



# Urban Mining: Australia

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Never Stand Still

Engineering

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# Overview

Australia and Sydney

Urban mining definition and Australian context

Status of Urban Mining in Australia

MFA for metals, phosphorus and carbon in Australia and Sydney

The Future

# Australia



22.7million, growing at 1.5 – 2%pa ...36 - 42M by 2050?

GDP: USD 1-1.3 Trillion, growing at 2-4%pa; Number 12 – 14 in G20

HDI: No 2 in the world.

Manufacturing declining; Mining significant; Services: 70% employt, GDP.

5% unemployment..stable

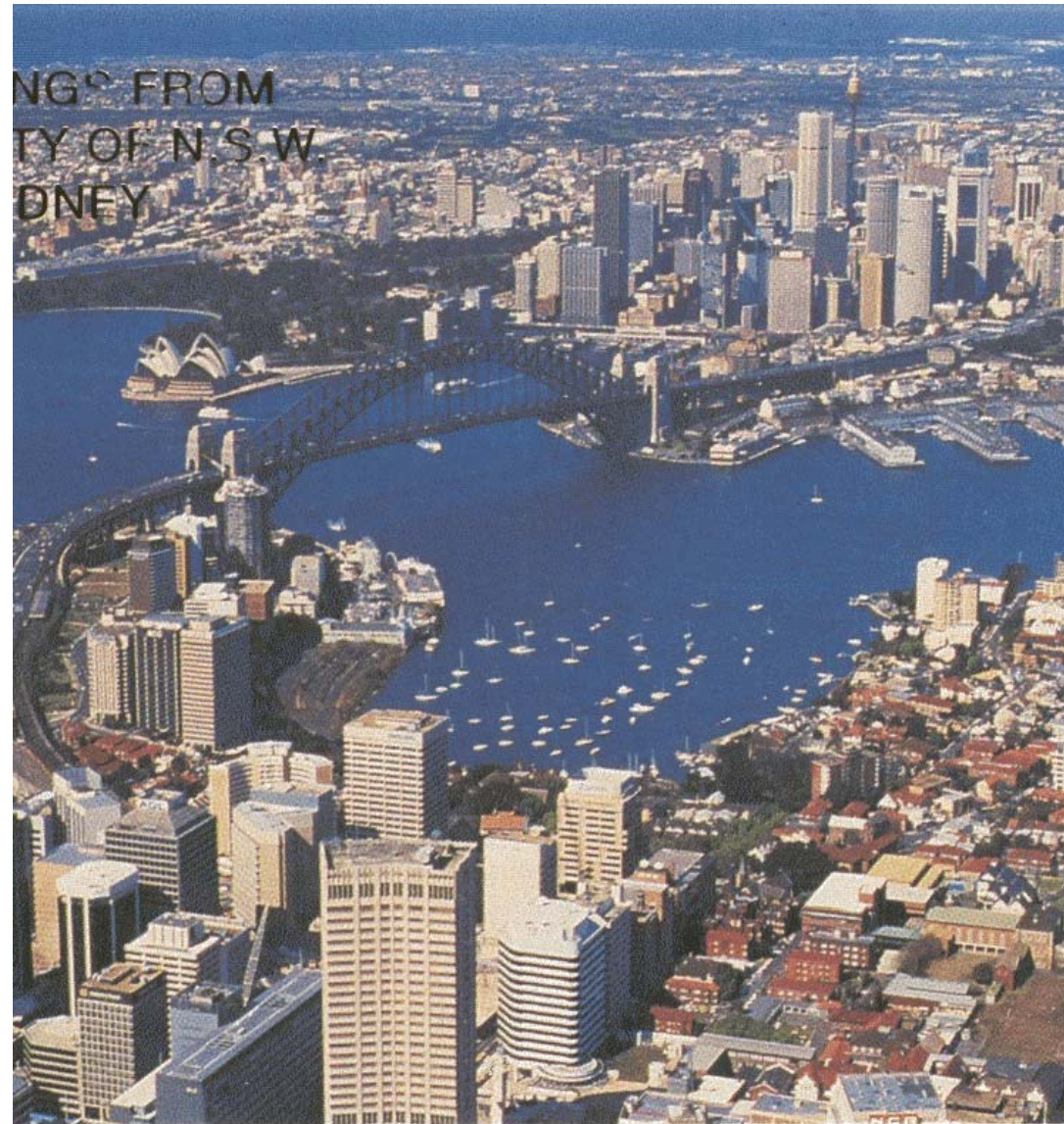
# Sydney

4.6M ...7.5M by 2050?

A growing city...1.5% p.a.

77% of State of NSW population

Australia's oldest and largest city.



# Urban Mining

Brunner (JIE, Vol15, No3):

“a systematic reuse of anthropogenic materials from urban areas...(by)..

- 1.creating a knowledge base by preserving information from production through recovery,
- 2.Locating facilities within service oriented cities”

Australian context:

- Growing cities
- Agricultural production and export
- Mining ores and concentrates: contaminants
- Little and declining manufacturing
- Asian trading zone, high labour costs, shortage of skilled labour.



# **Sustainability: from a materials management perspective**

Need materials to make goods to satisfy service needs and wants

Resource conservation and environmental protection

Need an account of materials and energy at different scales:

corporate -> regional -> national -> global

Quantify material flows comprehensively:

resources -> mine wastes

-> materials -> goods ->use emissions

-> end of life goods

**Urban mining a component of this broader sustainability context in Australia**

# Status of Urban Mining in Australia

National Level

State of NSW level

Corporate Level

Professional Associations

Critique and Need for a more comprehensive system.

# National Level:

## Product Stewardship Act 2011

A national law, with implementation at national level

Product stewardship, but can be modified to EPR

Covers waste minimization through life cycle of good

A good can be included if:

- it contains hazardous substances
- there is the potential to improve resource recovery
- can protect the environment or humans.

By voluntary product stewardship

By co-regulatory product stewardship

By mandatory product stewardship.

Initially TV and computers by end of 2011.



