

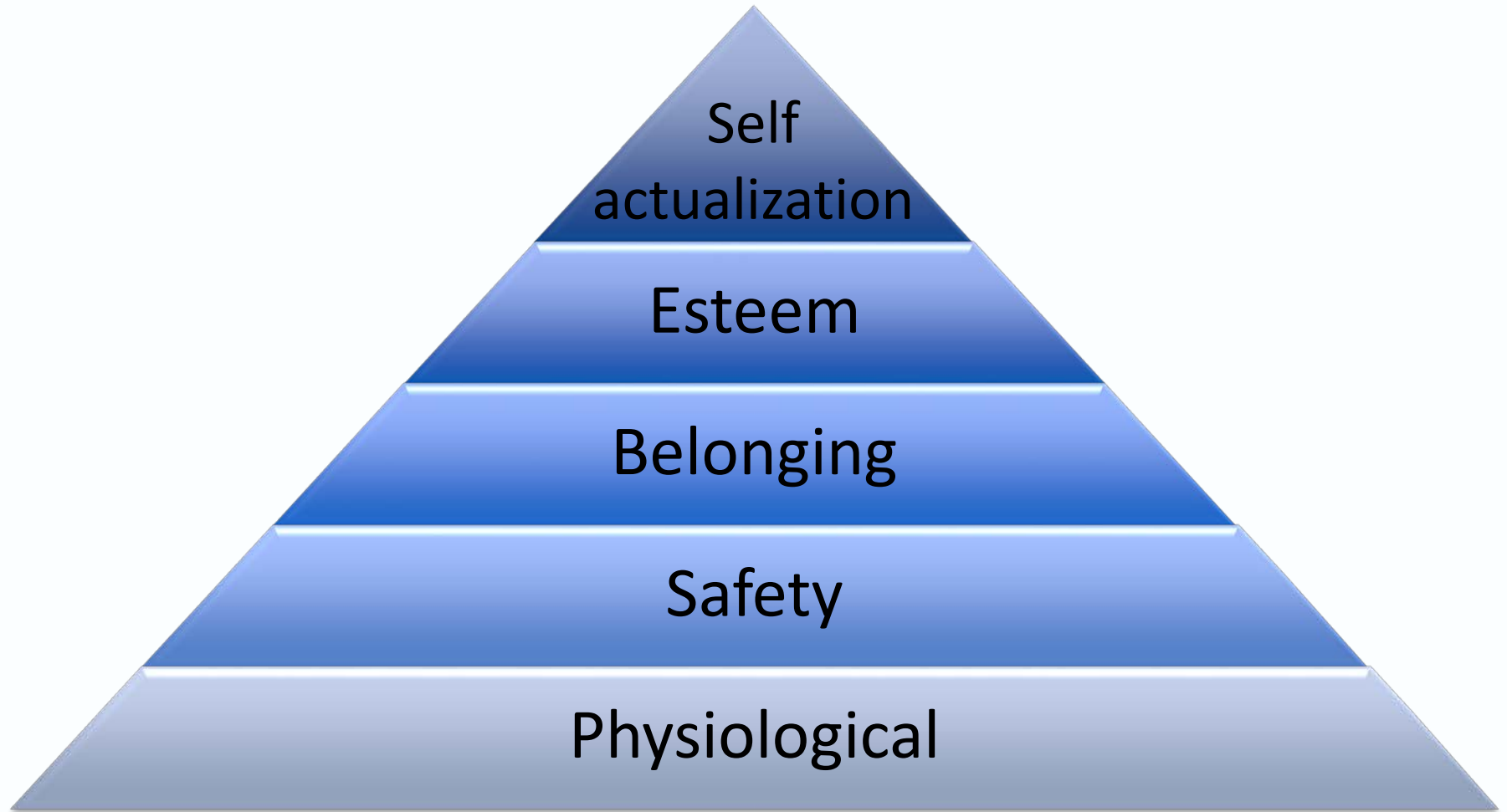
# An overview of the energy, food and water nexus

International Energy Forum | 16 April 2014

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# Maslow's “hierarchy of needs” highlights importance of energy, food and water nexus



# A “wicked problem” – EFW nexus is one of the 21<sup>st</sup> century’s most difficult issues to solve

## 1. **Complex**

Multiple connections across scales between energy, food and water make it a complex, interconnected problem to solve

## 2. **Local**

The local and temporal constraints especially of water and to some extent food need to be understood with high spatial and temporal resolution

