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SCIENCE, TECHNOLOGY AND RESEARCH INTO SPORT SURFACES

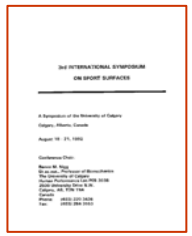
2007

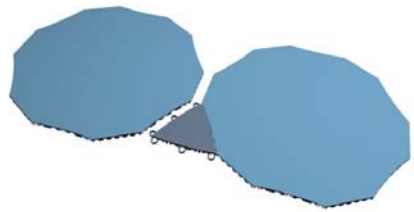
University of South Australia

Grass is not always Greener:

The Application of Life Cycle Assessment to Natural and Artificial Turf Sports Surfaces.

"Exploration of the Force Attenuation Features of Sustainable Multi-Sport Surfaces in Relation to Netball Injury Prevention".





Research examines "lateral dissipation" claims of sports tile surface manufacturers. Claims state that modular tile surfaces are able to attenuate the damaging effects of high horizontal forces in addition to the vertical forces involved in sports such as basketball, netball and volleyball.

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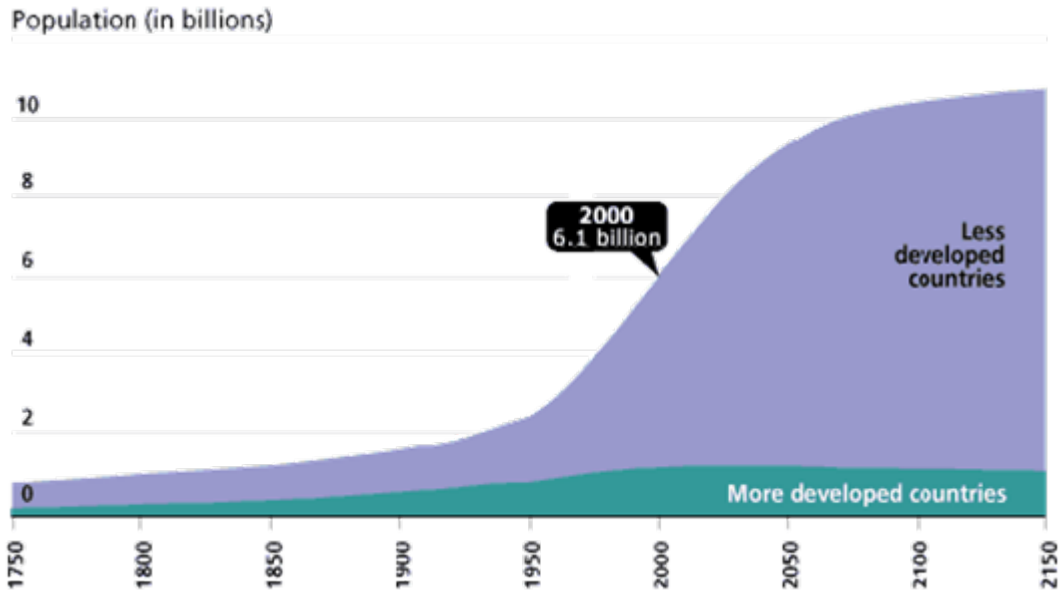
Sustainable Development

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

(World Commission on Environment and Development, *Our Common Future*, 1987)

How sustainable is the way we currently live?



Australia's Population:

Population is forecast to grow from 20 million to 23 million by 2021.

(Living Planet Report 2006)

How sustainable is the way we currently live?

Global Fresh Water:

Lakes, rivers, wetlands and aquifers are being degraded through excessive withdrawals, pollution and introduction of pests.

Australia's Fresh Water:

About 26% of Australia's surface water management areas are close to, or have exceeded, sustainable extraction limits.

(Living Planet Report 2006)

How sustainable is the way we currently live?