# New South Wales

WARR Act 2001

WARR Strategy 2003, 2007, 2011:

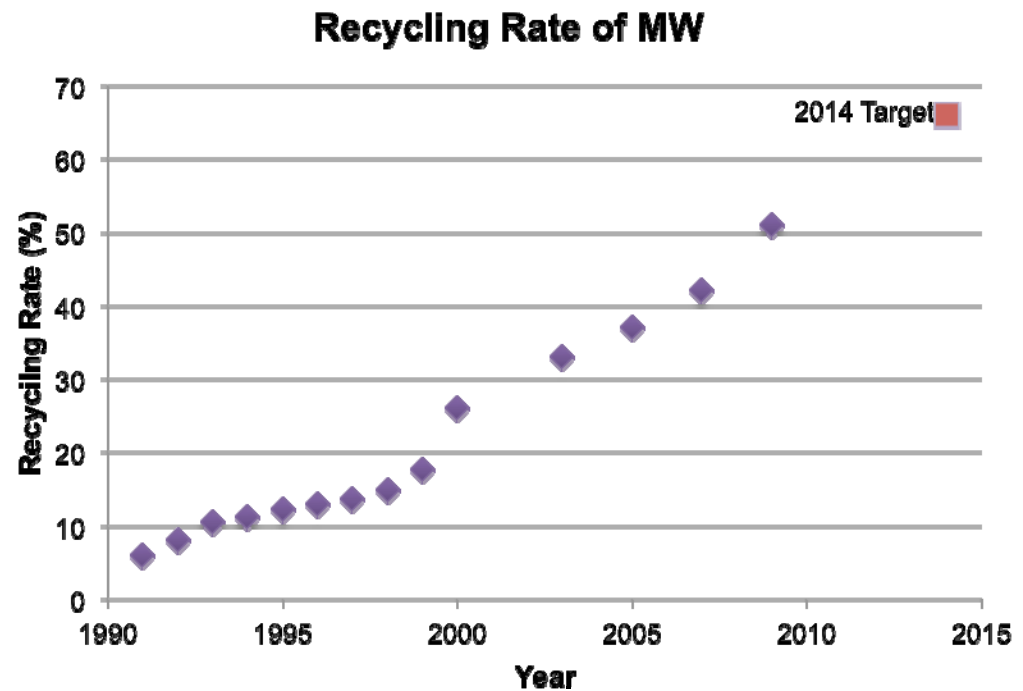
		2002–03	2004–05	2006–07	2008–09	2014 Target
<b>SMA</b>	Municipal	33%	37%	42%	51%	66%
	C I	33%	35%	42%	50%	63%
	C&D	68%	66%	70%	77%	76%
	Overall	48%	49%	54%	62%	

Priority Wastes:

e-Waste: batteries, computers, mobiles, other electrical, TV

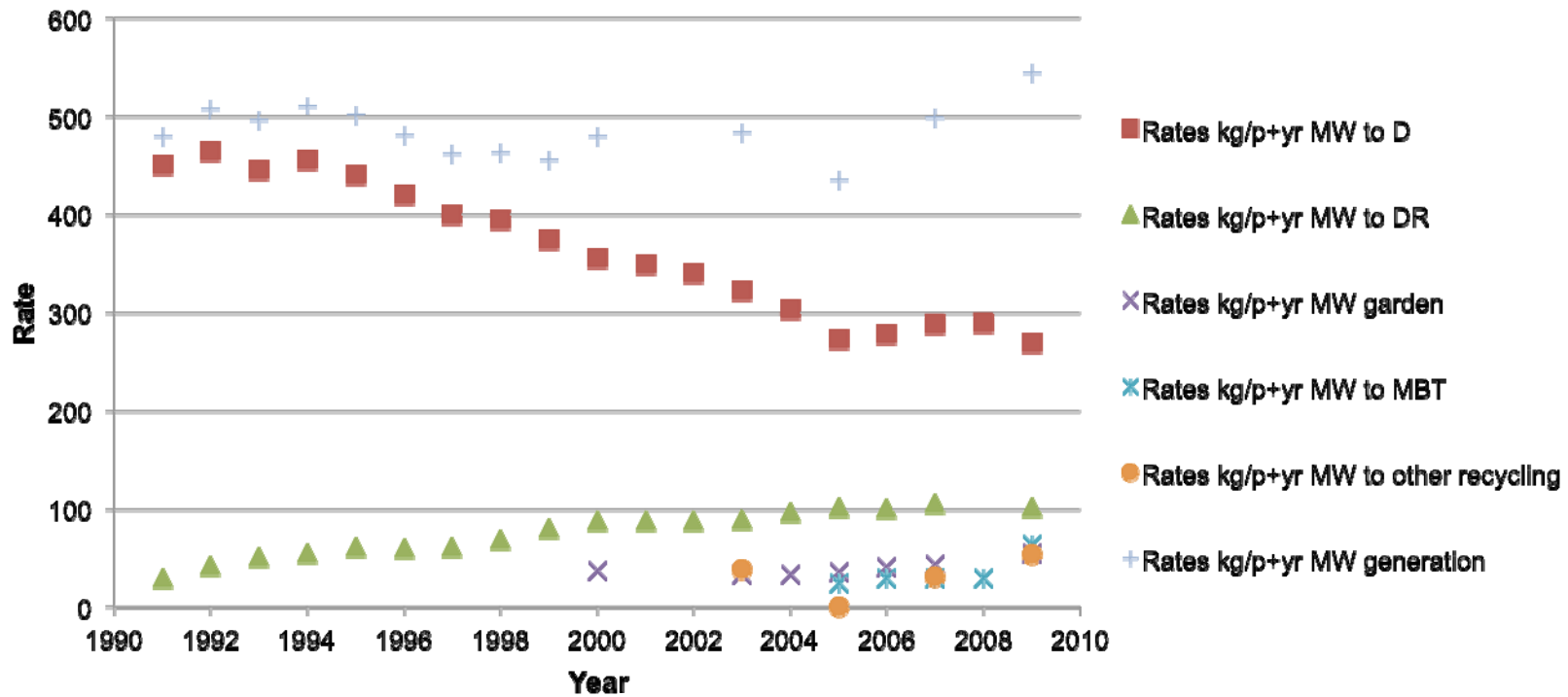
## WARR Act, and related Strategies

- 1990s: Reduce per capita municipal waste to disposal by 60% between 1990 and 2000
- 2000s: Increase municipal waste recycling rate to 66% by 2014.
- Options to achieve target:
  - Better at source segregation recycling
  - More MBT plant construction to divert more residual MWtoD
  - Waste to Energy plants for MBT residuals or MW toD.



