



CRC Construction Innovation
BUILDING OUR FUTURE

**THIS EVENT IS PART OF
THE AUSTRALIAN
INNOVATION FESTIVAL**



*Industry Seminar
Tuesday, 26 April 2005
Brisbane City Hall*

Bringing Innovation to Facility Management



Ebsworth & Ebsworth LAWYERS

'yes'
OPTUS



*THIS EVENT IS PART OF
THE AUSTRALIAN
INNOVATION FESTIVAL*



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Built Environment Research Unit
Queensland Department of Public Works



Sustainable Building.....

Management

Software Tools

KEYWORDS

- Ecologically Sustainable Development (ESD)
- Sustainable Asset Management (SAM)
- 3 Dimensional Computer Aided Design (3D CAD)
- Industry Foundation Classes (IFC)
- Life Cycle Assessment (LCA)
- LCA of Computer Aided Design (LCADesign)
- LCA of Computer Aided Detailing (LCADetail)



CAD

ESD

LCADefine

LCADesign

LCADevelop

LCADetail

LCA Deliver

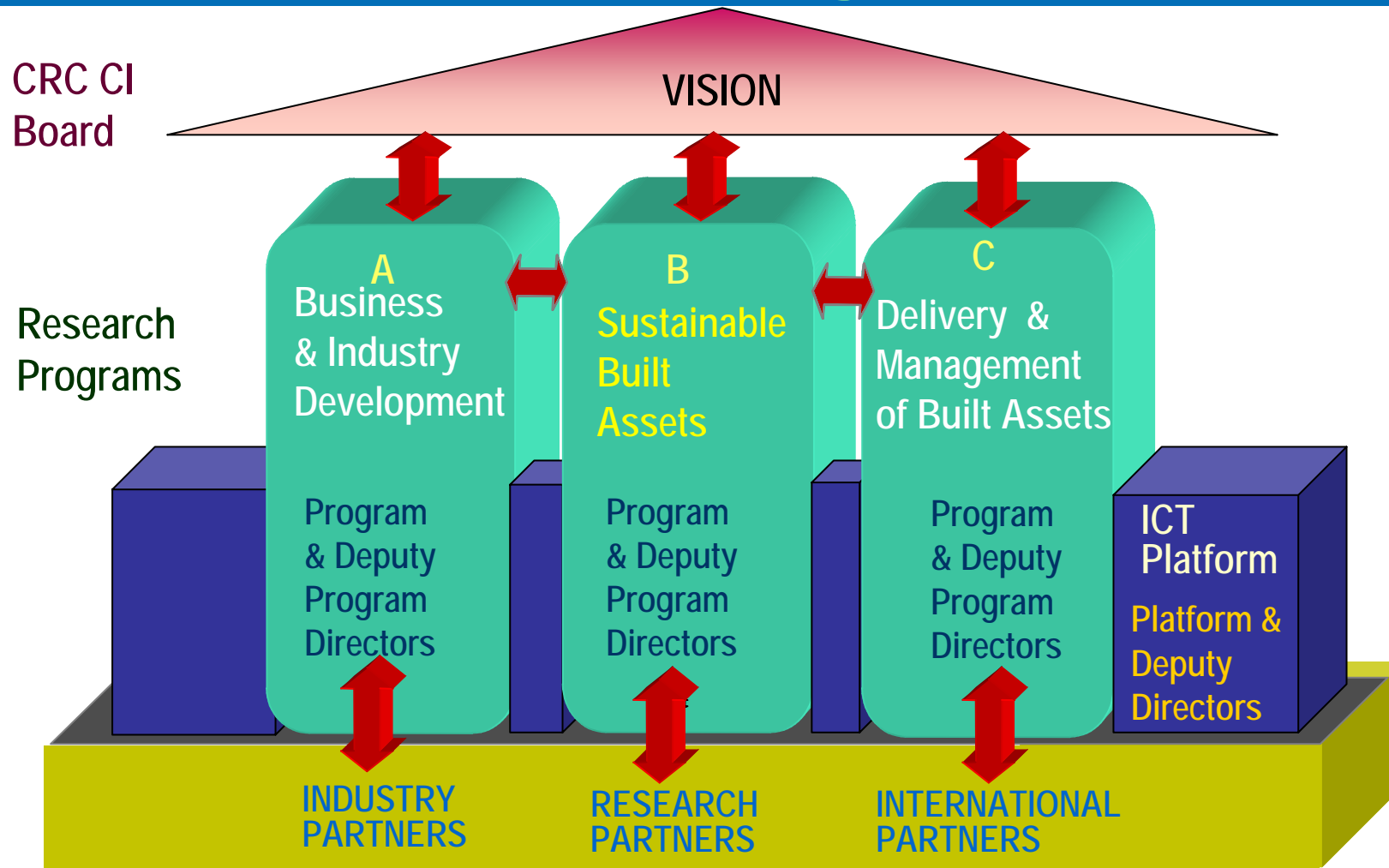
LCA Deconstruct



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CRC for Construction Innovation: Research Program Structure



4



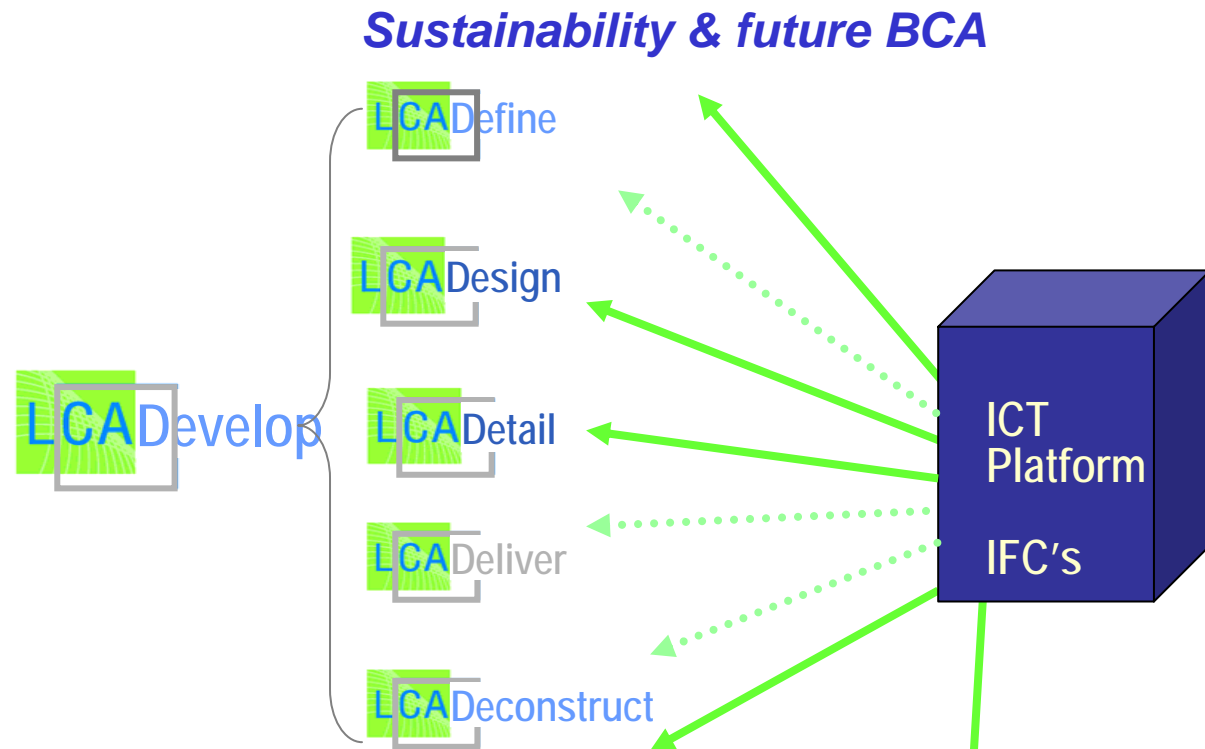
CRC Construction Innovation
BUILDING OUR FUTURE

- **\$64M in cash & in-kind over 7 years**
- **Government, Industry & Research 19 Partners 50 EFTS**

Bringing Innovation to Facility Management 26.04.05 BCC

CRC CI: Sustainable Building

- Frameworks



- Virtual Building Representation
- Eco-profile Commercial Building
- Indoor Environments ICT
- Sustainable Subdivisions





Sustainable Building Project Partners.....+



Government



Research



Industry



Design

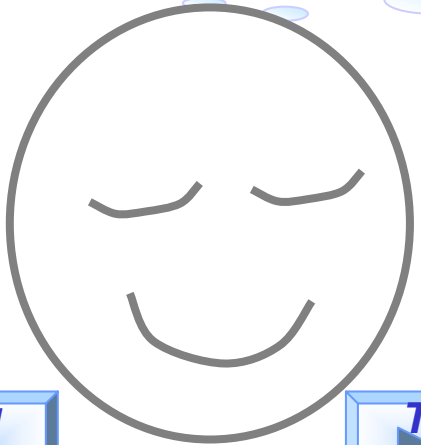


Facility Management Stakeholders

Imagine

Tools & systems on one IT platform!

CAD Model of building information!