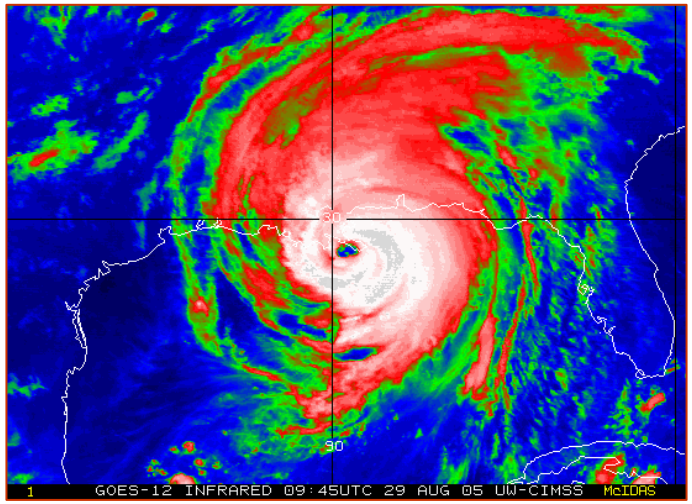
Global Warming:

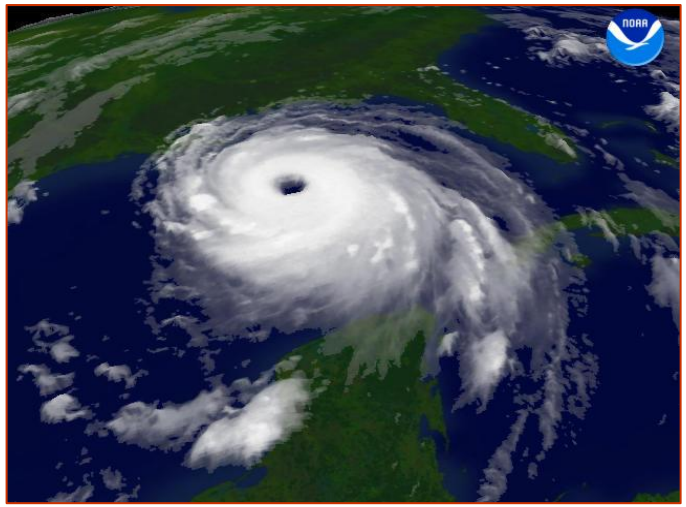
The intensity and occurrence of severe weather events linked to climate change is increasing.

Australia:

Australia's per capita emissions of greenhouse gases is amongst the highest in the world. Much of this is due to the way we generate power.

Climate Change





River ‘Screams Help’

The River Murray is about to reach salinity levels above accepted standards for drinking water and scientists say it is "screaming for help".

Adelaide Advertiser Newspaper, September 04, 2007

South Australian Government Water Restrictions

September 2007- Sports Grounds and Recreation Facilities

Level 3 Water Restrictions:

- A hand-held hoses fitted with a trigger nozzle may be used on any day but only before 8am or after 8pm.
- Watering cans and buckets may be used at any time.
- Sprinkler systems may be used once a week between the hours of 8pm and 8am.
- The day of the week and time of operation for each of the sprinkler stations is to be determined in conjunction with SA Water and is subject to a permit.
- Testing of sprinklers will not be permitted without prior approval of SA Water.

Hindmarsh Stadium

http://www.austadiums.com/stadiums/stadiums.php?id=54

- Stadium completely rebuilt for the 2000 Sydney Olympics.
- Capacity of the stadium is 16,500 including seating for around 15,000.
- It is the home of soccer in South Australia, hosting A-League side Adelaide United.
- The venue is regarded as one of the best purpose-built soccer venues in Australia.
- 9600m2 pitch area which requires 12.6 mega litres of water to irrigate each year.
- This is roughly equivalent to the water used by 45 households each year.
- Stadium is currently still exempt from water restrictions.