## 3. **Non-linear**

Energy, food and water issues often feature thresholds, lag time and tipping points, which means foresight and understanding matter

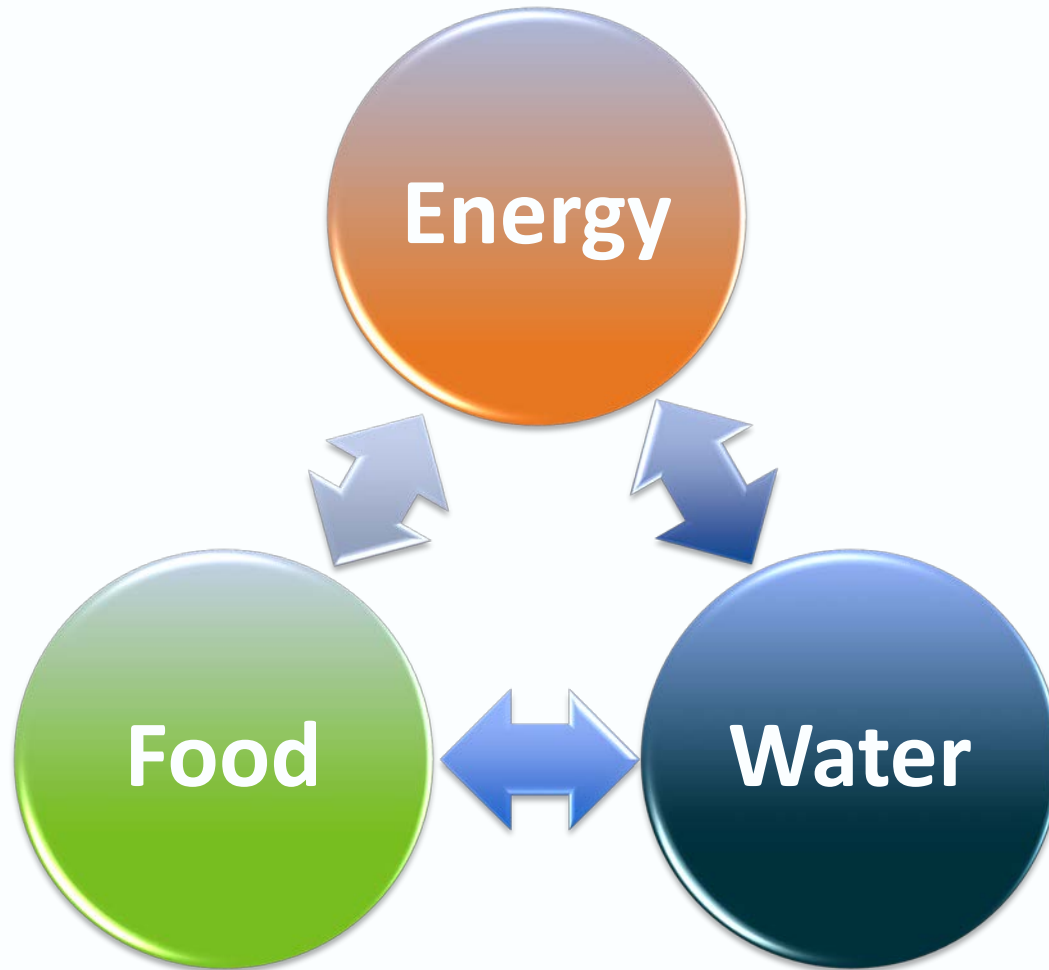
## 4. **Evolving**

Energy, food and water constraints could become more pronounced in future, for example due to resource depletion and climate change

