Urban lands will triple in area in the first three decades of the 21st century, suggests research published Sept. 17, 2012, in the journal PNAS.

Shown here, an astronaut image, taken Aug. 10, 2011, of the lit-up cities across northwestern Europe.
Urban development is set to triple in the first three decades of this century, the largest cityscape expansion in human history.

By 2030, 6 out of every 10 people will live in a city.

Majority of predicted urban growth (55 percent) is expected to occur in Asia, including a 1,800 km east coast urban corridor in China plus seven state capitals throughout India.

This sprawl will swallow up a landmass nearly equivalent in size to South Africa.

By 2030 we will need to produce 50% more food and energy, together with 30% more fresh water.

This will consume Bio Diversity hotspots leading to the extinction of 139 amphibian, 41 mammalian and 25 critically endangered bird species.

By 2030 the number of High Rise's will be excessive.

...use of steel and glass

The Challenge v/s the present

Excessive...
The Challenge v/s the present

Excessive...

...use of artificial light

...heat from glass

...stress on air conditioning

Excessive...

...gated and golf communities

...stress on infrastructure
The Challenge v/s the present

**Excessive**...

...cars on the road

...carbon footprint

The Challenge

1. Will be about Electronics and Communication

2. Will be about the symbiotic approaches of Biotechnology.

3. Will be about being Passive Right.

4. Will be about the high efficiency of Nano Technology.

The future...

2. Will be about the Carbon freedom by use of Wind and Hydrogen.
The Challenge: The path to sustainable development

**Environmental**
- A viable natural environment

**Economic**
- Sufficient economy

**Social**
- Nurturing community

---

**Sustainable development**

**Sustainable economic development**

- Zero Carbon
  - Making buildings more energy efficient and delivering all energy with renewable technologies.

- Zero Waste
  - Reducing waste, reusing where possible, and ultimately sending zero waste to landfill.

- Sustainable transport
  - Encouraging low carbon modes of transport to reduce emissions, reducing the need to travel.

- Sustainable materials
  - Using sustainable and healthy products, with low embodied energy, sourced locally, made from renewable or waste resources.

- Local and sustainable food
  - Choosing low impact, local, seasonal and organic diets and reducing food waste.

- Sustainable water
  - Using water more efficiently in buildings and in the products we buy, tackling local flooding and water course pollution.

- Land use and wildlife
  - Protecting and restoring existing biodiversity and natural habitats through appropriate land use and integration into the built environment.

- Culture and heritage
  - Reviving local identity and wisdom, supporting and participating in the arts.

- Equity and local economy
  - Creating bioregional economics that support fair employment, inclusive communities and international fair trade.

- Health and happiness
  - Encouraging active, sociable, meaningful lives for good health and well-being.
**Meeting the Challenge**

**DESIGN STRATEGIES**
The largest energy reduction can be achieved through design.

**TECHNOLOGIES & SYSTEMS**
Including on-site renewable energy systems.

**OFF-SITE RENEWABLE ENERGY**

20% maximum.

---

**The Challenge**

Life is divided into three terms – *that which was, which is, and which will be.*

Let us learn from the past to profit by the present, and from the present, to live better in the future.

William Wordsworth
Meeting the Challenge

PRESENT Right FUTURE Ready

Nature: Mentor, measure, model

With 3.85 billion years of experience the natural world is the only global and reliable guide we have to judge our actions.