# Municipal waste generation rates, kg/p+yr

**Rate of MW Generation, Disposal and Recycling**



# Corporations

Waste companies: Veolia, SITA, Transfield Cleanaway:

waste collection, recycling, treatment, disposal to Councils and corporations

E-waste: Sims, Close the Loop...charge councils, corporations for recycling end of life goods

hand sort/dis-assemble, shredding, Fe ,Al, Pb recovery; PCBs to Korea or Europe.

Whole of life approach:

LABs, Computers, Consumer Batteries

Alcoa: also buys back end of life Al to melt to sell on to primary produced Al customers.

Fuji-Xerox photocopier machines to Thailand and then Japan for recycling, treatment

# Fuji-Xerox



# Professional Associations: WMAA

NSW/ACT	VIC
<ul style="list-style-type: none"> <li>• Compost NSW</li> <li>• Construction &amp; Demolition</li> <li>• Resource &amp; Energy Recovery</li> <li>• Landfill</li> <li>• Biosolids</li> <li>• Educators</li> <li>• Metal Recycling</li> <li>• Alternate Waste Technologies</li> <li>• Young Professionals</li> <li>• Strategic Planning and Implementation</li> <li>• Hunter Region Group</li> <li>• NSW Carbon Committee</li> <li>• Industrial Ecology</li> </ul>	<ul style="list-style-type: none"> <li>• Compost VIC</li> <li>• Landfill</li> <li>• Educators</li> <li>• Young Professionals</li> <li>• Hazardous Waste</li> <li>• Resource &amp; Energy Recovery</li> <li>• VIC Carbon Committee</li> </ul>
WA	QLD
<ul style="list-style-type: none"> <li>• Compost WA</li> <li>• Landfill</li> <li>• Educators</li> <li>• Young Professionals</li> <li>• WA Carbon Committee</li> <li>• Construction &amp; Demolition</li> <li>• Commercial &amp; Industrial</li> <li>• Resource &amp; Energy Recovery</li> </ul>	<ul style="list-style-type: none"> <li>• Compost QLD</li> <li>• Landfill</li> <li>• C&amp;D</li> <li>• Educators</li> <li>• Energy from Waste</li> <li>• QLD Carbon Committee</li> </ul>
SA/NT	
<ul style="list-style-type: none"> <li>• Compost SA</li> <li>• Landfill</li> <li>• SA Carbon Committee</li> <li>• Waste Educators (SA)</li> </ul>	



# Industrial Ecology in WMAA

## ***“What is Industrial Ecology?”***

*Industrial Ecology promotes enhanced sustainability by stimulating innovations in the reuse of waste materials. **The wastes or by-products of one industry are used as inputs in another industry, thereby closing the material loop of industrial systems and minimizing waste.***

*Waste and by-products must be reused as input materials in a systematic way to close the material cycle as efficiently as possible;*

*Loss caused by dispersion must be minimized. This refers to products such as fertilizers, tyres, or solvents that may be dispersed into the environment and there is an obvious need to minimize the harmful effects and design of these products.*

*Maintaining the material balance. In material flow terms, this means ensuring that not more of a particular resource is used in one year than the amount of the resource produced in that same year.*

*Keeping renewable and non-renewable resources as long as possible in the material cycles, unless this is not environmentally desirable.*

*Energy must rely less on fossil hydrocarbons, while stimulating the use of renewable energy as much as possible.”*

# Critique and Need for more comprehensive system

Emphasis on collecting end of life goods and infrastructure components, and recycling materials from them after they are about to go to landfill.

Initial and ongoing driver: avoid landfill.

Some substances are lost in bulk recovery of Fe, Al; e.g. Cu, Zn, Pb;  
or contaminate these recovered substances; including P in MBT composting.

Some more comprehensive approaches:

Industrial ecology: but emphasis on manufacturing waste cycling to other manufacturers.

Alcoa: allow others to collect and separate Al from EoL goods...don't know about these goods.

ARA: Sims + Nyrstar: 60% of ULABs for Pb in Australia; sell back to LAB manufacturers.

Fuji-Xerox: very good: sell service, retain ownership of good, component re-use and substance recycling....they know their goods.



## Moore's Questions & Goals

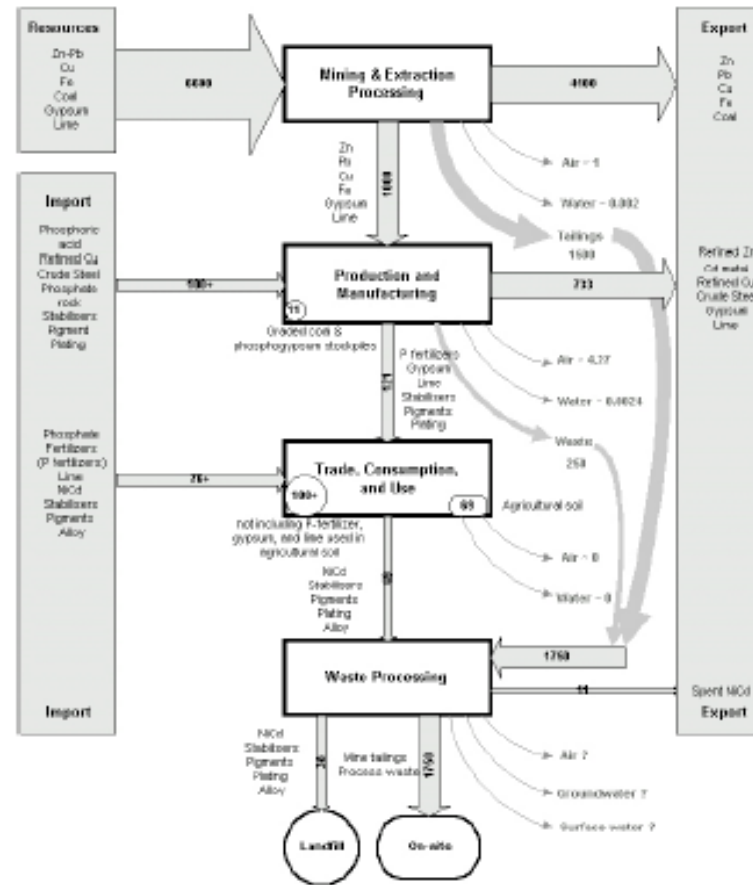
What is happening to low value hazardous materials?	Where are the valuable substances?
Hg, Cd, As	Declining non-renewable resources:
Australia:	oil, P, Cu
ores: Fe, coal	How much in:
concentrates: Cu, Zn, Pb, Ni	ores?
metals	tailings wastes?
Where does the Cd go that we export with our zinc concentrates?	<b>urban infrastructure and goods?</b> <b>landfills?</b>
	<b>How much energy/\$ to recover?</b>
	<b>How to design so a better future?</b>