## 5. **Hidden**

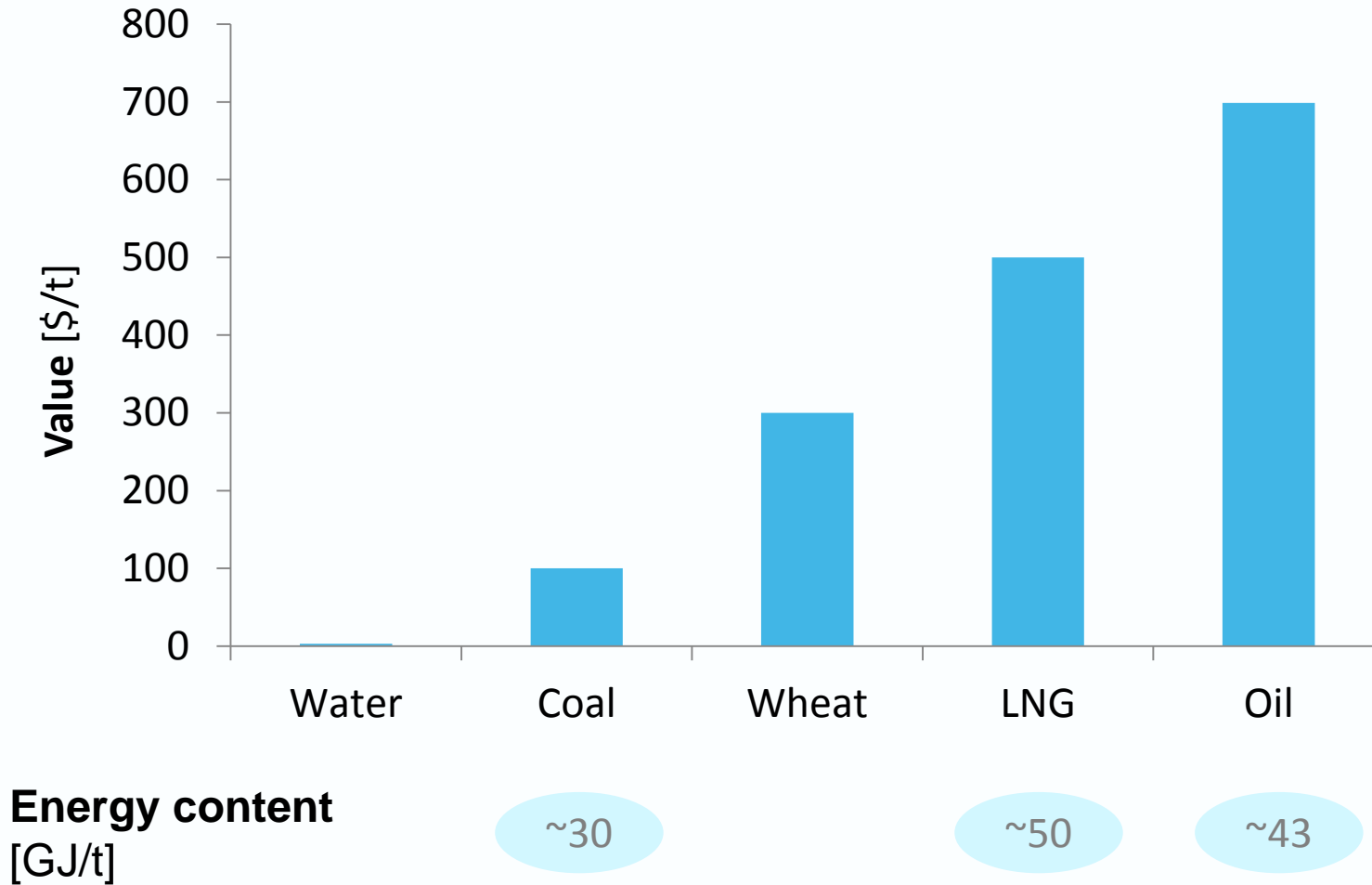
Existing and systemic energy, food and water issues may not immediately be apparent if an economy is affluent and doesn’t face a crisis