2 degree 29 degree 45 degrees
Case study
Central University of Tamil Nadu

Thiruvanur
Site Area : 517 Acres
Built up area : 27,00,000 sqft

CENTRAL UNIVERSITY - THIRUVANUR

Learning is wealth only could destroy,
Nothing else gives genuine joy.
- Thirukural, 400
(Translation by Shuddhananda Bharatiar)

Thiruvanur, located in the Cauvery Delta region is traditionally referred to as "the rice bowl of Tamil Nadu". It is undergoing a paradigm shift as an educational hub in this knowledge driven society.
<table>
<thead>
<tr>
<th>Challenge</th>
<th>Strategy</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>The challenge was to formulate design guidelines that conserved and recharged the land as a pattern of existing natural elements such as water and vegetation in a manner that sustainability was intrinsic to design and created a place where production and consumption can co-exist.</td>
<td>The master plan responds to the land as a pattern of natural elements and the architecture seamlessly imbues and infuses formal and informal learning processes. With less than 4% of the land built upon, this residential campus aspires to push the envelope by promoting urban agriculture, zero food miles as a way of life by involving the local community and triggering a regional response.</td>
<td>The built form and the landscape areas are the driving attributes of the campus architecture and the master plan exaggerates the importance of the landscape in the living environment. This is reflected by landscape urbanism being the precedential element of design and the buildings as accidental to the landscape. Students, usually enrolled into this university at an influential age of 16, study and grow in a campus where sustainability is intrinsic to its design, balancing the production - consumption equilibrium such that it becomes a way of life, thus learning the best lessons experience has to offer.</td>
</tr>
</tbody>
</table>
Site Analysis I Delta urbanism

Cauvery Delta Region – Site Location

- Cauvery Delta Region
- Site Parcel 1
- Site Parcel 2
- Thiruvallur
- Bay of Bengal

Site Analysis I Delta urbanism

Natural System – Hydrology Wetlands [Water]

- Storm Water Swales along the Irrigation Canals
- Existing Irrigation Canals
- Tree Cover

Natural System – Agriculture System [Land]

- Agriculture Land
- Paddy Field Edge Bund
- Storm Water Swales along the Irrigation Canals
- Existing Irrigation Canals
STORM WATER SWALES ALONG THE IRRIGATION CANALS
IRRIGATION CANALS
LAND FOR CAMPUS AGRICULTURE
RIPARIAN GROVES
LAND FOR BUILDINGS
STRATEGIES AND JUSTIFICATION
SERIES OF RECLAIMED ISLANDS ALLOWING THE LOW LYING WATER SYSTEM TO SEAMLESSLY CONNECT ACROSS FROM THE MAIN WATER NETWORK OF THE PLACE

Site Analysis I Delta urbanism
NATURAL SYSTEM – COMPREHENSIVE LAND DEVELOPMENT PLAN

Campus Making I Master plan
LAND ALLOCATION

LAND ACCUMULATION CONCEPTS FOR CONSTRUCTION ACTIVITIES

Reclaimed Islands
Irrigation Canals
River

Landscape 20.66%
Water body 34.51%
Lands for agriculture 22.69%
Road 9.08%

**GENESIS OF COMMUNITY**

**VILLAGE**

**CAMPUS AGRICULTURE**

**LAND BANK FOR FLOOD REHABITATION INCUBATION CENTRE**

**MAIN GATE**

**SECONDARY GATE**

**VEGETABLE MARKET**

**PUBLIC PARK**

**BRIDGE**

**SECONDARY GATE**

**RIVER FRONT PARK**

**DESIGN GRID**

**- PLACE VS PLACELESSNESS**

**FORMAL GRID**

(PLACE) EMPHASIZING THE ORGANIZED PLANNING LANGUAGE AT THE HEART OF THE CAMPUS. THE MODULES ARE ORIENTED TO THE AGRICULTURE PATTERN IN THE SITE

**INFORMAL GRID**

(PLACELESSNESS) EMPHASIZING THE RESPONSE OF THE BUILT ENVIRONMENT TOWARDS THE AGRICULTURE ACTIVITY AROUND.