# Substances analysed in Australia and Sydney

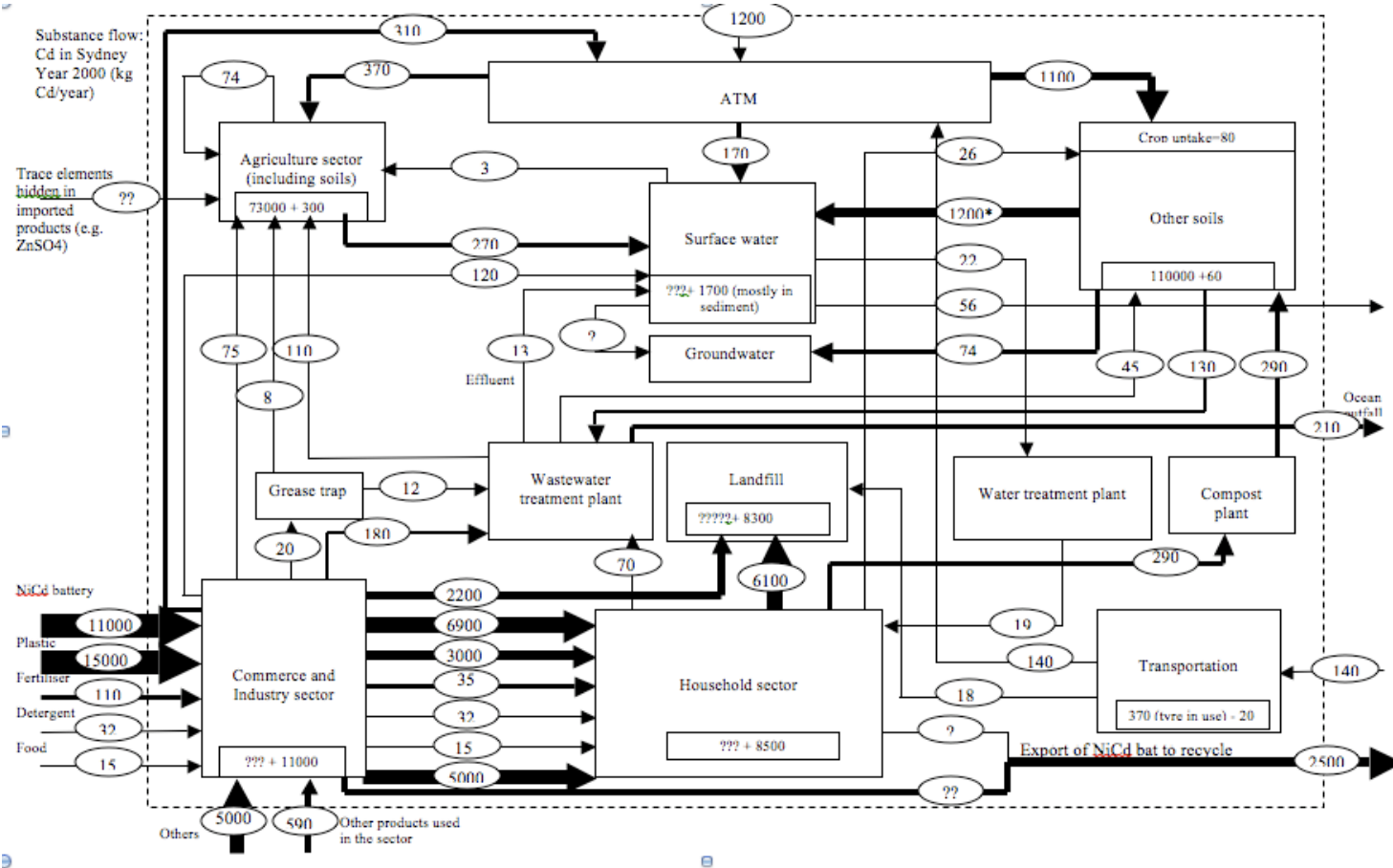
detailed in **PhDs**; initial in honours/masters projects

Metals	Nutrients	Carbon
<b>Cd</b> Hg <b>As</b>	<b>P</b> (only Sydney)	Only Sydney
<b>Pb</b> Zn Cu Fe Al Mn Cr	<b>P</b> (only MIA)	