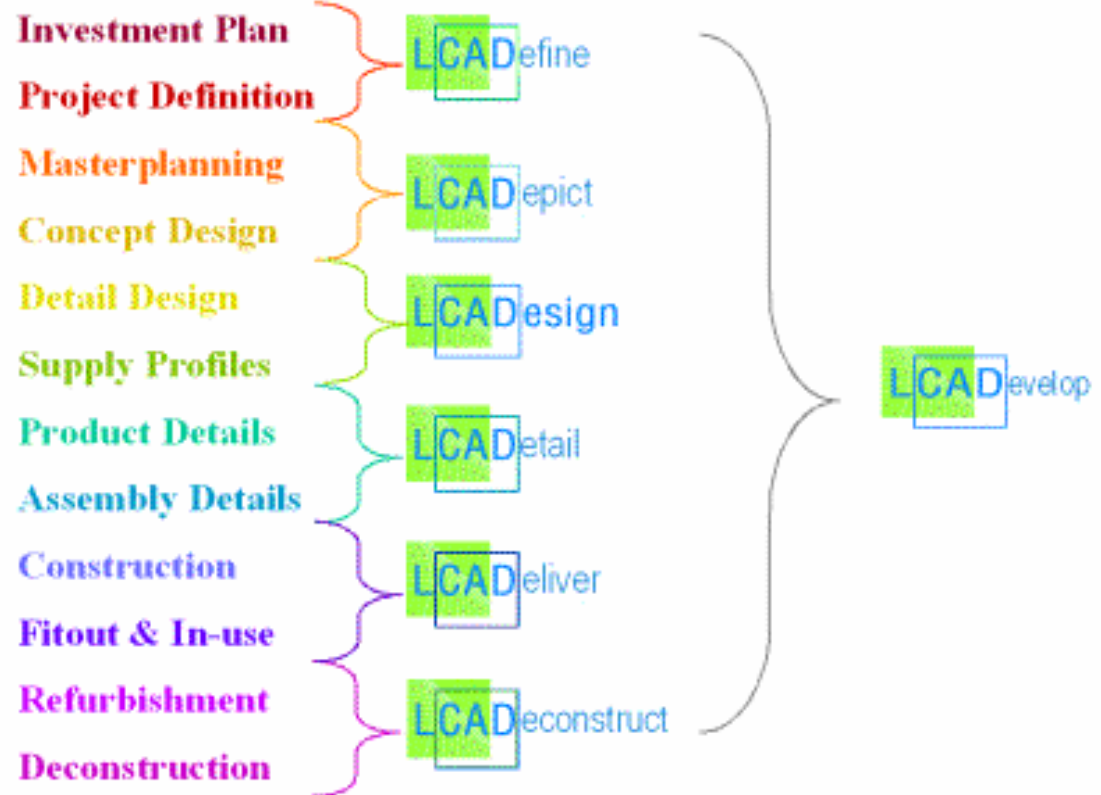
Facility Management Stakeholders

Visualise

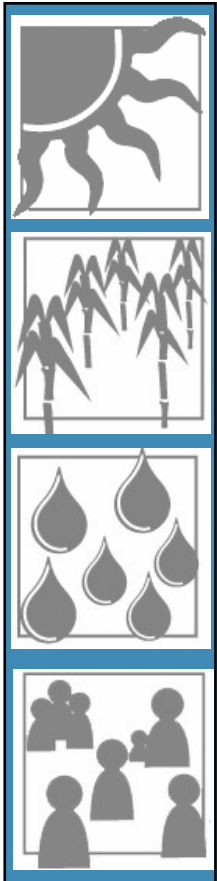
Tools & systems on one IT platform!



Building Project



Considering Sustainable Built Assets: Scope of Work



National Strategy for ESD

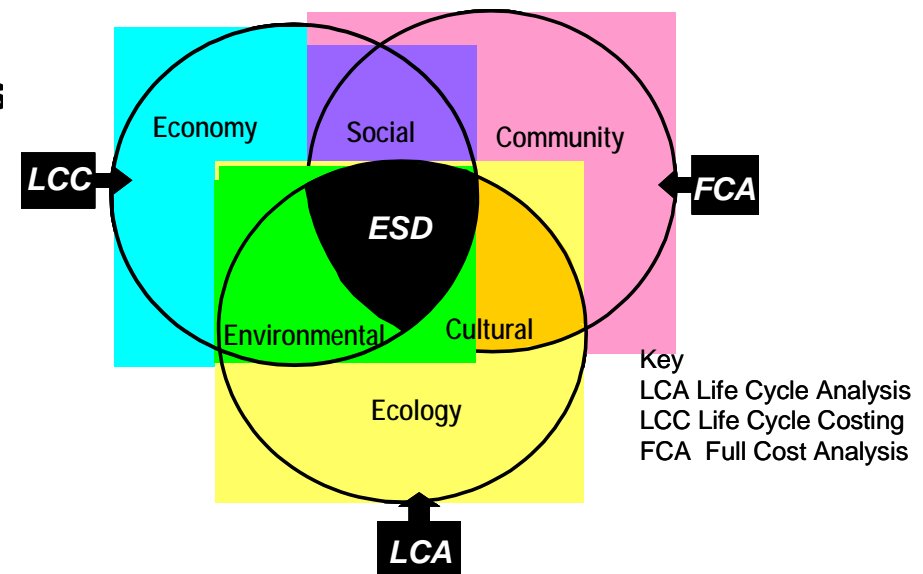
- ❖ use, conserve & enhance community resources so ecological processes on which life depends are maintained & total quality of life can be maintained now & in the future

CGI-97 Directions forum

- ❖ *Buildings' share 15- 42% gross environmental burdens*

Potential FM & SAM Tools

- ❖ CRC CI Projects
- ❖ On ICT Platform



Considering Sustainable Building: Stakeholder Needs

Scope

- ❖ Accommodation Focus
- ❖ Commercial Building
- ❖ National, Integrated Kit
- ❖ Easier appraisals with
 - Industry Database
 - CAD Model Take-off
 - Improved Selections
 - Support Management

Common language for

- ❖ Understanding
- ❖ Communication
- ❖ Documentation
- ❖ Decision-Making

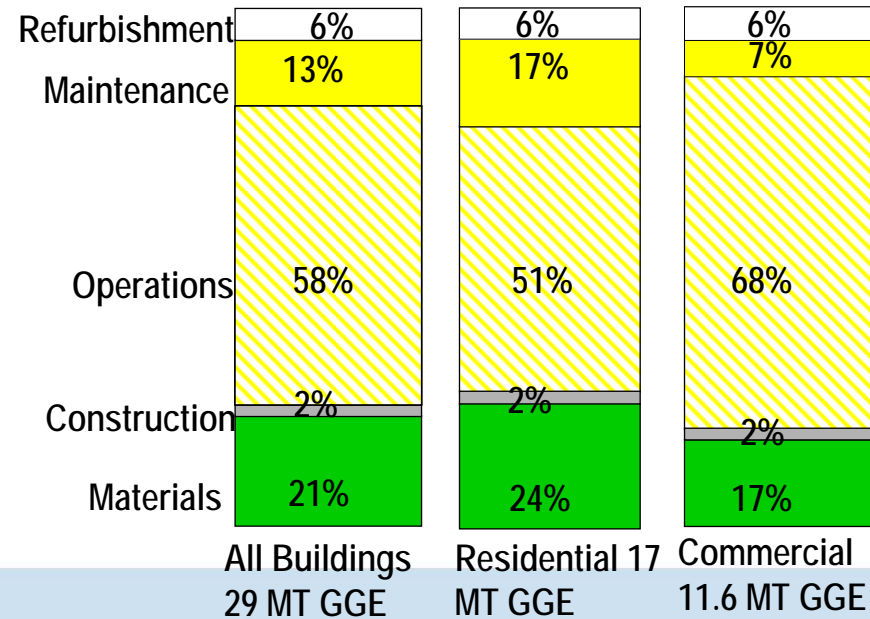
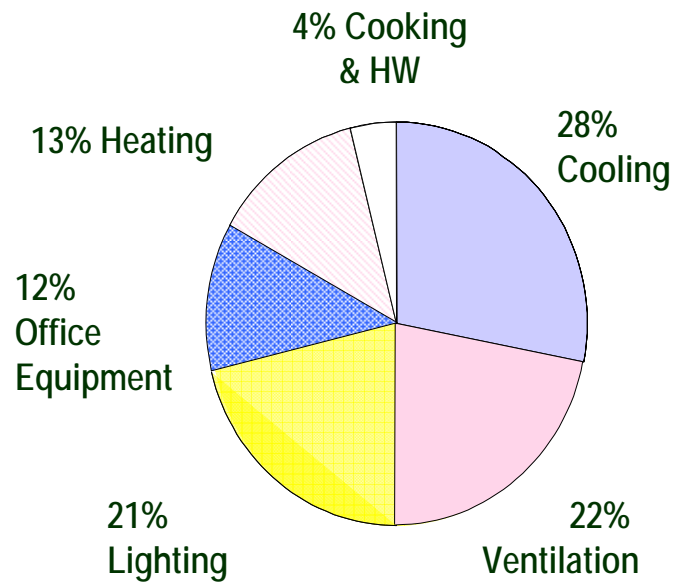
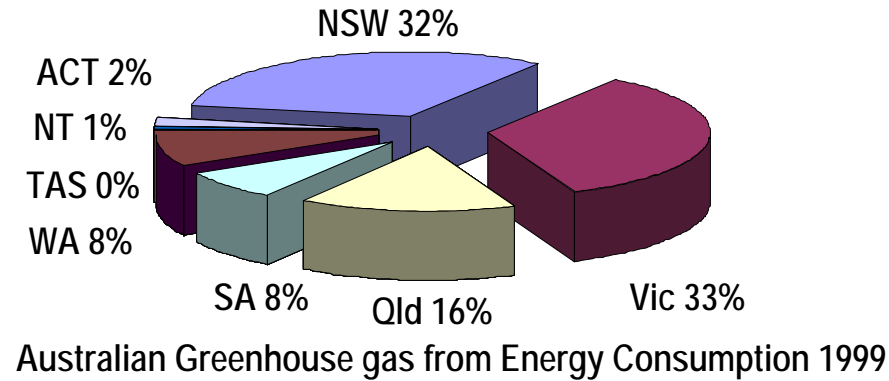
Tools Supporting FM throughout