# 1. Complex interconnections



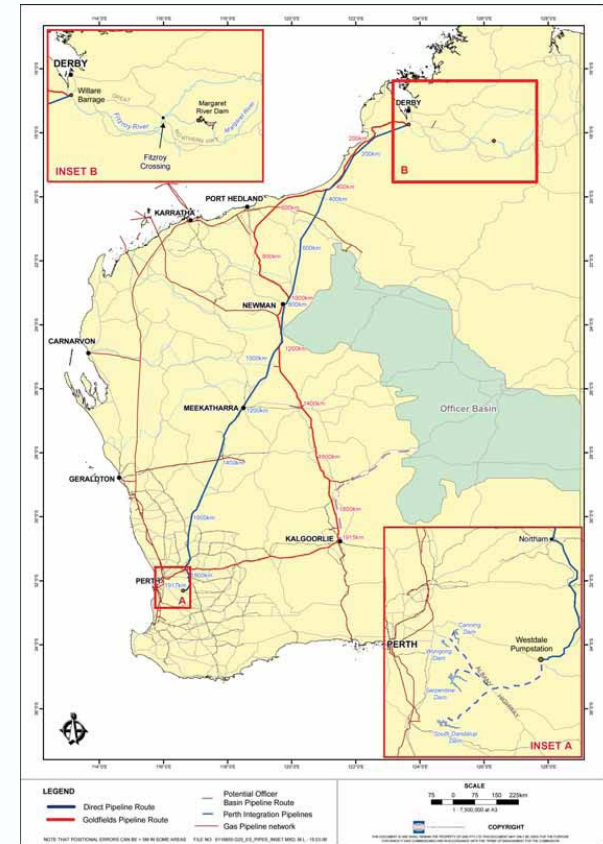
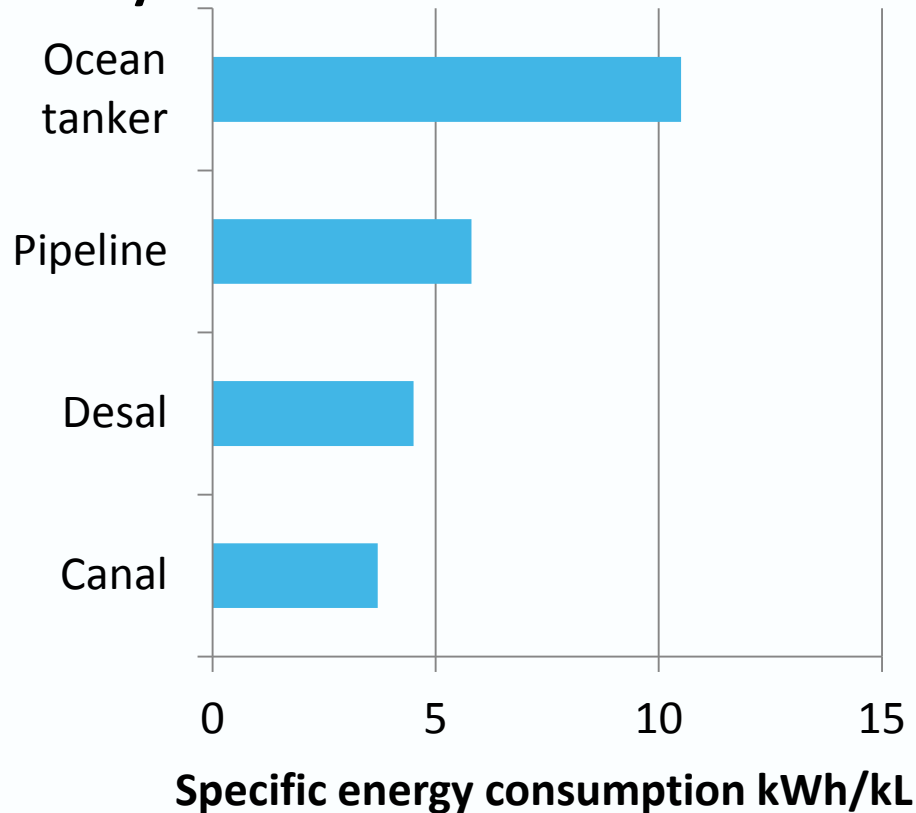
## 2. Local understanding required