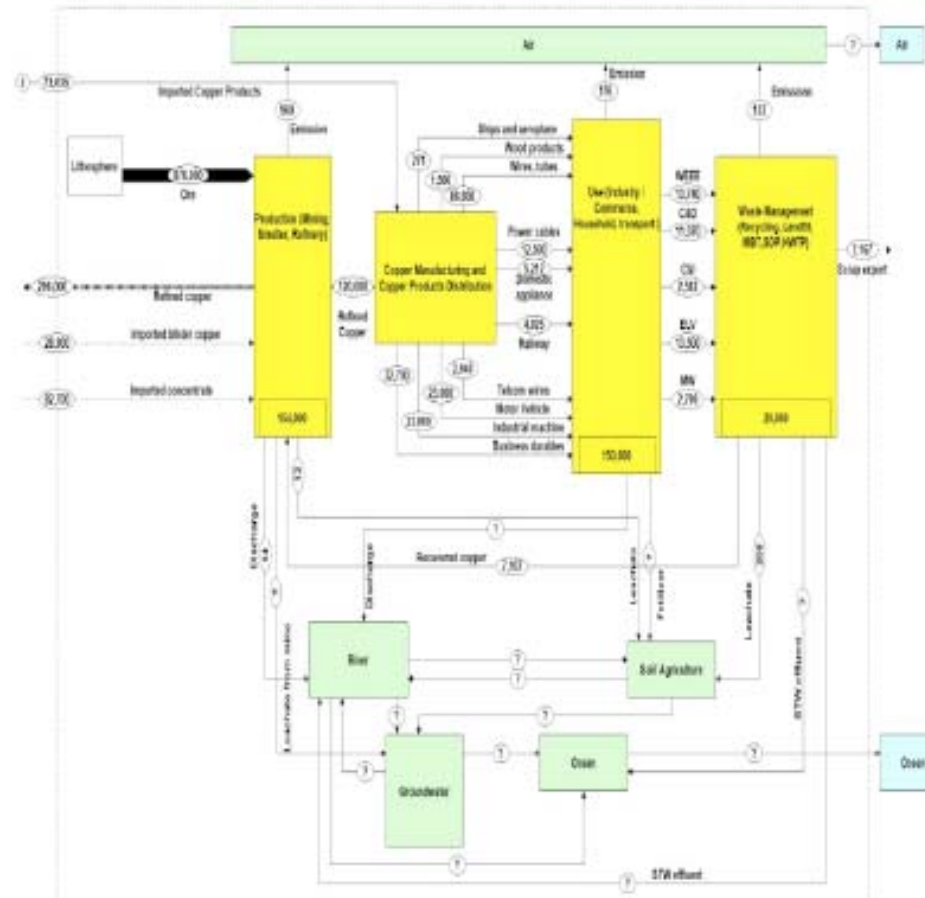
# Cd in Australia, tonne, 1998/99



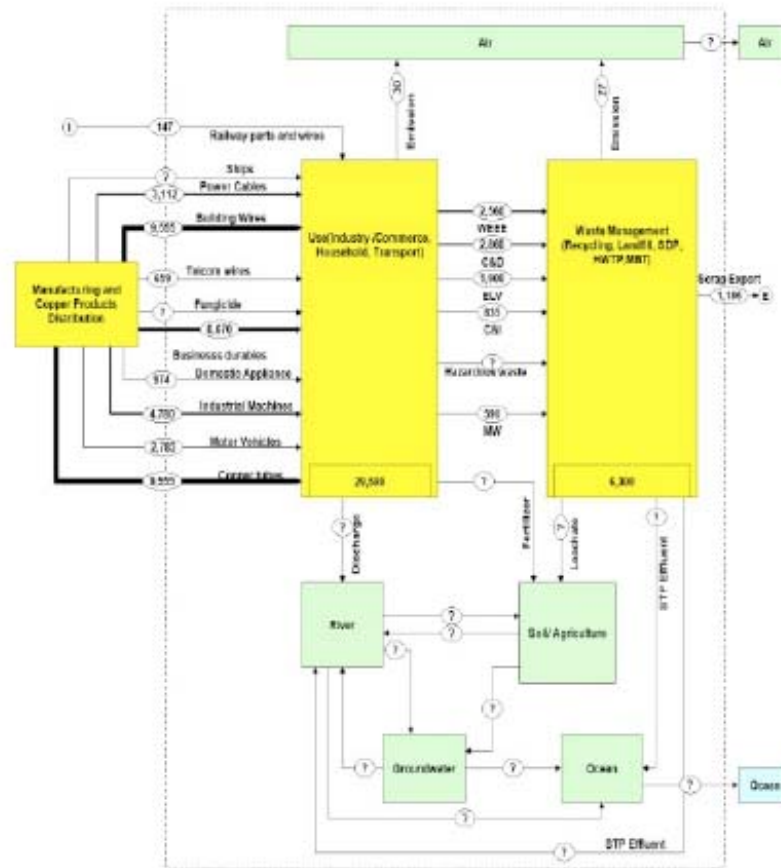
# Cd in Sydney, 2000, Kg/yr



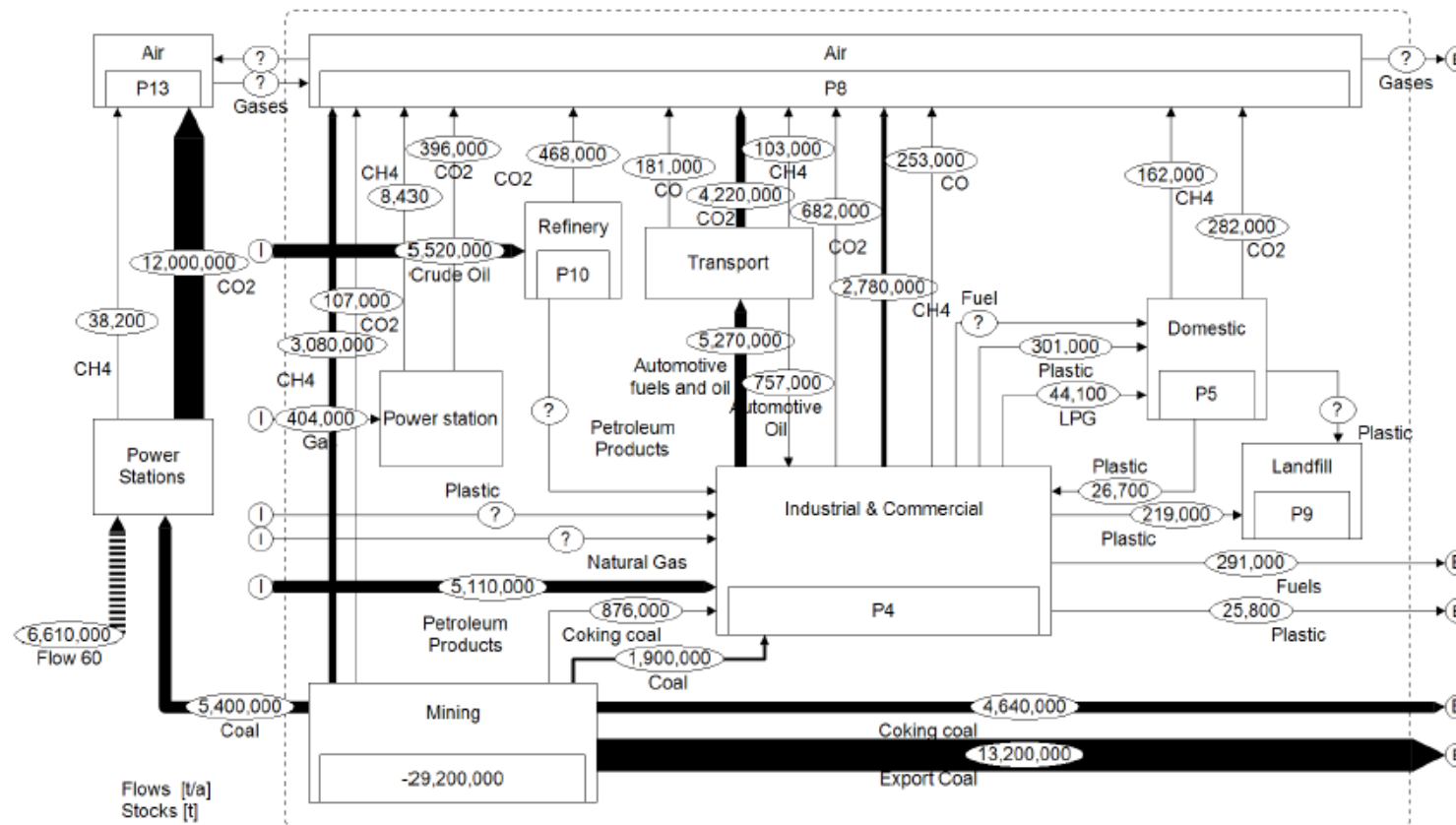
