The role of technology in sustainable development: The Environmental Technology Centre at Murdoch University

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The role of technology

- Development
- Sustainable development
- The need for integration
- Case study: Environmental Technology Centre at Murdoch University (ETC)
The Environmental Technology Centre:

A 2 hectare operational research and teaching environment landscaped on permaculture principles

over 40 environmentally sustainable technologies and examples of sustainable living

Buildings illustrate sustainable building and construction

Environmental Technology Centre (ETC)

• Centre of excellence for industry focused R & D

• UNEP International Environmental Technology Centre Cooperation Centre
ETC core research areas: Technologies in
- Water
- Permaculture
- Renewable energy
- Sustainable building and construction

AND THEIR INTEGRATION TO ACHIEVE SUSTAINABILITY
Current Urban Water Management

Integrated Urban Water Management
“closing the loop”
Rainwater harvesting

Rainwater tank

Pond for cooling

Wastewater reuse for subsurface irrigation

Biomax™
Organic Waste Management

Vermiculture

Primary Decomposition

Castings consisting of bacteria, organic matter, urea, and proteins.

Nitrogen fixation mainly occurs on burrow walls with nitrification mainly occurring on the castings.

Hydrolysis produces $\text{NH}_3$ and $\text{NH}_4^+$ concentration increases

Increased aerobic respiration rate increases

Secondary Decomposition

Fixation, nitrification and hydrolysis reactions continue

Increased surface area

Increased aerobic respiration results in increased heat released, which further stimulates microbiological growth.

Worm Digestion

Worm ingests organic matter, fungi, protozoa, algae, nematodes & bacteria

Increased aerobic respiration results in increased heat released, which further stimulates microbiological growth.

CO$_2$, $\text{N}_2$, $\text{O}_2$

Organic matter consumed

Organic matter consumed

Organic matter consumed

$\text{NO}_3^-$ concentration increases

Leaching

Green Waste

Biosolid Matrix
Permaculture

Water and energy

Solar hot water heater

Solar powered RO desalination

Solarflow™

Solar water pumping

Solarflow™

Solar Thermal Technologies

Insulation

Glass or plastic

Green architecture

- East west orientation
- Minimising energy for heating and cooling
- Solar lighting

- Photovoltaic panels as roof
- Inverter to grid avoids battery
Concrete slabs contain flyash

Walls in rammed earth with recycled bricks
Appropriate construction materials

Use of recycled concrete

Crushed waste glass incorporated into concrete
Gives terrazo effect

Kitchen cupboard and wall panels from recycled plastics
Wider integration

• High NABERS rating for ETC
• But individual sites do not constitute a settlement
• We need to incorporate integrated urban water management into urban planning
• Similarly for energy, building, transport
• Bioregion for food production
Conclusions

• Technologies can assist with sustainable development
• They tend to be smaller scale
• They need to be integrated
• With each other and with the wider context of urban planning and development