*INDICATIVE*



## 2. Local understanding required – Western Australian water example

Transporting 200 GL from the Kimberley to Perth

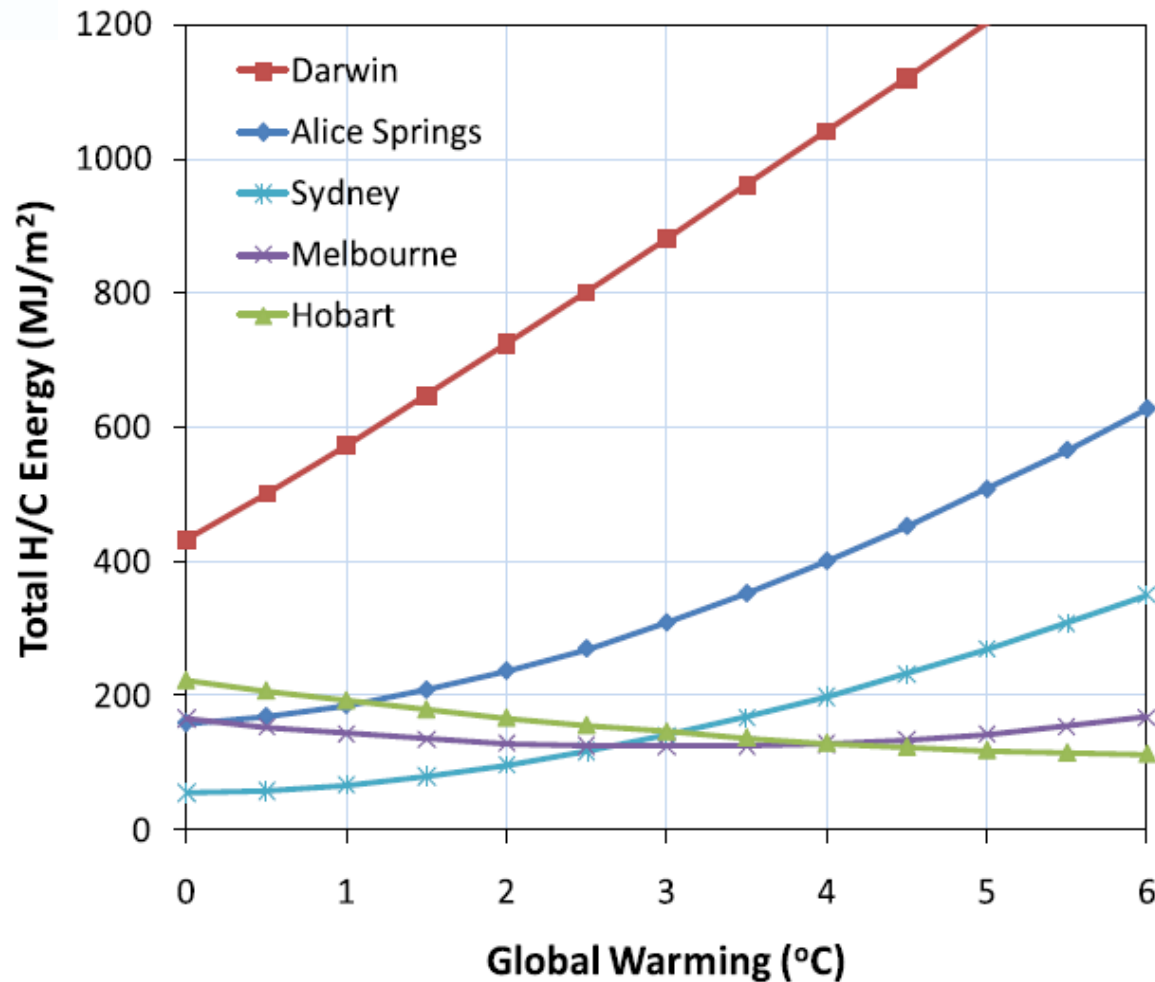


### 3. Thresholds, lag times and tipping points



Photo: Abandoned house, Orreroo-Hawker Road (James McCormack)

## 4. Evolving constraints – Building example



Source: "Global warming and its implication to emission reduction strategies for residential buildings", X. Wang, D. Chen, Z. Ren, Building and Environment (2010)



# Three approaches may help us manage the energy, food and water nexus

## 1. Understanding

Aim to understand and where possible project with high spatial and temporal resolution the economic, bio-physical and social implications of the nexus