# Cu in Australia, 2008 tonnes



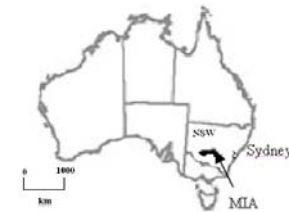
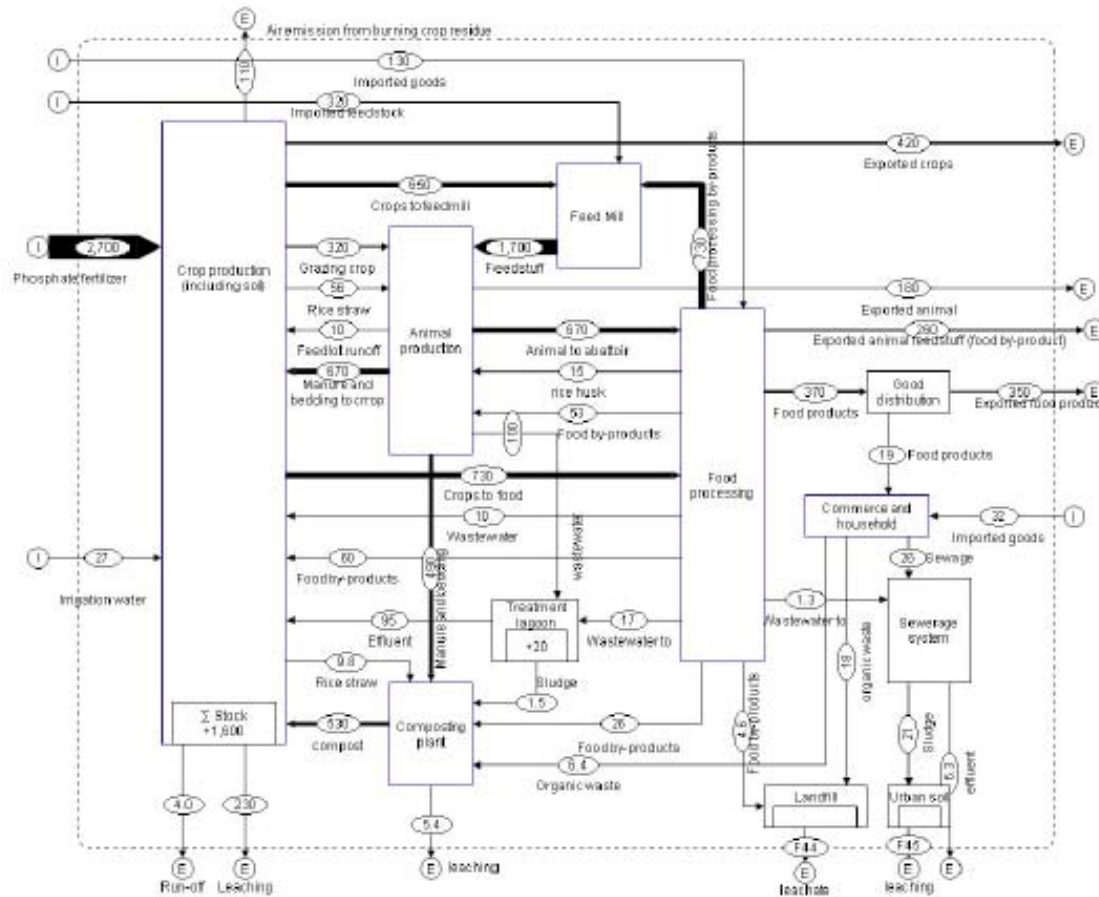
# Cu in Sydney, 2008 tonnes