Environmental Impacts

- Manufacture
- Irrigation
- Organic Decomposition
- Pesticides
- Fertilisers
- Grass cutting and other turf maintenance
- Land utilisation

Environmental Impacts

- **MANUFACTURE**
- **Irrigation**
- **Organic Decomposition**
- **Pesticides**
- **Fertilisers**
- **Grass cutting and other turf maintenance**
- **Land utilisation**

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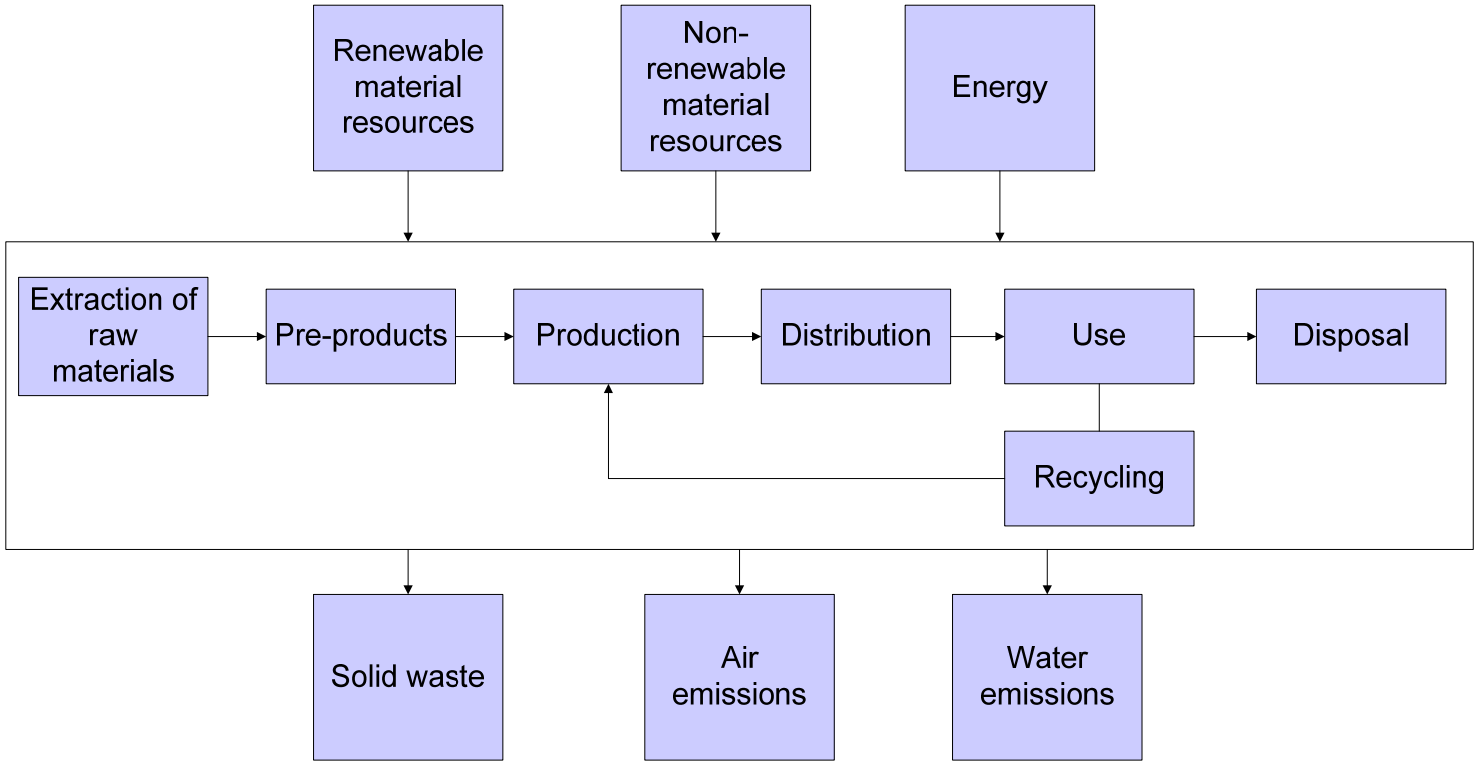
- LAND UTILISATION