**Campus Making I Collaborative spaces**

**ACADEMIC ZONE**

**CAMPUS AGRICULTURE/ RIPARIAN GREEN**

**RESIDENTIAL / HOSTEL ZONE**

**ADMINISTRATION & ADMISSION ZONE**

**SPORTS & AMENITIES ZONE**

**COMMERCIAL ZONE**

**SCHOOL & HOSPITAL ZONE**

**CAMPUS AGRICULTURE/ RIPARIAN GREEN**

**ZONING STRATEGY**

**OPEN SPACES – ARTICULATED NATURAL LANDSCAPES**
Campus Making I Collaborative spaces
OPEN SPACES - ORNAMENTAL LANDSCAPES

Campus Making I Environmental sustainability
A CHAMPION OF ENVIRONMENTAL STEWARDSHIP

SUSTAINABILITY INTRINSIC TO DESIGN
• INNOVATIVE USE OF NATURAL RESOURCES
• A PLACE WHERE PRODUCTION AND CONSUMPTION CO-EXIST
• CENTRE FOR ECOLOGICAL EDUCATION
• CENTRE FOR ORGANIC FARMING

Environment
Appropriate planting and efficient irrigation systems can reduce irrigation water use by 50% to 70% and overall water consumption by up to 25%.

- Group plants with similar water requirements on common zones to match precipitation heads and emitters.
- Use drip irrigation for trees, shrub beds and areas of groundcover to eliminate evaporation losses.
- Choose low-volume, low-angle sprinklers for lawn areas.
- Program automatic controllers for night irrigation to reduce losses due to evaporation and wind drift.
- Select controllers with adjustable watering schedules and moisture sensors to account for seasonal variations, and calibrate them during commissioning.
- Where possible, use grey water for irrigation. Use barrels at the bottom of rainwater leaders for manual irrigation of trees and shrubs.

Outdoor light ON/OFF control (Infrared switch)

- Outdoor Landscape area to be lighted: 486281 sqmts.
- Total lighting connected load for outdoor lighting with LED and Fluorescent Hybrid system: 50 KW.
- Reduction in energy consumption: 50%.
- Return of investment time for extra capital cost: 4 years
Treated water to be used for FLUSHING, LANDSCAPE WATERING and for WATER COOLED HVAC system.

Water use at source CAN BE REDUCED BY 25 – 40% by using water efficient sanitary fixtures.

Water efficient fittings will be conserving 47% water usage at source.
SOLAR THERMAL

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

PHOTOVOLTAIC

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.

SOLAR ENERGY

Campus Making I Environmental sustainability

11/27/2013

Provide 100% hot water
All of the total hot water needed in this development can be provided with 1,900 sq m, which is about 6% of the total roof area.

Provide 100% lighting energy
With the remaining roofing area, the project can generate about 420 MWh/yr, which is approximately the energy needed for lighting.
A/C Load reduced with the following measures:
- Orientation, Shade, Efficient glass

Air conditioned spaces:
- All Faculty houses bed rooms
- Research staff
- Visiting faculty
- Director and Dean's residences
- 200, 400 seat Lecture Hall, Auditoriums
- Faculty offices
- Reception, Discussion, Conference halls and server rooms

SAVINGS

33%

SAVINGS 33%

SAVINGS 28%

SAVINGS 31%

SOLAR THERMAL
100% Reduction of the total hot water by solar thermal.

SOLAR PV
100% Reduction of common area and outdoor lighting on Solar PV.

BIO GAS
60% Reduction in cooking energy by Bio-gas.

EFFICIENCY
- 30% Reduction in HVAC, including bioclimatic design.
- 40% Reduction in Lighting, including day lighting design

TRANSPORT
80% Reduction due to reduced car usage and bicycle transit network.

70% reduction in global carbon-dioxide emission compare to conventional case.
Livable and Sustainable Communities

The future...
Is about creating
Livable and Sustainable Communities

Livable Communities……..10 principles

- Design on a Human Scale
- Provide Choices - variety
- Efficient urban transport
- Preserve Urban Centers
- Encourage mixed use development
Livable Communities……10 principles

- Build Vibrant public spaces
- Create a neighborhood identity
- Protect environmental resources
- Conserve landscapes
- Design Matters

PASSIVE Right  FUTURE Ready
'The future of Architecture is in its expression as city structure, not just as buildings, and in its self – conscious ecological awareness.'

Richard Register