- Investment
- Planning
- Acquisition
- Pre & Post-occupancy

Integrated Platform for Assessing:

- ❖ Benchmarking
- ❖ Environment & Economic Costs
- ❖ Comparing Alternatives
- ❖ Service Delivery Outcomes

Considering Sustainable Building Situation: e.g Commercial Building Greenhouse Gas



Considering FM Achievement Delivering : First Australian 5 star NGBRS Commercial Building



William McCormack Place

Awards

- * National FM Environment
- * First Commercial Building 5 Star ABGRS

Cost:

SAME AS CONVENTIONAL

Sustainability Low impact

Healthy Interior Lo VOCs

Equitable Access & Safety

Material Recycled Content

Labor Local Industry

Energy Waste Recovery

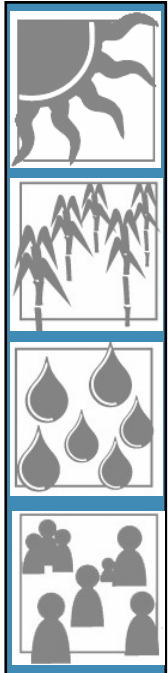
Daylight Shading, Glazing









Adaptable Churn/ Other Use



www.build.qld.gov.au

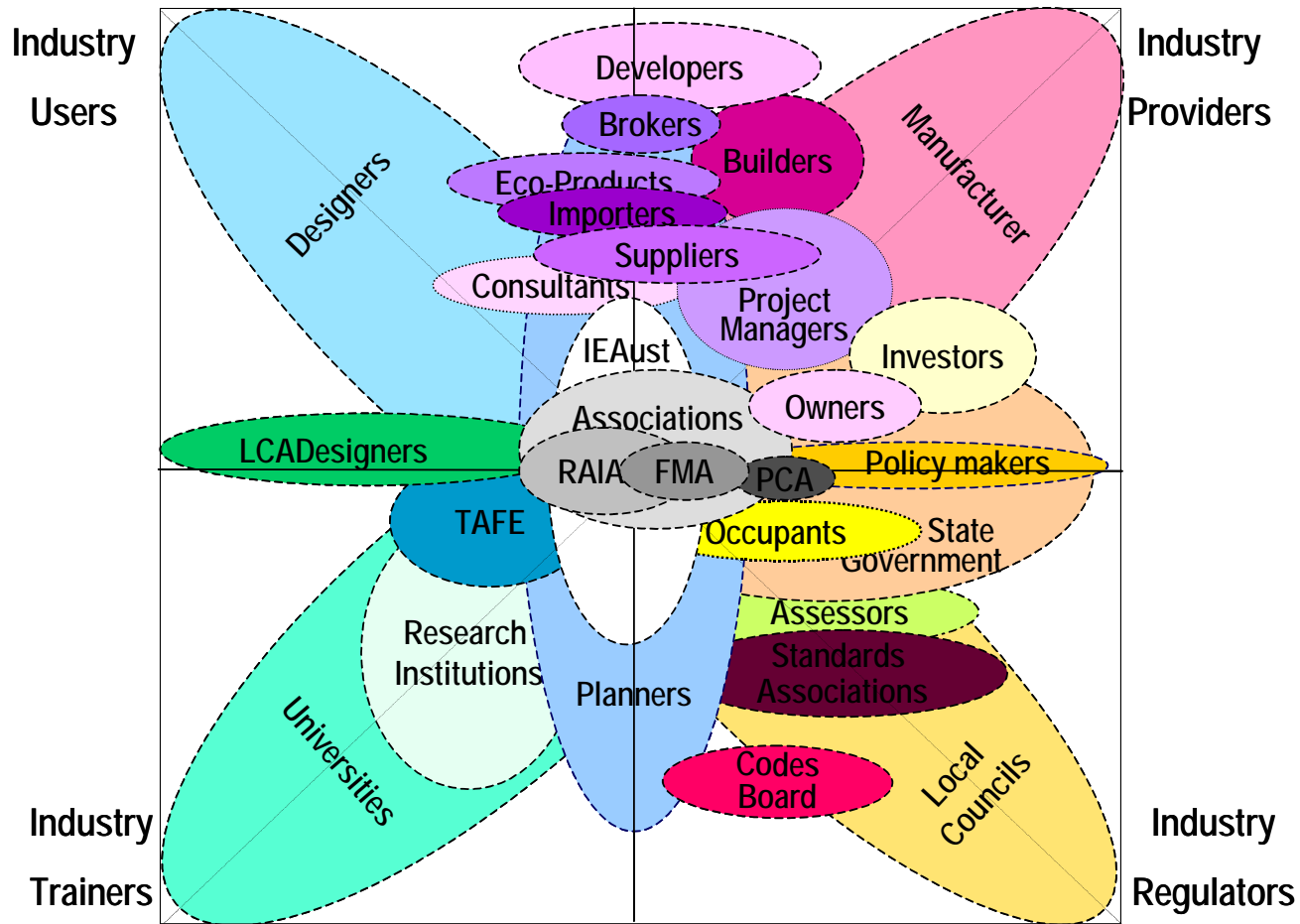
Considering Sustainable Built Assets: Complex Criteria & Green Tools



Supply		Conserving Resources of	
<i>Community</i> 	<i>Energy</i> 	<i>Materials / Land</i> 	<i>Water</i> 
natural heritage	passive design	durability	efficient use
cultural heritage	efficiency in use	waste avoidance	catchment
built heritage	waste avoidance	renewables	waste avoidance
access & safety	fossil fuel	material safety	waste reduction
Sinks		Reducing Emissions to	
<i>Air Indoors</i> 	<i>Air Outdoors</i> 	<i>Materials / Land</i> 	<i>Water</i> 
low VOCs	ozone depletion	construction waste	low effluent
effective ventilation	greenhouse gas	recycled material	low waste
healthy IAQ	particulates	avoid toxic waste	potable water







Considering Sustainable Built Assets: Many Stakeholders & Roles







Considering Sustainable Built Assets: Many Tools for Many Jobs

Stakeholder	Profession	Communication	Documentation	Life Cycle Phase
Investor	Broker, Client, Agent	Feasibility Literature	Policy, Benchmarks	Asset Investment
Owner	Corporate, Community	Policy and Class	Classing System	Acquisition
Developer	Urban, Land, Builder	Bid Development, Estimate	Development Apps.	Development
Manager	Facility, Portfolio, Asset	Strategies/tactics, Standard	Management Systems	Management in-use
Planner	Portfolio, Asset	Guide, Benchmark	Guides, Benchmarks	Strategic Planning
Purchaser	Eco labeling, Costings	Brief/Tender Eco-Values	Bid Assessments	Procurement
Provider	Logistics, Marketing	Marketing Assessment	Campaigns	Project Initiation
Designer	Architecture/Landscape	Design, Model	Blueprints/Plans	Design life cycle
Consultant	Engineer, Research	Data, Efficiency/IAQ	Reports	In-use, operations
Surveyor	Quantity	Specification	Bills of Quantities	Procurement
Manufacturer	Environmental Control	Eco-label, Product profile	Label, MDS	Procurement
Manager	Project, Site	Schedule, Specification;	Project Plans	Construction
Builder	Commercial	Plan, Certification	Construction Plan	Project Delivery
Operator	Facility & Building	Manual	Manuals	Occupancy in use
Occupant	Tenant, Owner,	Tenancy Checklist	Checklists	Pre Occupancy

Considering Sustainable Built Assets: Many Life Cycle Considerations

Criteria	Flow	Planning	Design	Procure	Construct	Operate	Disposition
Conserve Sources	Energy 	renewable	daylight	daylight	thermal comfort	efficiently	recover
	Water 	catchment	efficiency	catchment	avoid run-off	reuse	check quality
	Material 	reuse	interoperable	interoperable	disassembly	reparability	recover
	Community 	amenity	equity	equity	OH&S	WH&S	heritage

Protect Sinks	Energy 	low toxicity	fresh air	fresh air	noise/dust EMP	control, EMS	control, EMS
	Water 	Interactive	low impact	low impact	nature corridor	educative	habitat refuge
	Material 	safety	disassembly	local	WH&S	WH&S	heritage
	Community 	amenity	equity	local	OH&S	WH&S	heritage

Considering Sustainable Building: Commercial Building Design

SOFTWARE TOOL 2004

- Consider impacts in design
- Assess eco-friendly alternatives
- Include embodied & operational factors

LCA Design

*Works off
3 Dimensional CAD*

Considering Commercial Building Design



Enables Professionals

- ❖ to make informed decisions
- ❖ on environmental & economic cost impacts
- ❖ automatically from 3D CAD models

Project Objective to

- ❖ develop preferred appraisal tool
- ❖ provide uniform database
- ❖ cover various product combinations

Uses



Object orientated CAD architectural system with IFC export capability



IFCs provide common interpretation of real-world objects for IT to be interoperable.

