Towards Water and Food Security through Energy Efficiency:

Addressing the adaptation gap

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Water, Energy and Food (land resources) Security are linked.
Water, food (land) and energy: management in silos

I'm looking for help on this, virtual team...

Land

It's not part of our remit

Water

We are fully committed

Energy

We want to help but...

Traditional silos getting in the way?
Diver of change: *climate change*

Estimated impact of +3 degrees C change on crop yields by 2050  
(Source: Water Resources Institute)
### Achieving food security: three responses

<table>
<thead>
<tr>
<th>Discourse/Response</th>
<th>Summary</th>
<th>Perceived Strengths</th>
<th>Potential Limitations</th>
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</thead>
<tbody>
<tr>
<td>Sustainable Intensification (SI)</td>
<td>Producing more food from the same or fewer inputs</td>
<td>Defined the end goal rather than prescriptive practices</td>
<td>Insufficient attention to trade-offs, over-focus on supply side and singular sector focus</td>
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<tr>
<td>Resilience Thinking</td>
<td>Capacity of a system to respond to threats and retain ability to deliver benefits</td>
<td>Addresses challenge of resource management in presence of uncertainty and threats</td>
<td>Difficult to quantify systems linkages, uncertainties and trade-offs</td>
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<tr>
<td>Nexus</td>
<td>Interconnections between food, water, energy and environment</td>
<td>Emphasis on trade-offs, investments, policies and governance, can engage new knowledge, technologies, markets</td>
<td>Difficult to map onto current governance structures and implement in a systematic manner</td>
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Source: Grafton et al. (2016)
A paradigm shift is needed: Water-energy-food nexus

http://chinawaterrisk.org

Challenge: from conceptualisation to operationalisation
How do we fight climate change?

Source: Centre for international Forestry Research
Connecting the dots…

**Adaptation Mitigation synergies**

Source: Center for Clean Air Policy

**Adaptation**
- Afforestation
- Open space preservation
- Land use changes
- Relocation
- Infrastructure protection
- Building design
- Flood mitigation
- Emergency response
- Business community plans
- Community engagement

**Mitigation**
- Energy efficiency strategies
- Renewable energy
- Combined heat and power
- Sustainable transportation
- Methane capture and use
- Industrial process improvements
- Carbon sequestration and sinks

**Green Infrastructure**
- Protect sustainable transportation
- Building weatherisation
- Water & energy conservation
- Power system resilience

**Notes:**
- The diagram illustrates how adaptation and mitigation strategies can complement each other to address climate change challenges.
A paradigm shift towards Water-energy-food nexus: **HOW?**

- A whole-of-system understanding (including links)
- Innovative cross-sectoral solutions
- Innovative Decision Support Tools
- Transparent monitoring and evaluation framework
- Effective governance and institutional arrangements
- Equitable financial mechanisms
- Transdisciplinary multi-sectoral collaboration

Science, Technology, Engineering and Mathematics (STEM)
A whole-of-system understanding

- A broader and inter-related view of water and energy customers - across domestic, agricultural and commercial users; including supply chain and embodied flows through agricultural products.
- Access to datasets across sectors for better decision making and servicing the needs of multiple stakeholders.
Innovative solutions

INTEGRATED RESOURCE RECOVERY
The path to green energy
Innovative solutions

- Recirculating shower
- Waterless or ionising clothes washers
- Waterless dishwashers
- Airshower

Not a product endorsement
Decision Support Frameworks and Tools

Example: Risk and Options Assessment process for Decision-making process (ROAD) (Grafton, 2016)
Hypothetical causal pathways for a Murray-Darling Basin Farmer in the presence of Drought: Applying ROAD (Grafton et al. 2016)
Decision Support Frameworks and Tools

Data integration and Visualisation tools e.g. eReefs (source: Great Barrier Reef Foundation)
A collaborative partnership...

Example – The Healthy Waterways Partnership

- Special collaboration between government, industry, researchers and community

- Working towards understanding, planning for and managing the use of waterways and catchments in South East Queensland (SEQ)

- Includes the Australian Government, 6 Queensland (State) government agencies, all 11 local governments in the region, 4 universities, 30 major industries and 38 catchment, landcare, environment and community groups

**Healthy Waterways Vision**

Our waterways and catchments will, by 2026, be a healthy ecosystem supporting the livelihoods and lifestyles of residents and visitors and will be managed through collaboration between community, government and industry.
Underpinned by Adaptive Management Framework

On-going knowledge acquisition and technology development (role of STEM)

Continuous improvement in planning/policy

Effective communication of knowledge for policy/planning

Framework for Action - solutions (targeted & committed)

Critical role of monitoring (links actions to provision of community and environmental values)
Policy framework for managing the nexus: South Asia example

(Rasul, 2014)
## A paradigm shift towards Water-energy-food nexus: *Role of STEM*

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<th>Feature</th>
<th>Description</th>
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<tr>
<td>A whole-of-system understanding</td>
<td>That reflects the pathways and linkages between water, food/land and energy.</td>
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<td>Innovative cross-sectoral solutions</td>
<td>That recognises the complementarity and potential competition.</td>
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<tr>
<td>Robust decision support tools/frameworks</td>
<td>That simulate the system and links and test management solutions.</td>
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<td>Transparent monitoring and evaluation framework</td>
<td>That will have a metric for the nexus</td>
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<td>Effective governance and institutional arrangements</td>
<td>Through embedding the nexus in planning schemes that recognise trade-offs.</td>
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<td>Equitable financial mechanisms</td>
<td>That ensures efficiencies and value-for-money for end users.</td>
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<td>Transdisciplinary multisectoral collaboration</td>
<td>That recognises the convergence of different objectives and outcomes and underpinned by respect and equality.</td>
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Driver of Change: Sustainable Development Goals
New initiative: Queensland Water-Energy-Food Security Alliance

- Co-ordinating a series of pilot demonstration trials involving water and energy utilities, and agribusiness.

- A program of collaborative research, monitoring and decision-tool development on water-energy-food nexus research.

- Co-design of innovative tools and alternative options to enhance profitability and sustainability of water and energy resources, while reducing adverse environmental (GHG) impacts.

- Capacity building and training, especially designing and engaging in a transdisciplinary learning, capacity building and reflection process.

- A national water-energy-food conference series to bring internationally recognised thinkers and leading technologies, to showcase best practice in Queensland and Australia.
Driver of change: increasing energy costs

[Bar chart showing energy usage per 1,000,000 people for Wastewater and Water from 2007, 2030 Business as usual, and Target 2050 (80% GHG reduction).]
Technology Development