## 2. Markets

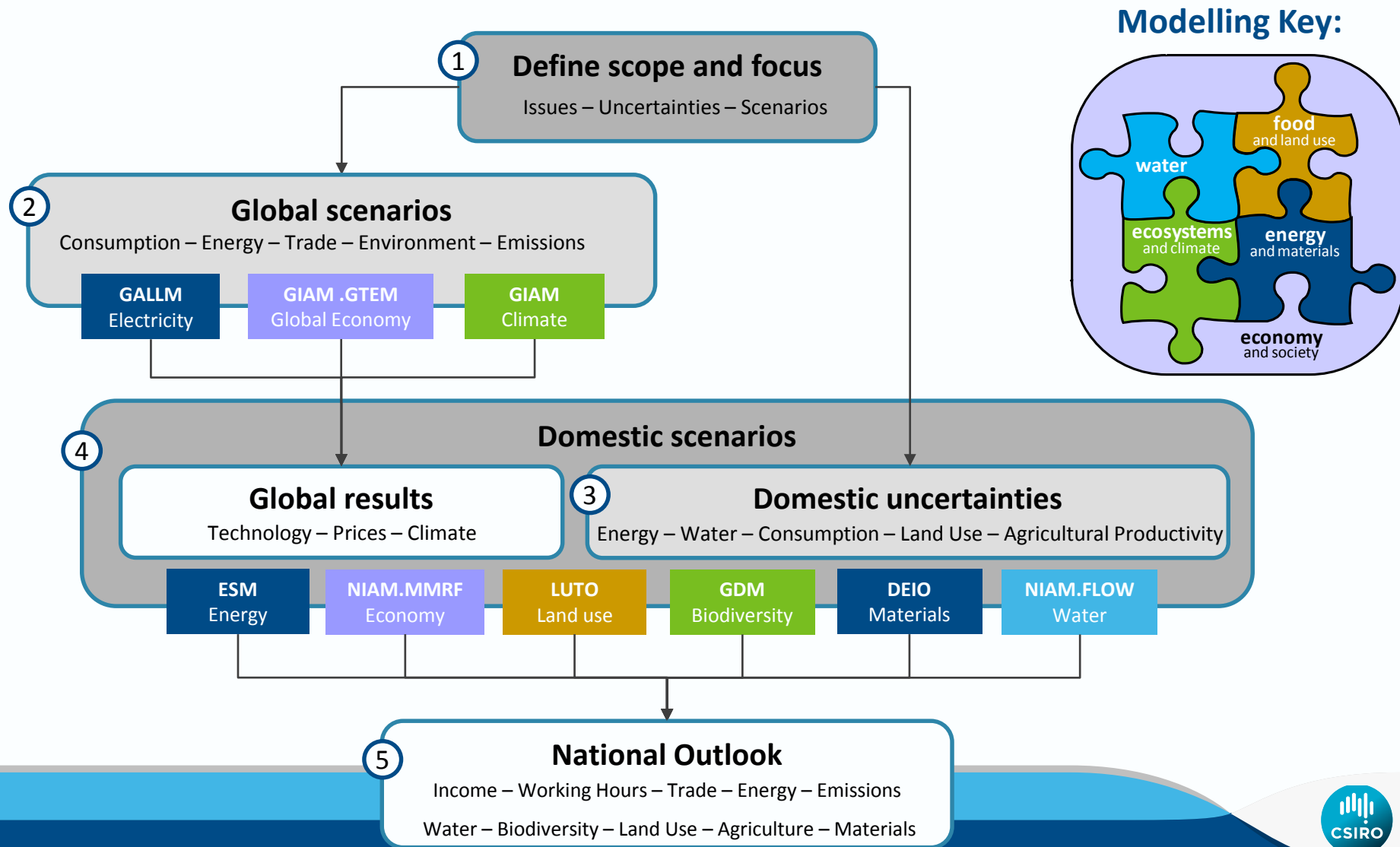
Develop markets or other mechanisms that allow for the economically efficient allocations of scarce resources such as energy, food and water

## 3. Innovation

Invest in direct and indirect innovation, i.e. in new technology/system RD&D and education respectively, to eliminate waste and increase efficiency and productivity