# Carbon, Sydney 2008/09 tonnes

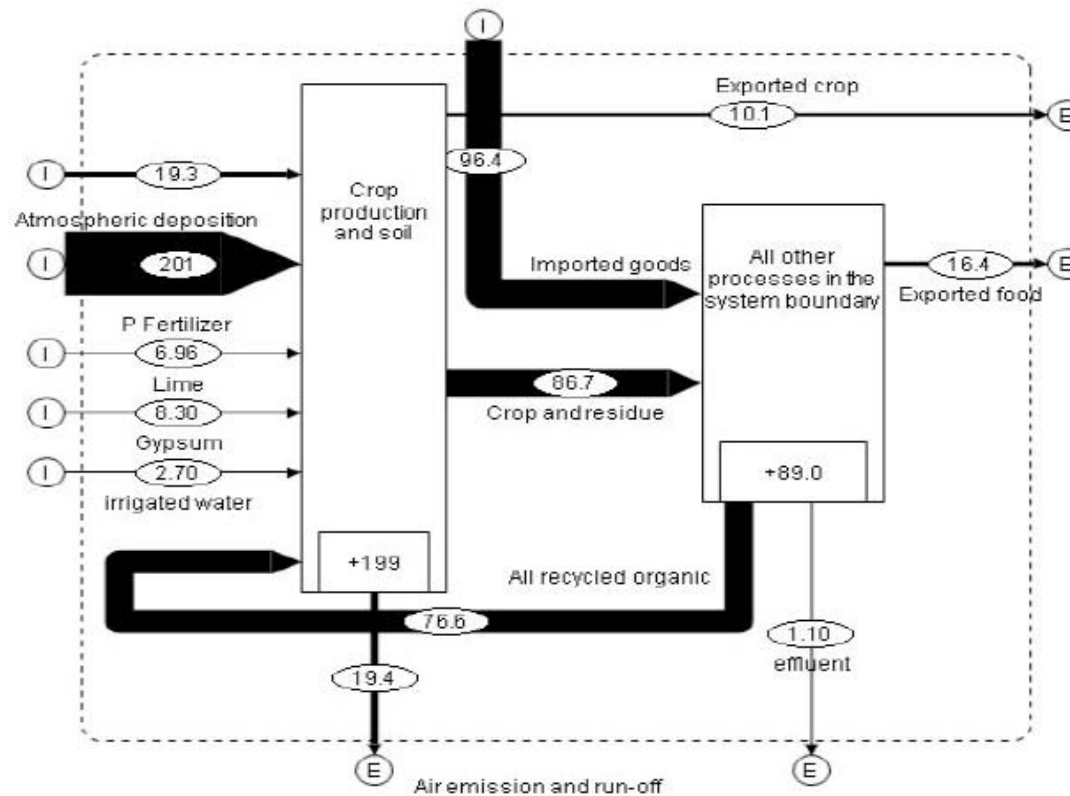


# Phosphorus in MIA, t, 2003





# Cd balance in MIA 2006, kg



Cd balance in the Murrumbidgee Irrigation Area, 2006, Kg

# Application of GIS with Cd loading on soils over 10 years

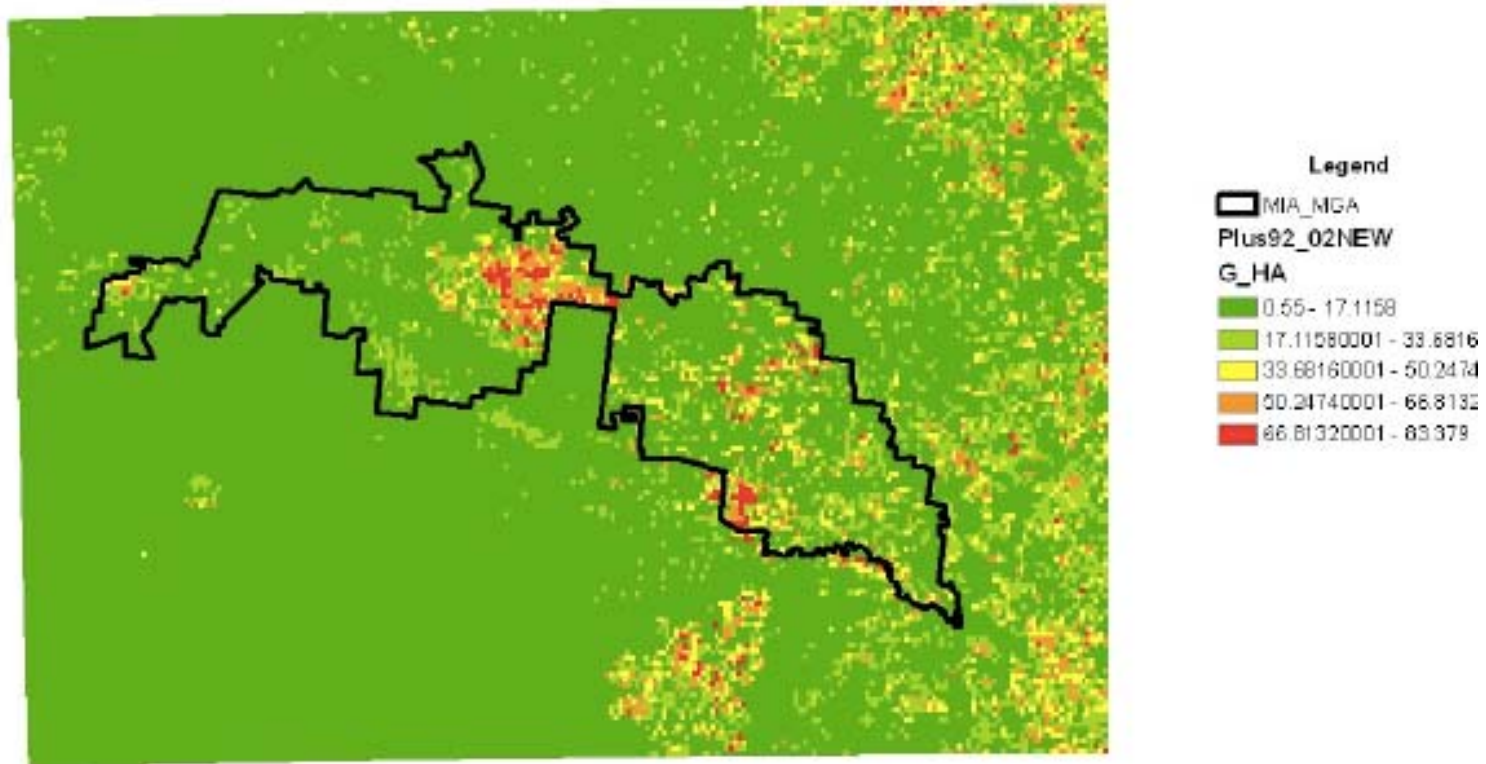


Figure 7.6: Spatial accumulated net Cd balance in MIA (1992-2002) (g/ha)