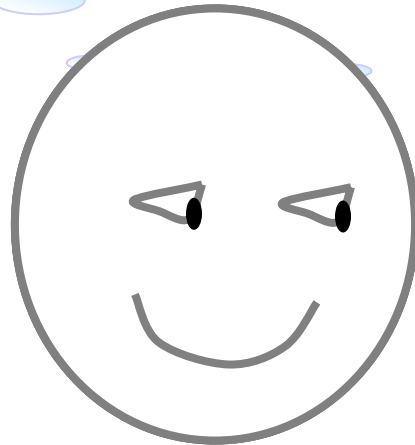
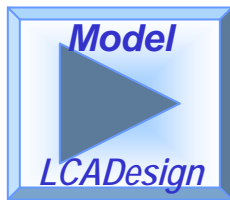
*International Alliance
for Interoperability*

Sustainable Built Assets:

Experience
LCADesign

*CAD Model of ESD
building information!*

*ESD tools & systems
on one IT platform!*



LCADefine

LCADepict

LCADesign

LCADetail

LCADeliver

LCADeconstruct



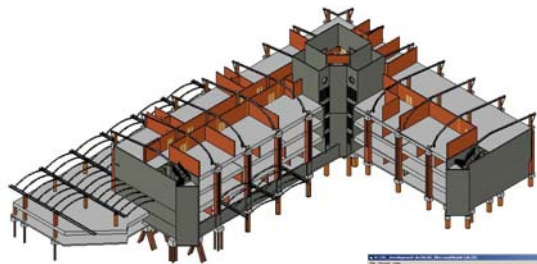
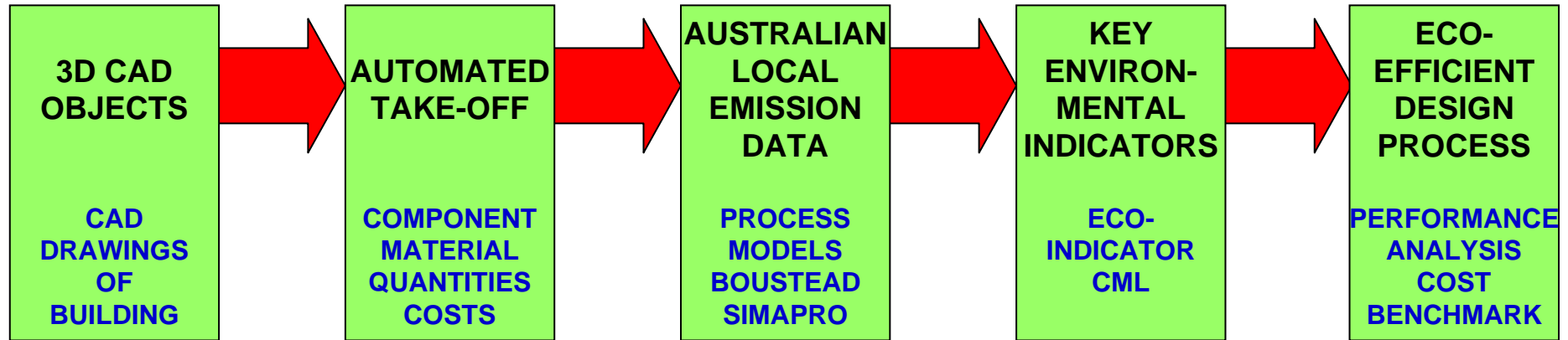
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Considering Assessment: Capabilities

- ❖ Automated from 3D CAD
- ❖ At sketch/detailed design
- ❖ Includes interactions between issues
- ❖ User-selection of measures transparent
- ❖ Easy to identify trade-offs
- ❖ Drill-down to “hot spots”
- ❖ Objects to whole design
- ❖ Comprehensive national databases

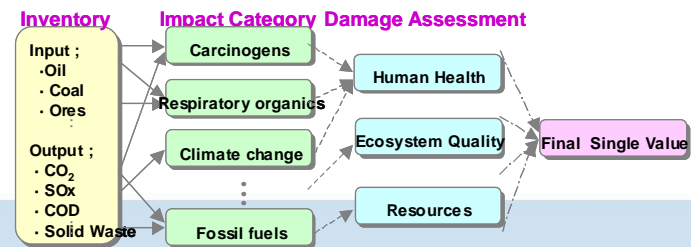
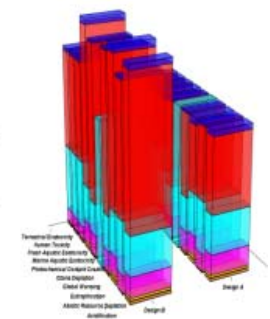
Scope:

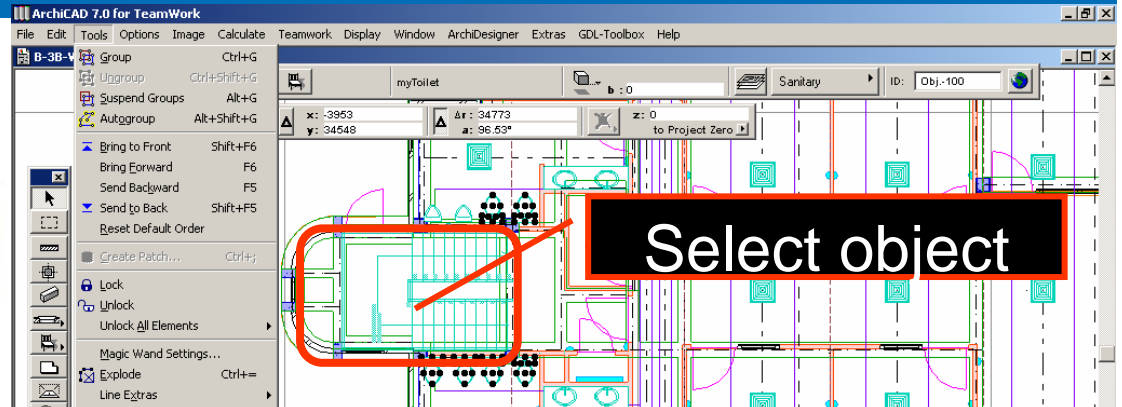
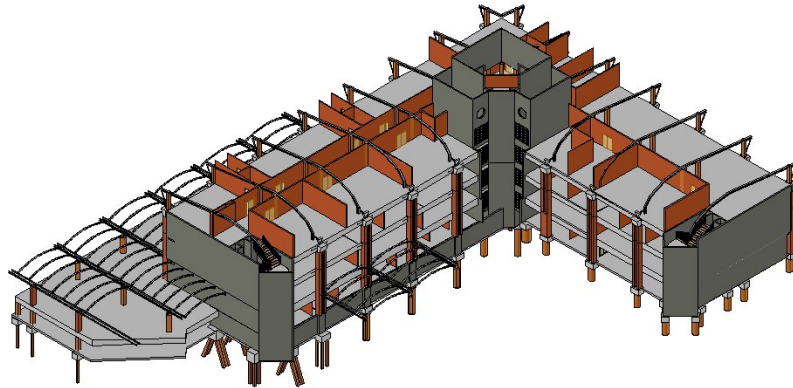
- ❖ design performance against sustainability criteria
- ❖ impacts of alternatives all levels design analysis