# 1. Analytical understanding highlights issues

## Example Australian National Outlook

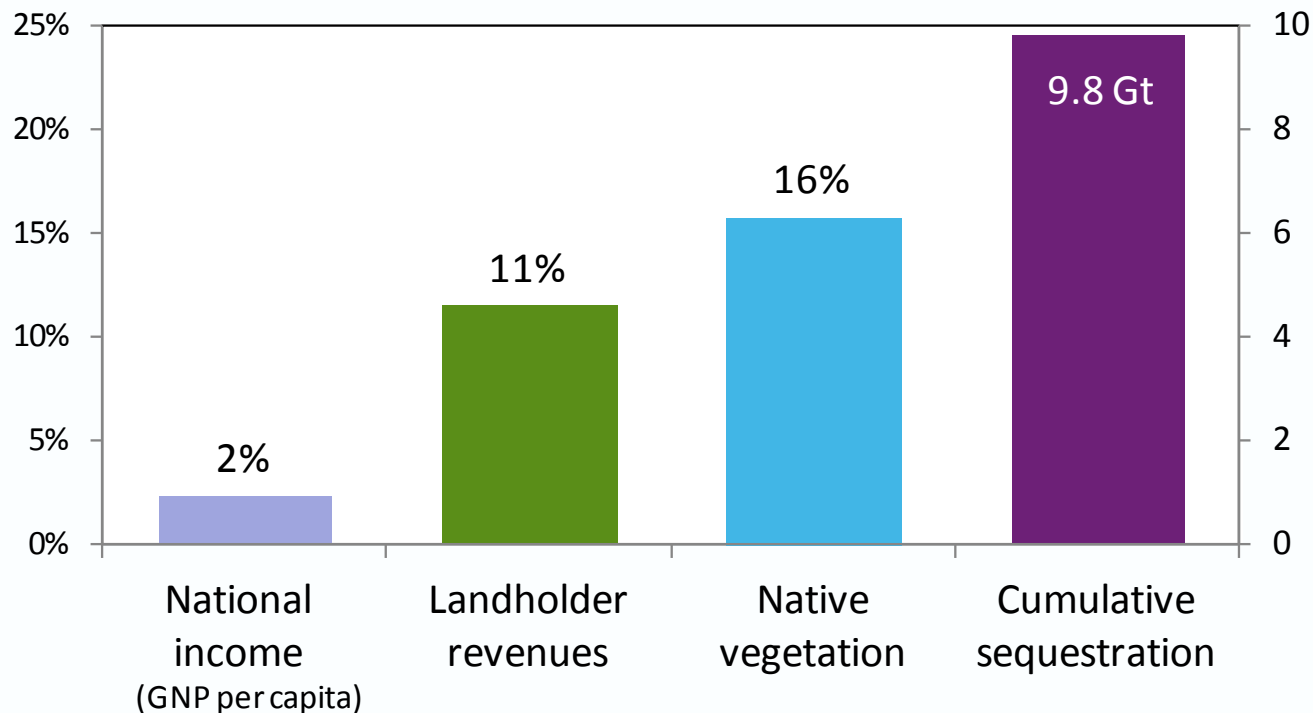


## 2. Markets can allocate resources efficiently

### Example National Outlook land sector markets

#### Potential gains from land sector markets, 2050

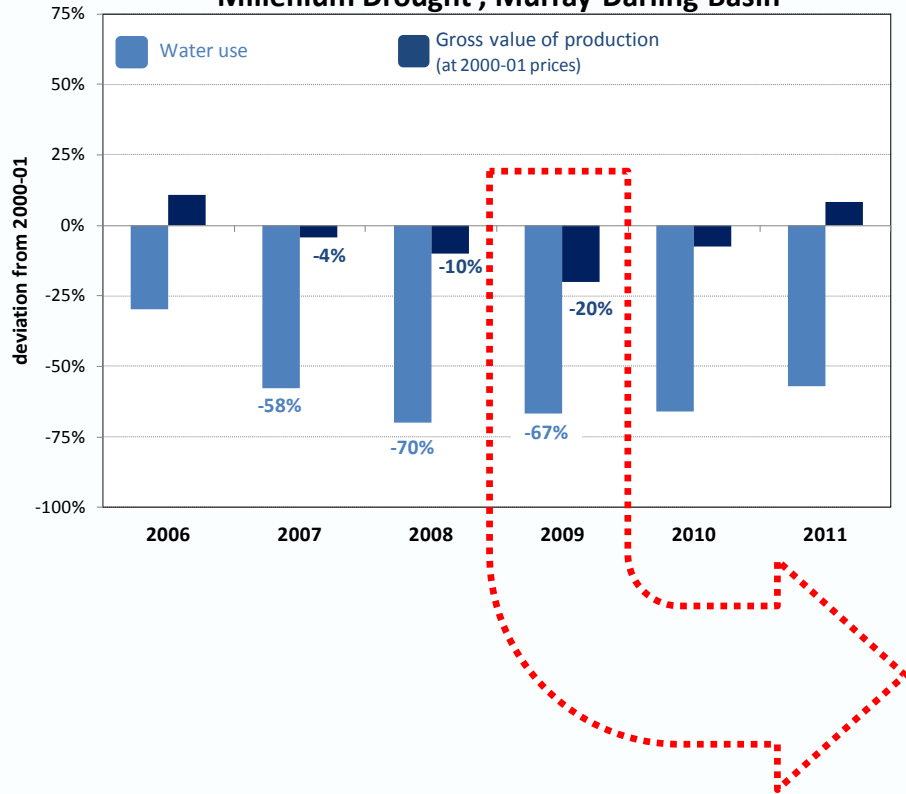
Additional benefits to Australia of markets for carbon and biodiversity plantings, in the context of very strong action to limit climate change, relative to existing trends.