# Organic carbon balance in MIA, 2006, ktC/yr

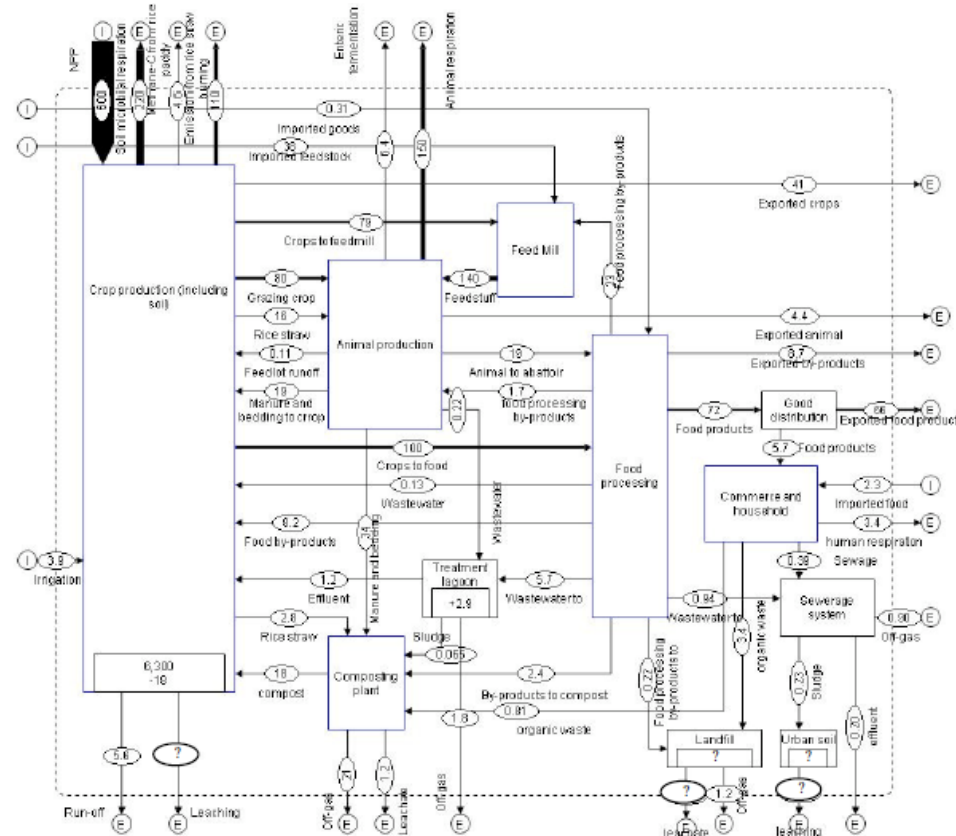
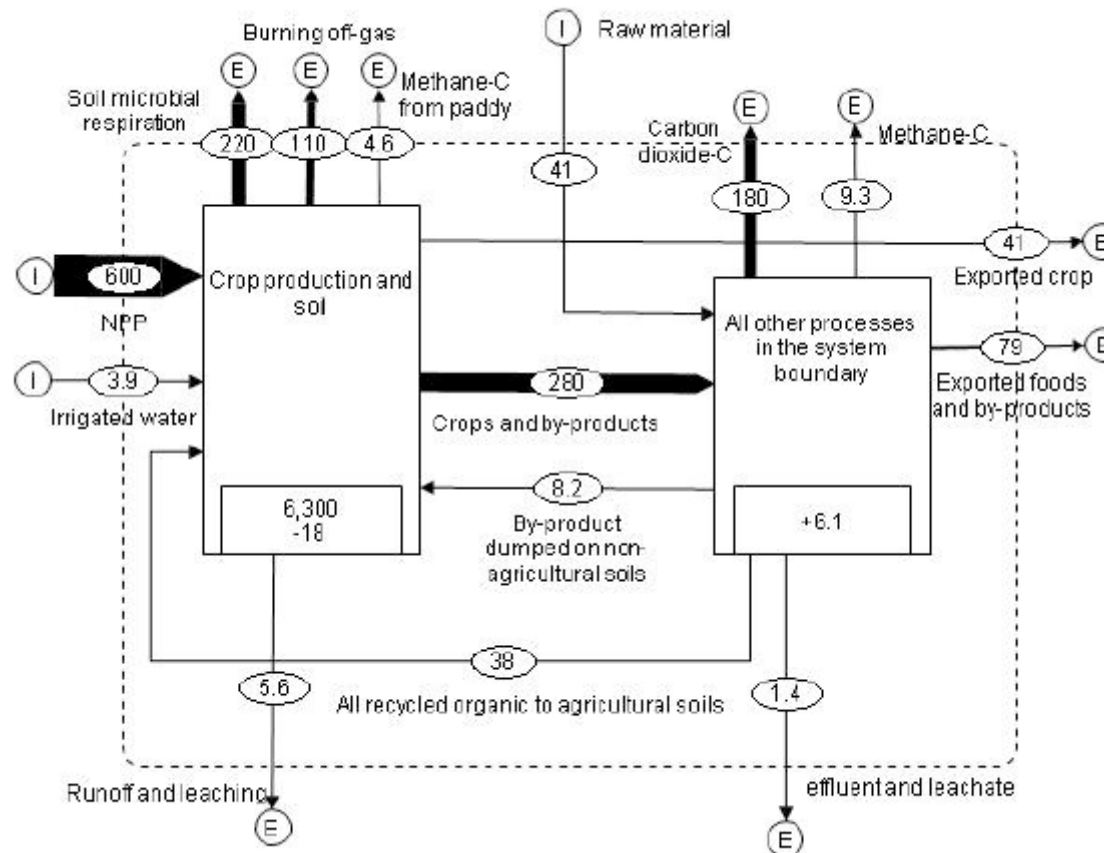


Figure 6.1: Organic C balances in MIA in 2006 (kt C/y)

# Aggregated simplified C balance, 2006, ktC/yr



# The Future

