energy growth from the OECD to **the non-OECD.**
- **I**n 2035 virtually all (95%) of the projected growth is in the non-OECD with energy consumption growing at 2.3% p.a. 2012-35. OECD energy

  consumption, by contrast, grows at just 0.2% p.a. over the whole

  period and falling from 2030 onwards.
- China has emerged as the key growth contributor, but by the end of 2035 **China's** contribution is starting to fade. **India's** contribution grows, almost matching that of China in the final decade of the forecast.

BP Energy Outlook 2014

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Australian Government
Australian Renewable Energy Agency

Want to know more?

Arena.gov.au

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