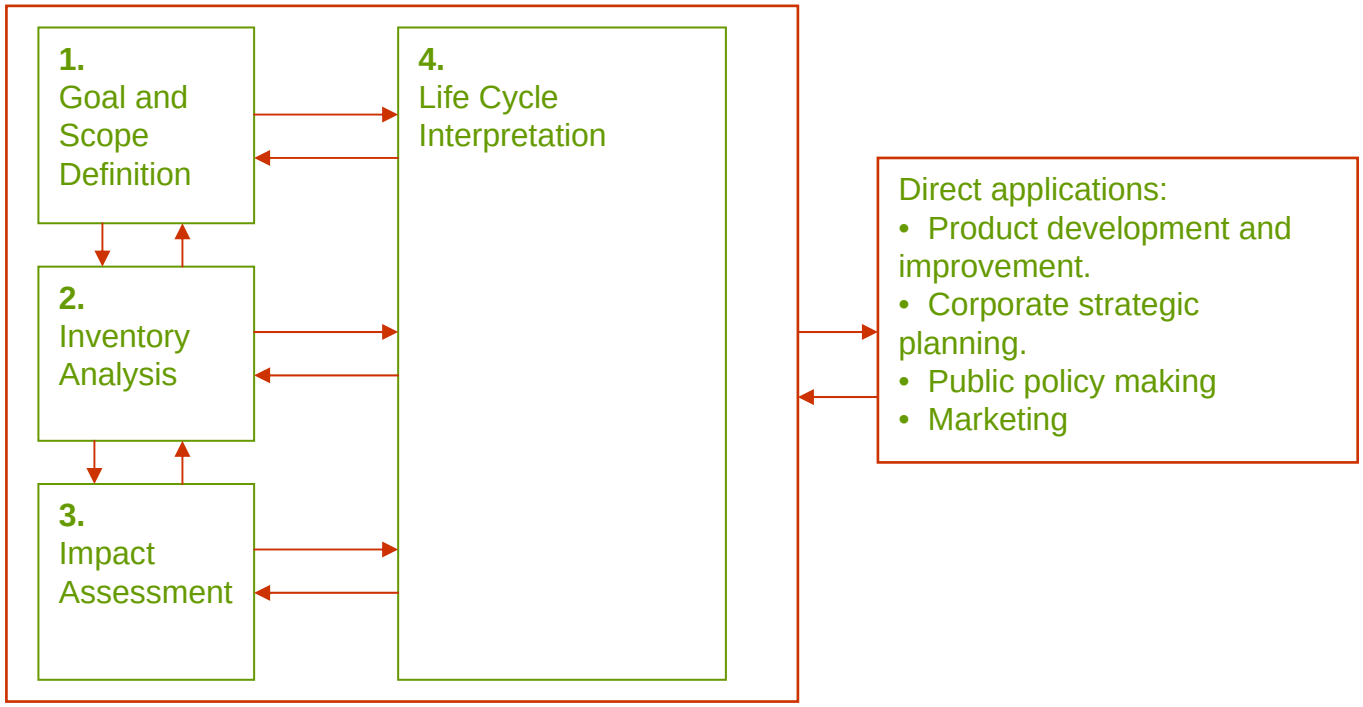
Product Life Cycle

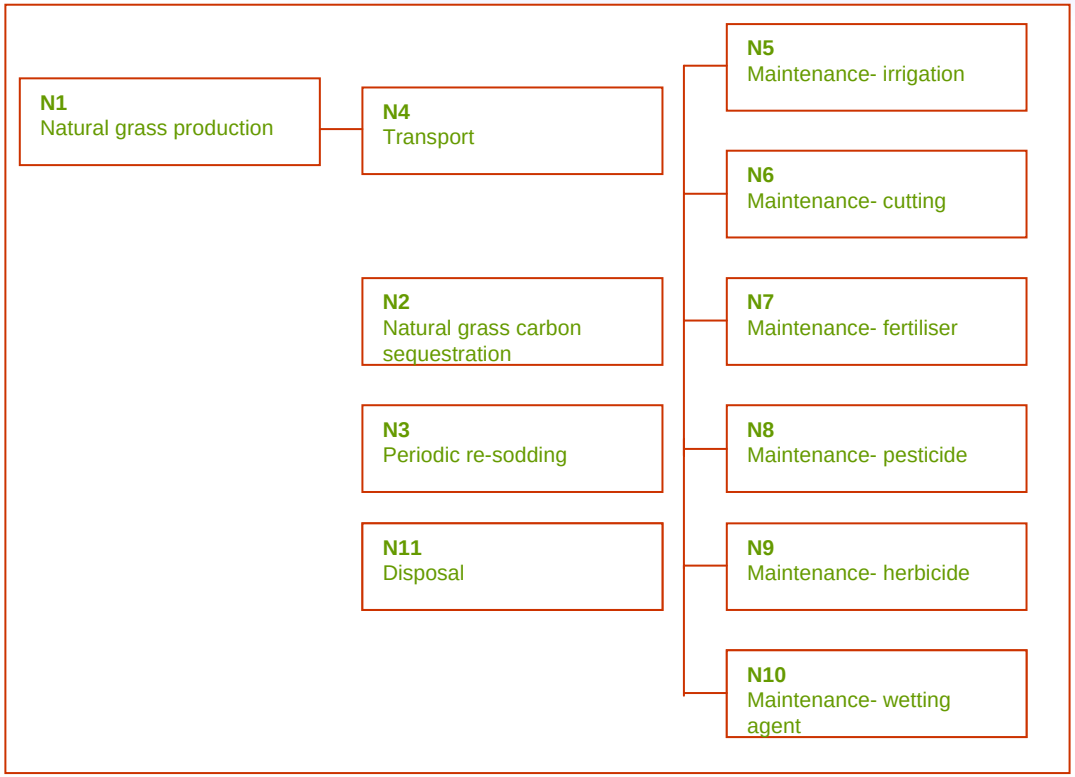


Stages of an LCA

A Life Cycle Assessment consists of four independent elements:

1.Definition of goal and scope (ISO 14040)
2.Life cycle inventory analysis (ISO 14041)
3.Life cycle impact assessment (ISO 14042)
4.Life cycle interpretation assessment (ISO 14043) (LeVan, 1995)