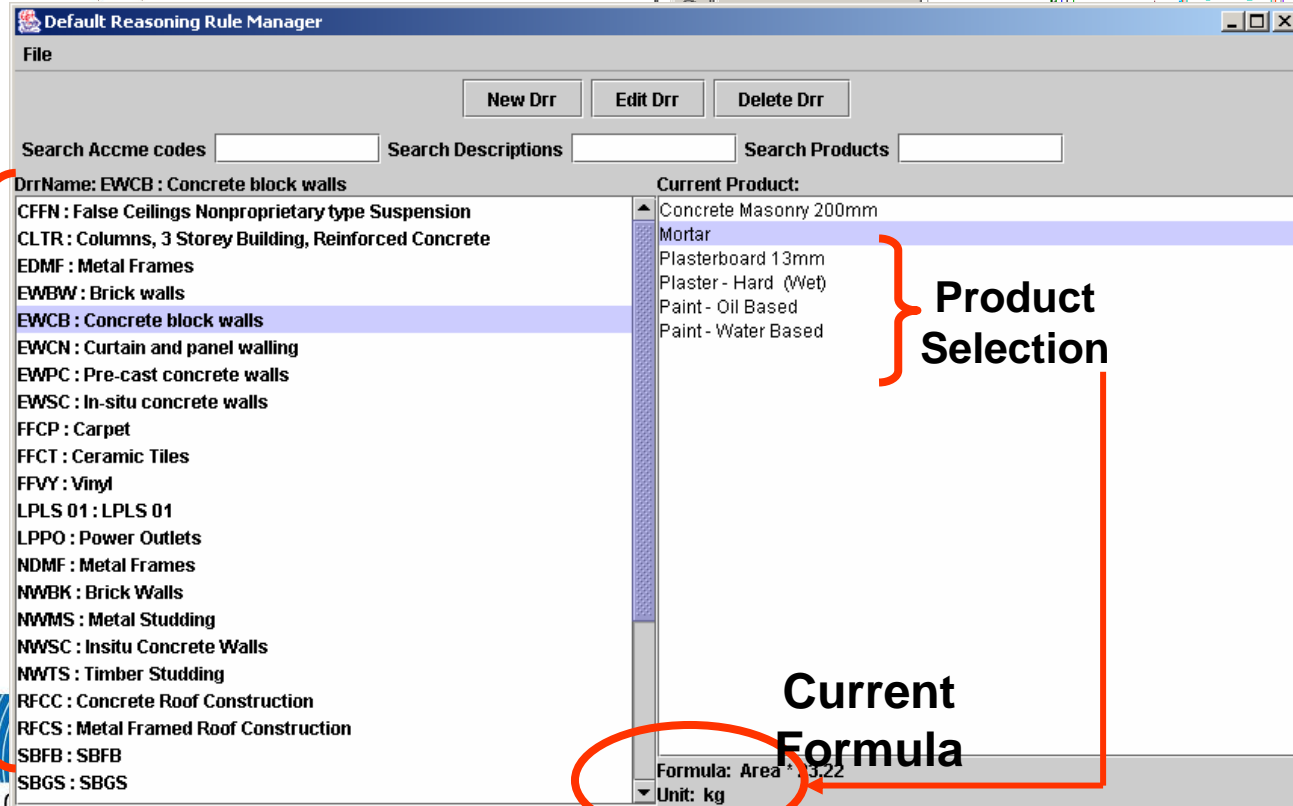
Code	Input operation	Quantity	Unit
1	Air emission dust in processing	7500	mg
2	Air emission CO in processing	370000	mg
3	Air emission CO ₂ in processing	500000	mg
4	Air emission SOx in processing	8000	mg
612	Solid Waste Mineral Waste	0.0707	kg
818	Burn coal feed stock as fuel	0.2646	kg
867	Coal use in Australia	1.6262	MJ
878	Diesel Use in Australia	0.3900	MJ
884	Other Oil Use in Australia	0.1870	MJ
888	Natural gas use in Australia	1.5000	MJ
5542	Road Transport A 18+ tonne	0.0019	v km
5544	Rail Transport general freight	0.4800	v km
7014	Mixture for Cement Making	1.4400	kg

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Select object



Available Reasoning Rules

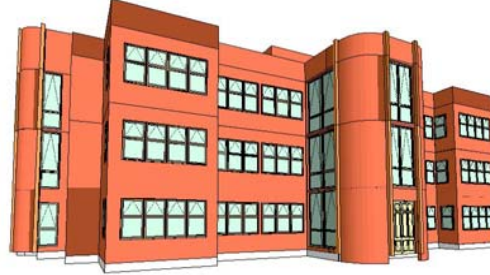
Product Selection

Current Formula

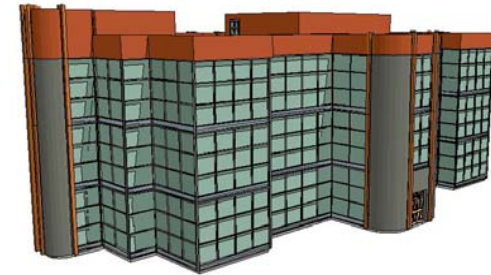
Select classification



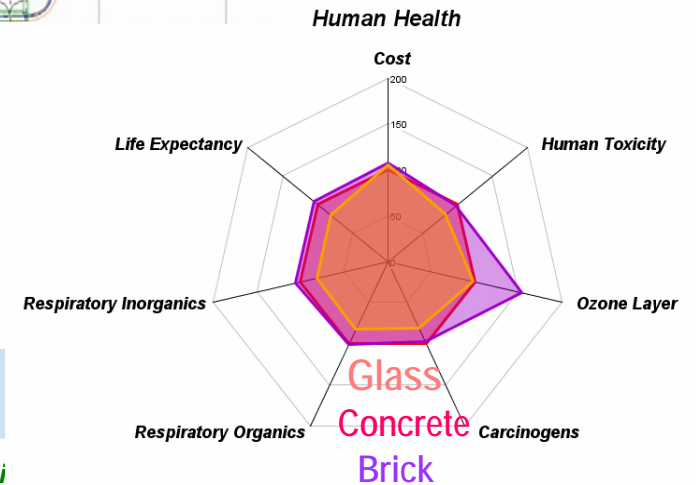
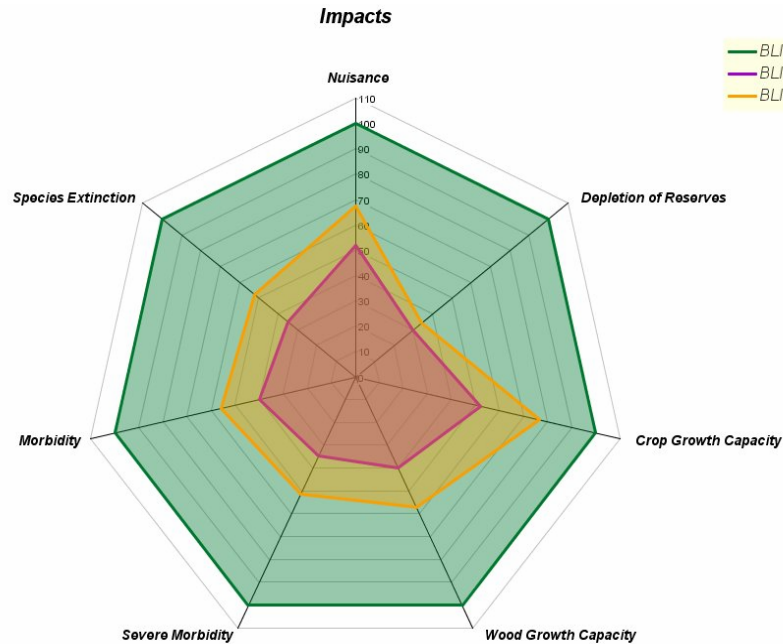
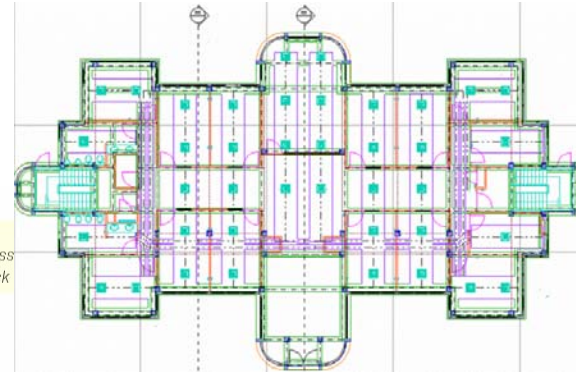
Pre-Cast
Concrete Panel



Brick Masonry



Glass Curtain
Wall

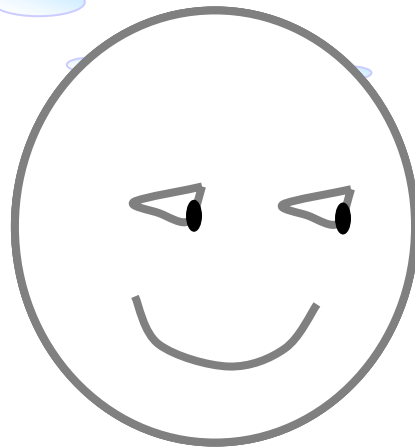
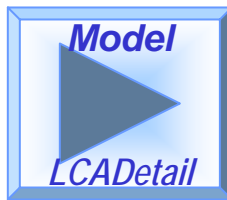


Sustainable Built Assets:

Experience
LCADetail

*CAD Model of ESD
building information!*

*ESD tools & systems
on one IT platform!*



LCADevelop



LCADefine

LCADepict

LCADesign

LCADetail

LCADeliver

LCADeconstruct



Considering Sustainable Building: Product Design

SUPPLY CHAIN

SOFTWARE TOOL 2005

- Consider impacts in product supply
- Assess eco-friendly alternatives
- Include embodied & operational factors



*Works off
3 Dimensional CAD*

To

- Deliver a National supply chain Database
- Provide Accredited Data
- Determine Product Profiles
- Capture Input Of Industry Suppliers

For

- Supply & Procurement Product Profiling
- Manufacturers & Fabricators Database
- Assessing Environmental Preferences
- Improving Industry Bottom Line