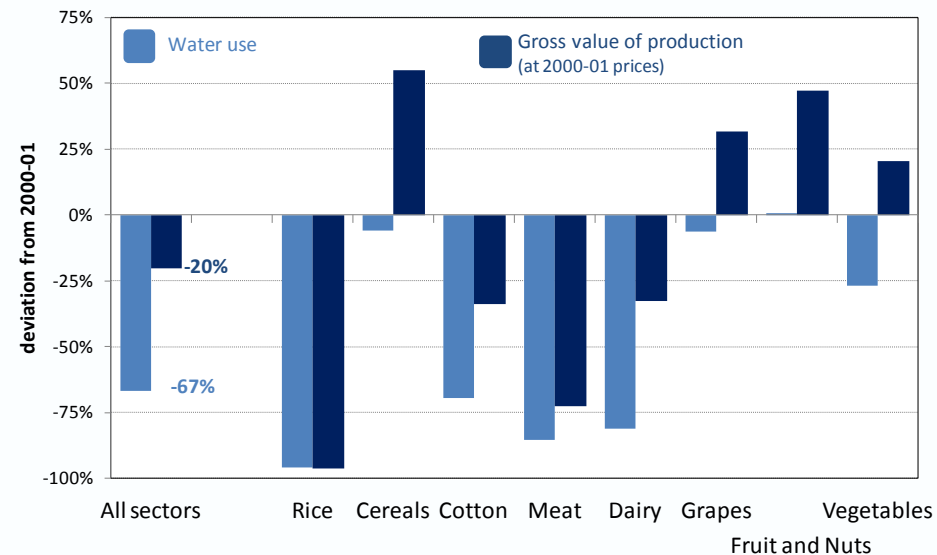
# 2. Markets can allocate resources efficiently

## Example Murray-Darling water market

Water Use and Value of Irrigated Agricultural Production:  
'Millenium Drought', Murray-Darling Basin



Water Use and Value of Irrigated Agricultural Production:  
2009 sector detail, Murray-Darling Basin



## 2. Markets can allocate resources efficiently

### Example Australia's energy security assessment

Table 2.1: Summary of liquid fuel security – 2011 NESA			
	Short term (to 2012)	Medium term (to 2016)	Long term (to 2035)
<b>Adequacy</b>	<b>HIGH</b>	<b>HIGH</b>	<b>MODERATE</b>
<b>Comment</b>	Open and well-functioning international and domestic markets continue to provide Australia with sufficient supplies of liquid fuels.	Increased global production is projected to adequately meet rising global demand.  Growth in global and regional surplus refinery capacity provides highly adequate supplies of petroleum products.	Combined resources of conventional and unconventional oil are considered adequate to meet global demand.  Significant global investment is needed to ensure that global supply meets rising demand.
<b>Reliability</b>	<b>HIGH</b>	<b>HIGH</b>	<b>MODERATE</b>
<b>Comment</b>	Access to well-functioning markets has helped create robust and flexible supply chains with a high degree of diversity of supply.  Proactive supply chain management is able to mitigate the effects of short-term supply disruptions.	Continued access to flexible global supply chains and availability of alternative supplies due to surplus refinery capacity allow the petroleum industry to continue to provide liquid fuel supplies with minimal disruptions.	Australia becomes more dependent on more international supply chains, geopolitically risky and geologically difficult sources of supply.  Australian refineries are likely to continue to face competitive pressures. Nevertheless, significant investment in regional refining is likely to continue to provide adequate supplies of refined products.
<b>Competitiveness</b>	<b>MODERATE</b>	<b>MODERATE</b>	<b>MODERATE</b>
<b>Comment</b>	High international crude oil prices remain manageable within the broader economy.  The strong Australian dollar helps offset high crude oil prices.	Continued high global prices remain manageable within the broader economy.  Commercial inventories, spare OPEC production capacity, and surplus global and regional refining capacity continue to provide a buffer against unexpected supply and demand shocks.	Strong demand growth in emerging economies and increased reliance on more expensive sources of supply are expected to cause global oil prices to continue to rise.
<b>OVERALL</b>	<b>HIGH</b>	<b>HIGH</b>	<b>MODERATE</b>



### 3. Innovation increases efficiency & productivity

Example BuildingIQ



Source: Prometheus by Paul Manship at Rockefeller Centre, NY (Photograph by Maria Azzurra Mugnai)



### 3. Innovation increases efficiency & productivity

Example Solar Brayton Cycle



# Opportunities for collaboration

1. Take a whole of system approach to assessing especially food security of potential supplier countries
2. Share lessons learned from successful Australian markets (e.g. water) and solve new challenges together (e.g. electricity grids)
3. Collaborate on education and technology development relevant for hot and arid countries



# Thank you

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