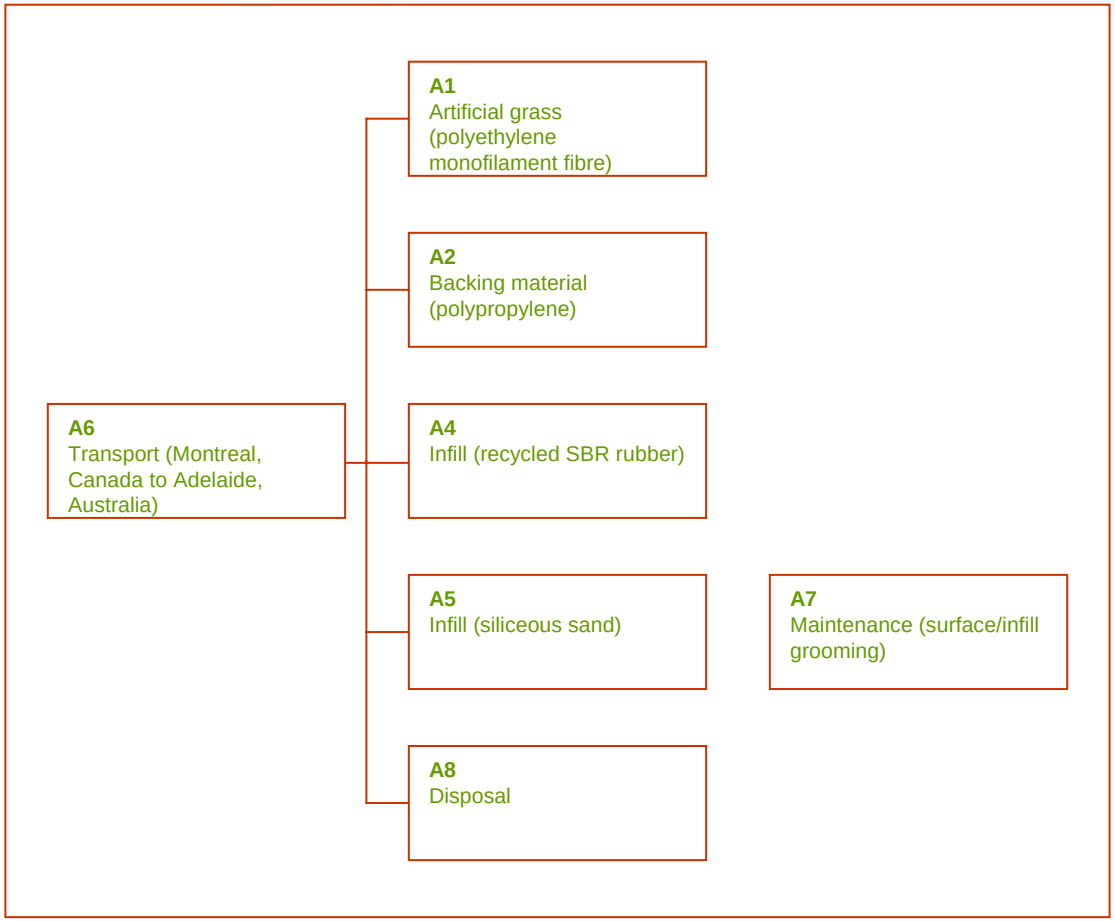


Natural Grass System Boundaries

Goal and scope definition

Description of:

- The question to be addressed.
- The scope.
- The required reliability.
- The criteria for a judgement.



Artificial Grass System Boundaries

Goal and scope definition

Description of:

- The question to be addressed.
- The scope.
- The required reliability.
- The criteria for a judgement.

Item	Component Name	Qty	Units
A1	Artificial Grass (polyethylene fibre)	8,335	kg
A2	Backing material production (polypropylene)	1,667	kg
A3	Backing material production (polyurethane)	4,763	kg
A4	Infill (recycled SBR rubber)	146,415	kg
A5	Infill (siliceous sand)	146,415	kg
A6	Transport (Canada to Australia)	16,750	km
A7	Maintenance (grooming)	6,138	litres diesel
A8	Disposal		

Goal and scope definition

Inventory analysis

Artificial Grass
Component Description

- Systematic description of all processes in life cycle phases.
- Data collection on each process step.
- Calculation of the inventory table with all raw material depletion's and emissions.

Item	Component Name	Qty	Units
N1	Natural grass production	290	1X35m rolls
N2	Natural grass carbon sequestration	1000	kg (CO_2e)
N3	Periodic re-sodding	57	1X35m rolls
N4	Transport (Nursery to Adelaide)	50	km
N5	Maintenance- irrigation	126	Mega litres
N6	Maintenance- cutting	22,042	litres diesel
N7	Maintenance- fertiliser	12,000	kg
N8	Maintenance- insecticide	50	litres
N9	Maintenance- herbicide	42	litres
N10	Maintenance- wetting agent	400	litres
N11	Disposal		