Applications

- Facilitate Industry Data Collation
- Detail Supply Chain Issues
- Clarify, Verify & Resolve Issues
- Facilitate Market Defense & Eco-labeling

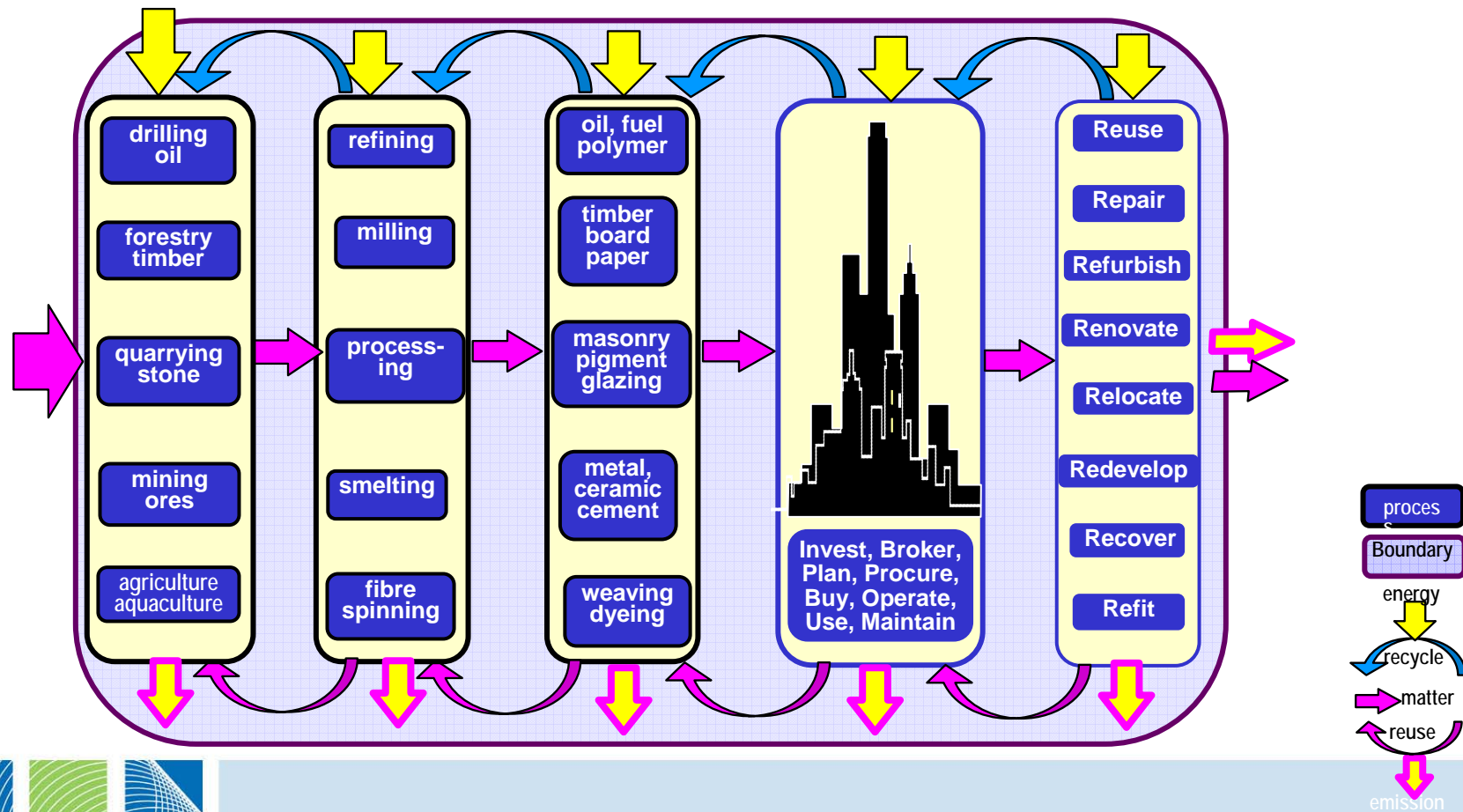
www.LCADetail.com
Tools & Database

Sink/source Data
Industry Details
Sensitivity
Analysis
Eco Practice
Eco-Profile
Consultancy
Packaging
Eco-label
Supply Tags
Procurement

***Works with 3
Dimensional CAD***

Inventory: City System

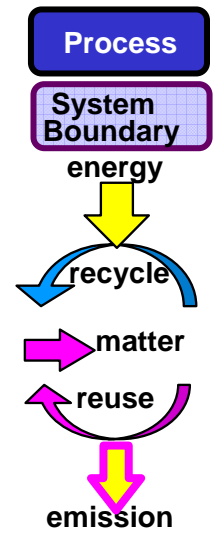
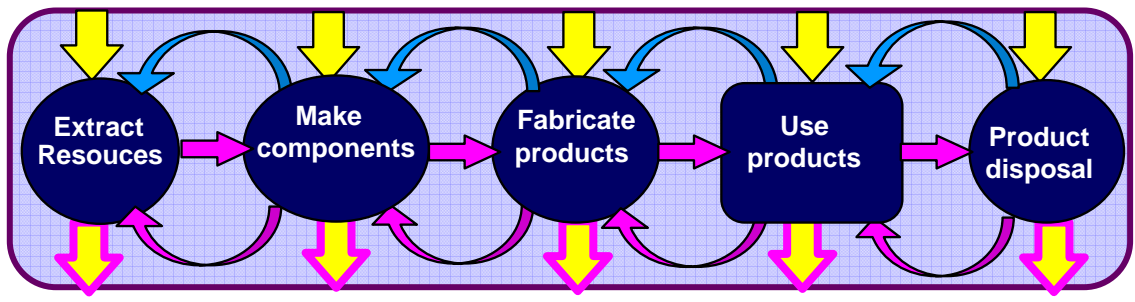
- Environmental accounting (ISO 14043) method to:
 - ❖ Compile an inventory of inputs & outputs of a product system
 - ❖ Evaluate their environmental impacts and
 - ❖ Interpret these results considering objectives of study



9015 Dry Process Cement Clinker Formation			
Code	Input operation	Quantity	Unit
1	Air emission dust in processing	7500.0000	mg
2	Air emission CO in processing	370000.0000	mg
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Note

- 0.0019 km Road
- 0.48 km rail freight;
- 0.2646 kg Bowen coal
- 0.0707 kg Mineral Waste.
- raw material 1.7kg,
- 1.44 kg mixture
- CO₂ ex fuel 500000 mg
- 7500 mg dust,
- 3750 mg CO,
- 8000 mg SOx,
- 1.6262 MJ Coal fuel use,
- 1.5 MJ natural gas,
- 0.3900 MJ-Diesel,
- 0.187 MJ Oil;