Goal and scope definition

Inventory analysis

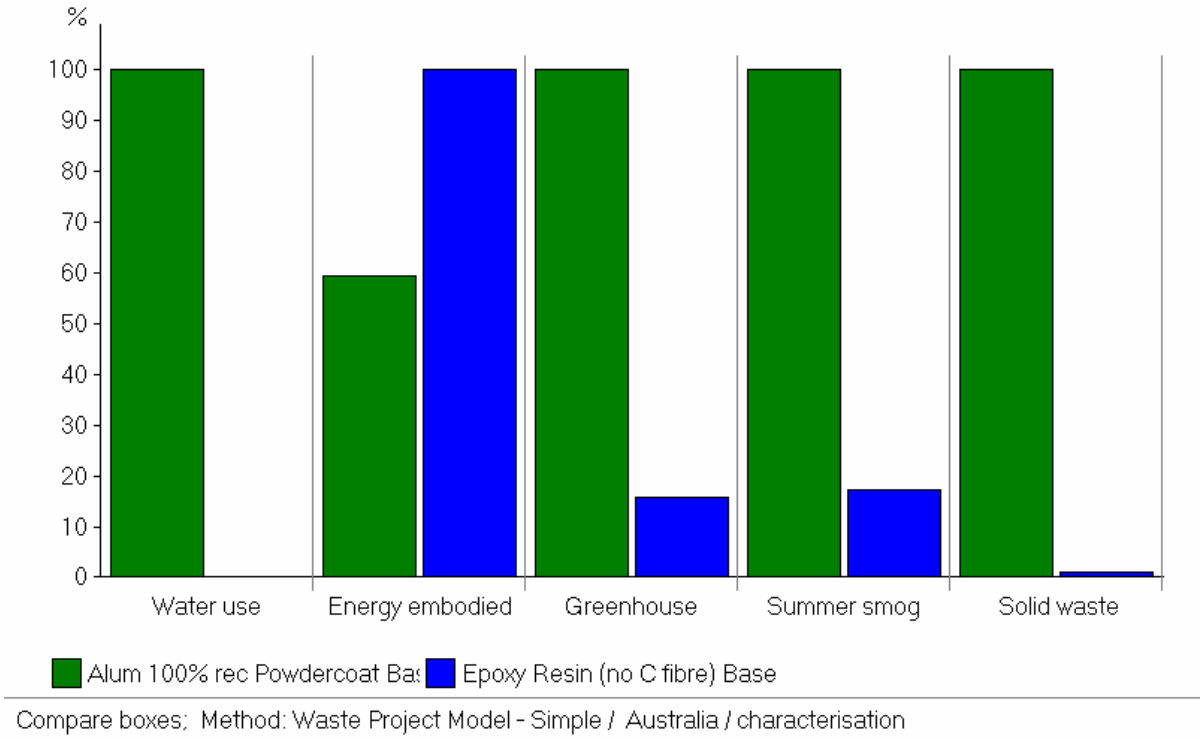
Natural Grass Component Description

- Systematic description of all processes in life cycle phases.
- Data collection on each process step.
- Calculation of the inventory table with all raw material depletion's and emissions.

GHG Global Warming Potentials

- Global Warming Potential (GWP) is an index used to convert relevant non-CO_2 gases to a CO_2 equivalent (CO_2-e) by multiplying the mass-based quantity of the gas by its GWP. The table below provides various GWPs for a 100-year time horizon published by the Intergovernmental Panel on Climate Change (IPCC) in the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Reporting Instructions.

Gas	Chemical Formula	IPCC 1996 Global Warming Potential[1]
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons HFCs		
HFC-23	CHF_3	11,700
HFC-32	CH_2F_2	650
HFC-41	CH_3F	150
HFC-43-10mee	$C_5H_2F_{10}$	1,300
HFC-125	C_2HF_5	2,800
HFC-134	$C_2H_2F_4$ (CHF_2CHF_2)	1,000
HFC-134a	$C_2H_2F_4$ (CH_2FCF_3)	1,300
HFC-143	$C_2H_3F_3$ (CHF_2CH_2F)	300
HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	3,800
HFC-152a	$C_2H_4F_2$ (CH_3CHF_2)	140
HFC-227ea	C_3HF_7	2,900
HFC-236fa	$C_3H_2F_6$	6,300
HFC-245ca	$C_3H_3F_5$	560



Goal and scope definition

Inventory analysis

Impact Assessment

- Sorting of all emissions and raw material depletion's to their environmental effects.
- Computation of single scores per effect.

How useful has LCA been in this application?

Pros:

- Covers the environmental impacts for the full life cycle of a playing surface.
- more rigorous and scientific than other qualitative, subjective tools.
- Various software tools are now available such as SimaPro and GaBi, to simplify the process.

Cons:

- Can be time consuming, complicated and expensive to use.
- Good quality data may not be available (i.e. for your specific region, or you may not have control over where the product will be manufactured or it just may not exist).
- Data and results can be viewed as “politically sensitive” and therefore difficult of impossible to obtain.
- This discipline is still in it’s infancy and still developing.

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