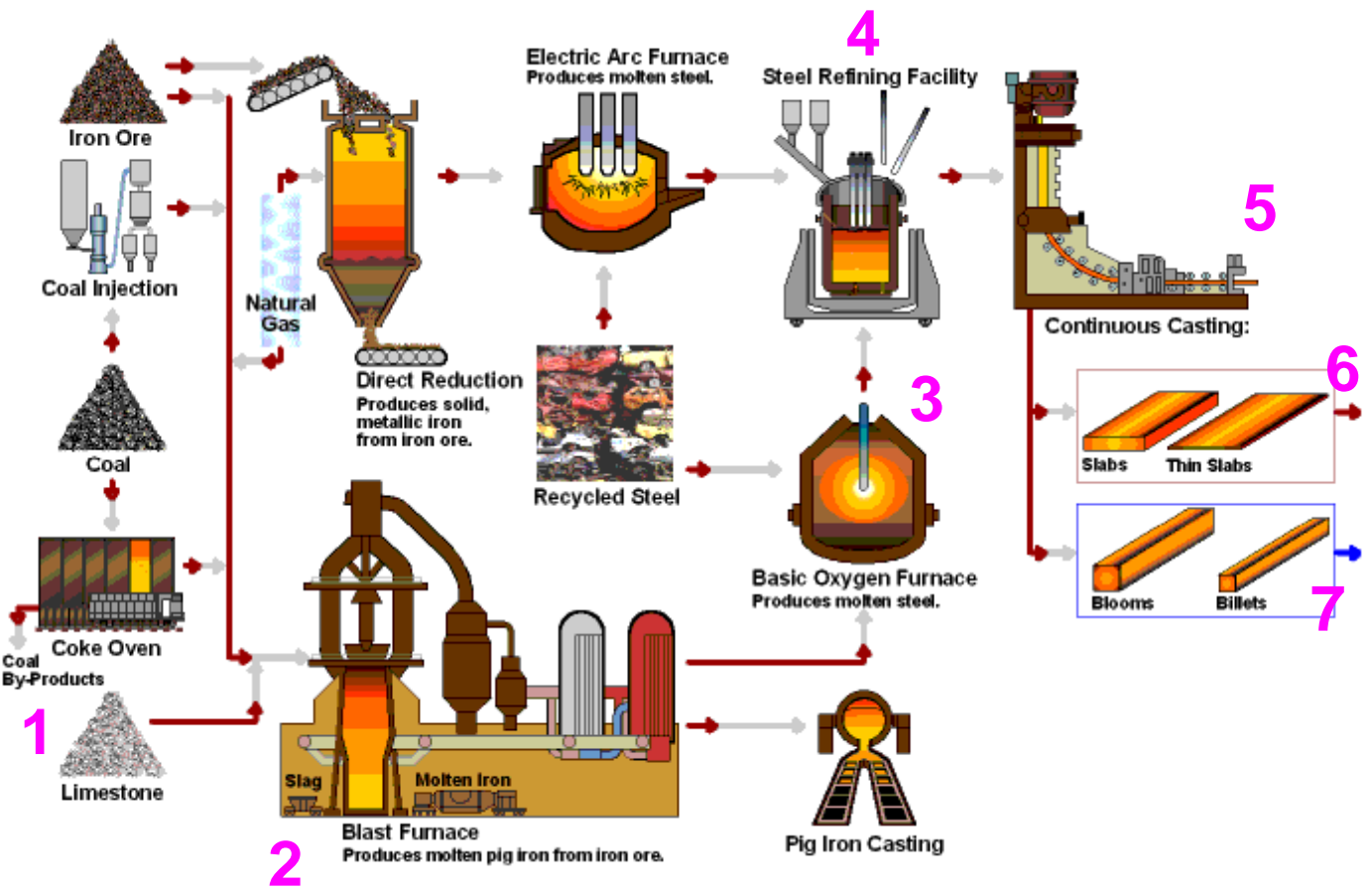


Example Process Flow

Iron Ore to Hot Roll

Whyalla plus Sydney Sequence

- 1 Iron ore, limestone, coal to coke ovens
- 2 Coke oven feed to Blast Furnace
- 3 BOSF for liquid iron + scrap O₂ reduce
- 4 LMF or IRUT Steel Finish Chemistry
- 5 slab bloom/ billet caster cooling beds
- 6 Rolling Mill to slabs to hot strip mill
- 7 4hi Structural Mill shape bloom - section
- 8 Ship to Newcastle/Sydney Rod/Bar Mill
- 9 Roll at Newcastle/Sydney Rod/Bar Mill



Technology Summary

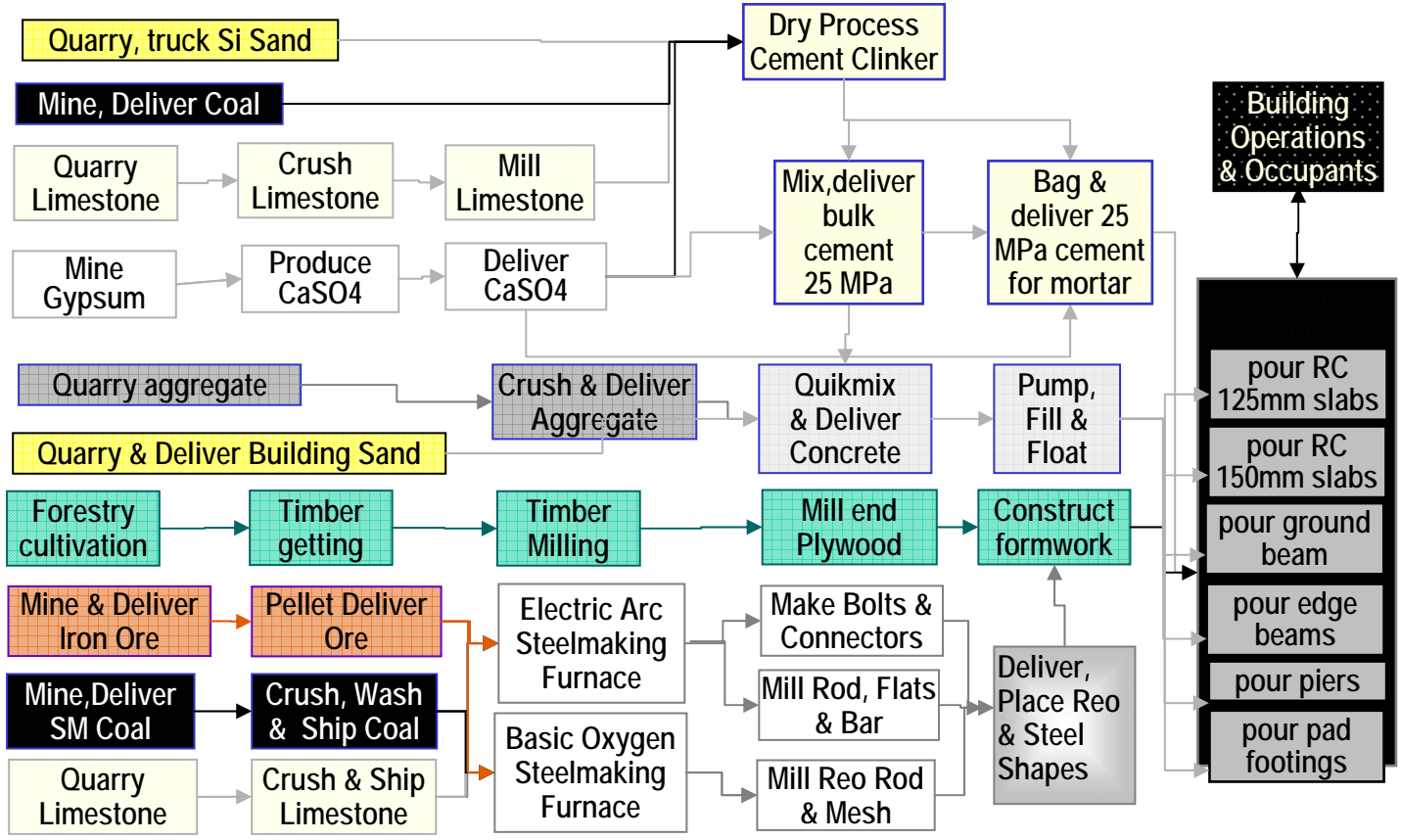
Major Players:

- Cement Australia (CA)
- Adelaide Brighton Cement (ABCL)
- Blue Circle Southern Cement (BCSC)



Owners	Player	Share %	Location	State	Process	MT	Operation	Fuel	MT
50% Holcim 5% CSR 25% Hanson	CA	42-45	Rockhampton	QLD	Wet	140	long wet	coal	3290
			Gladstone	QLD	Dry	1600	pre-calciner	coal/alt	
			Railton	TAS	Dry	1100	pre-calciner	coal	
			Kandos	NSW	Two Dry	450	susp preheater	coal fired	
Adelaide Brighton & RMC-Rugby	ABCL	30-33	Angaston	SA	Wet/S-Dry	250	long wet/s-dry	gas	2420
			Birkenhead	SA	Dry	1600	pre-calciner	gas	
			Munster	WA	X3 Wet	570	long wet	gas/coal/alt	
Boral	BCSC	20-23	Maldon	NSW	Wet	300	long wet	coal fired	2350
			Berrima	NSW	Wet Dry	440 1100	susp preheater long wet	coal fired coal fired	
			Waurnd Ponds	Vic	Dry	500	susp preheater	gas/alt	

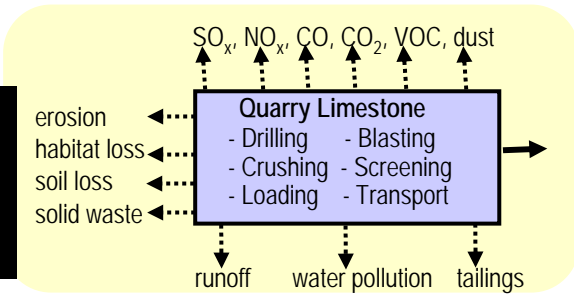
Reinforced Concrete Flows



NB Each operation may have up to:

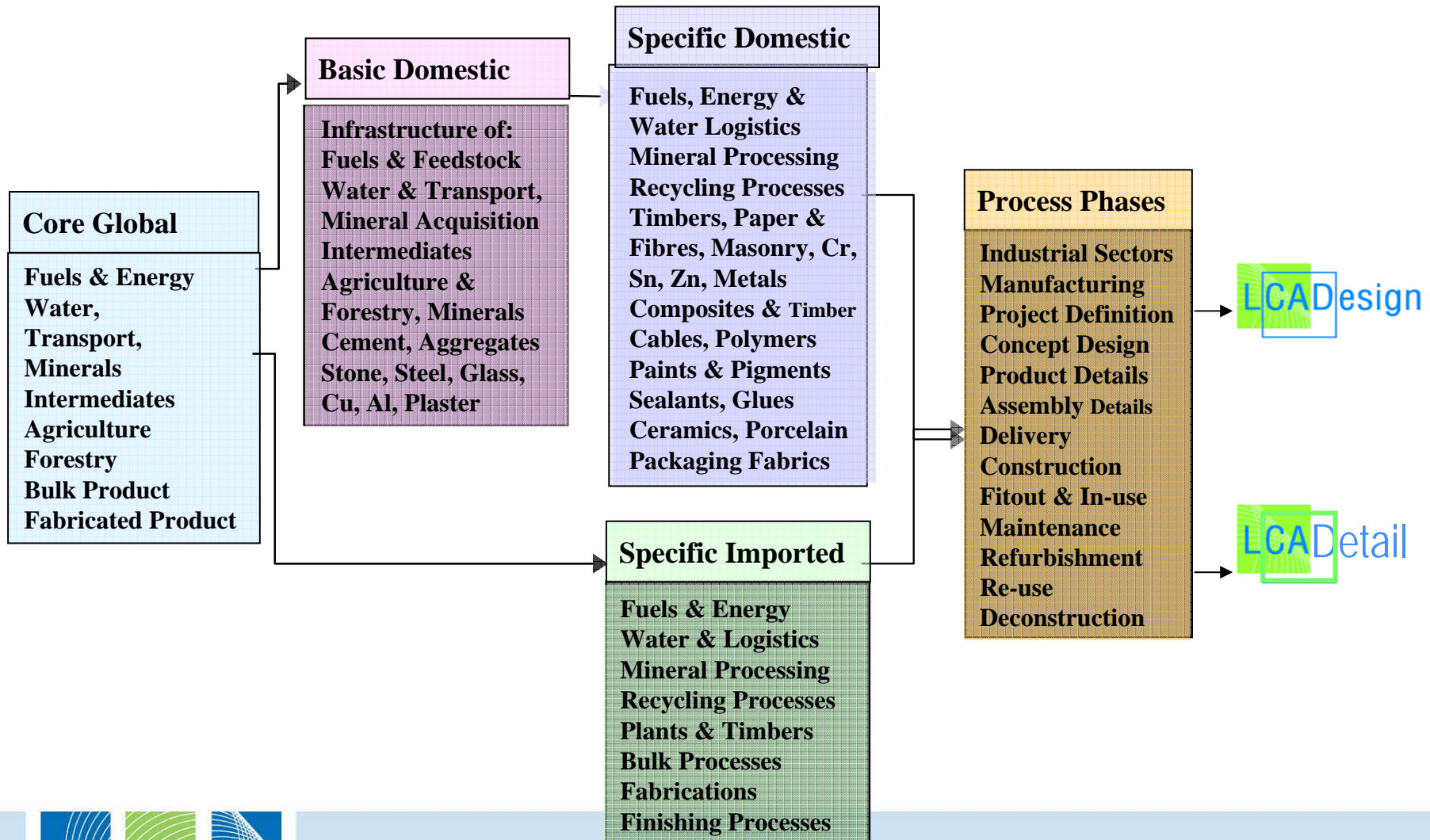
- 30 Raw Materials
- 43 Emission to Air
- 44 Emission To Water
- 16 Solid Waste Streams

e.g Water, Coal, Bauxite, Limestone, Scrap
 e.g. Dust, CO₂, Hydrocarbons, Methane
 e.g BOD, COD, Ammonia, Cadmium Fluoride
 e.g Slag, Ash, To Mine, From Construction

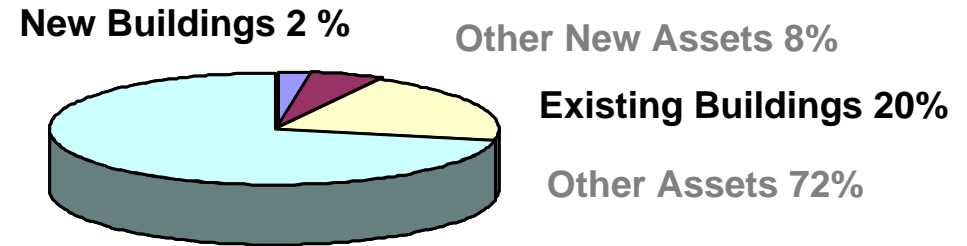
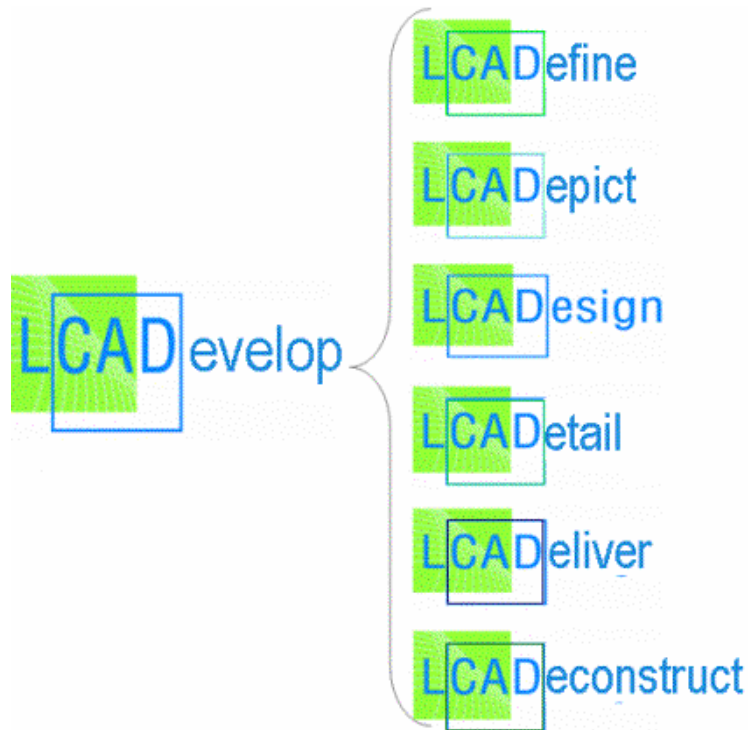


Inventory:

Domestic and Imported Product



Sustainable Facility Management: Tools, Databases



3D & 4D Platform Future

- Tools
- Databases
- Systems

Sustainable Facility Management: Tools, Databases

LCA Define

LCA Design

LCA Detail

LCA Deliver

LCA Deconstruct

Strategic Planning
Project Brief Prep
Design Brief Prep
Project Intent/
Project Objectives
Concept Develop
Design Tender
Tender Developing
Bid Assessment
Planning Approval

Brief Response
Build Information
Preliminary Exam
Objectives
Brief
Sketch /Model
Development
Assessment
Coordination
Specification

Sink/source data
Industry Details
Sensitivity Analysis
Eco Practice
Eco-Profile
Consultancy
Packaging
Eco-label
Supply Tags
Procurement

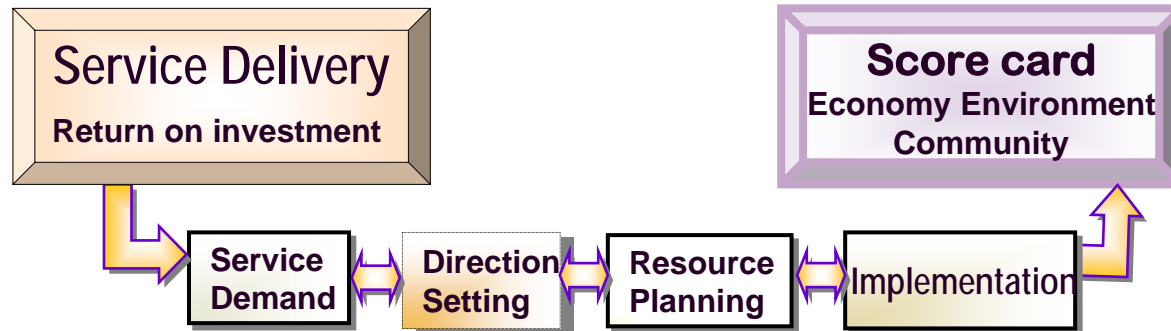
Supervision
Demolition
Construction
Fitout
Preoccupancy
Acceptance
Operation
Post Occupancy
Performance
Maintenance

Reuse
Renewal
Refurbishment
Renovation
Relocation
Redevelopment
Recovery
Recycling
Deconstruction



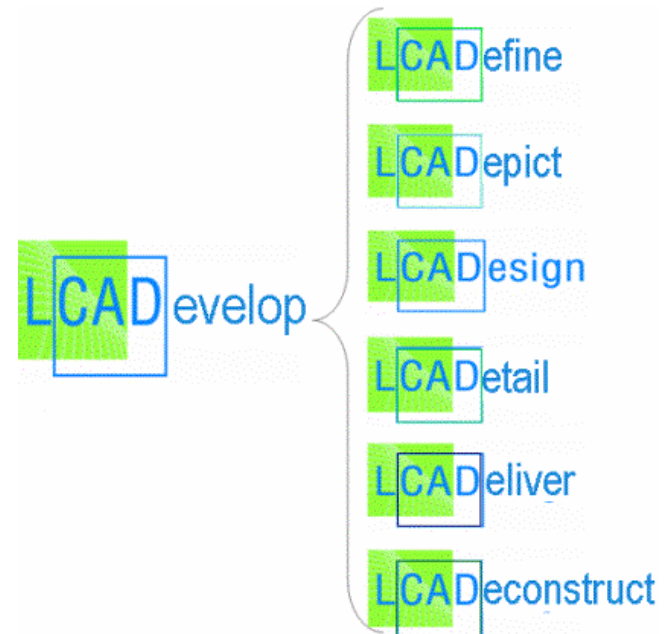
Sustainable Facility Management: Tools, Databases

IT: to do this



Integrated Decision Assessment on Industry Sector ICT Platform

On similar ICT CAD Platform as



Recommendations

Capital works to exploit

- 3D CAD Models
- 4D CAD Models
- IFC Software

NOW

Expect:

