Goa 2030: implementing a *RUrban* Sustainability Transition

Goa 2100 team

World Gas Conference

Amsterdam, 7th June 2006

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What is *RUrbanism* ?

- RUrbanism is balancing the Urban with the Rural: co-evolution of the countryside and its embedded city.
- Crucial in a country of 1.5 billion which may still be half rural in 2050

> Instead of cities colonising ecosystems to create fractured natural landscapes, dense urban islands will melt into a sea of biodiversity.
>
> Goa 2100 report, WGC 2003, Tokyo

- This approach by 2050 could allow 120 million Indians* to meet their basic needs without endangering the bio-diversity of India's fragile western coast**

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* 8% of the population on ** 5% of the land

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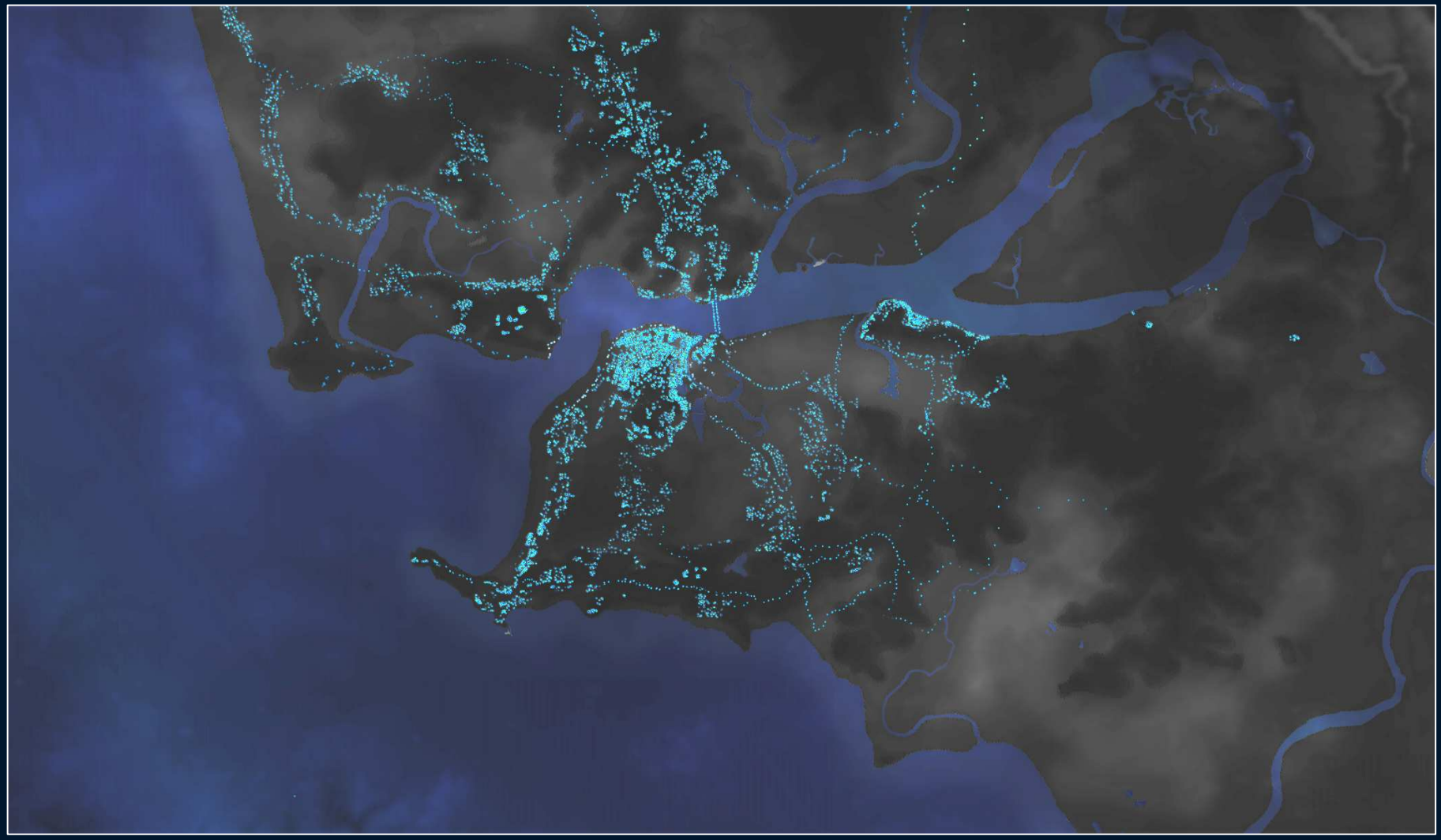
Greater Panjim at night: 2000



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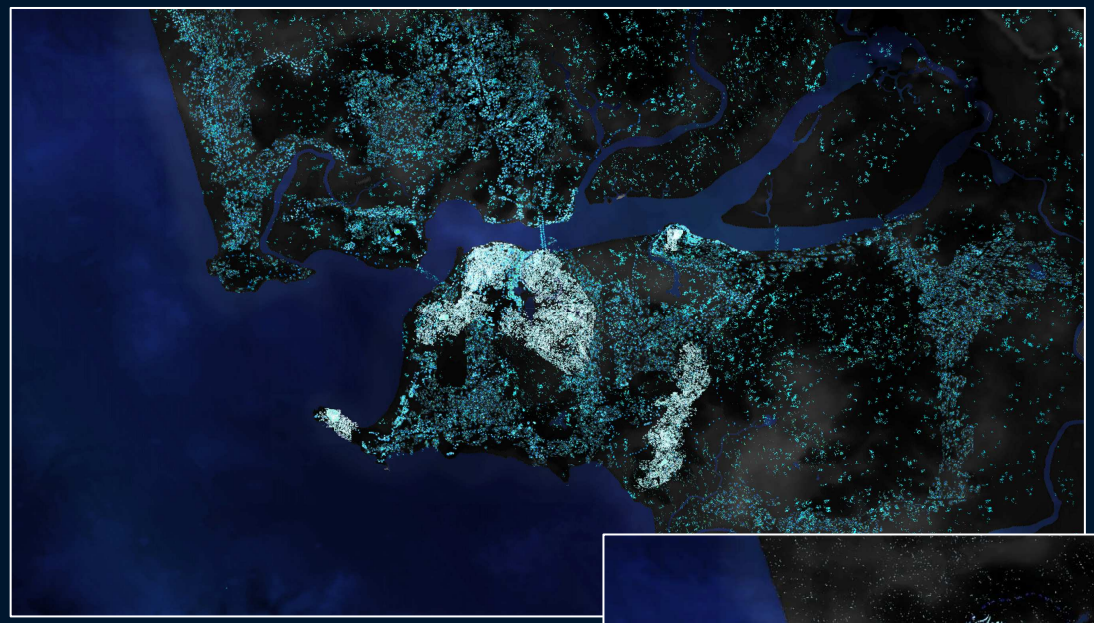
Greater Panjim 2100: two visions of the future



Death by
Urban sprawl

Urban
consolidation

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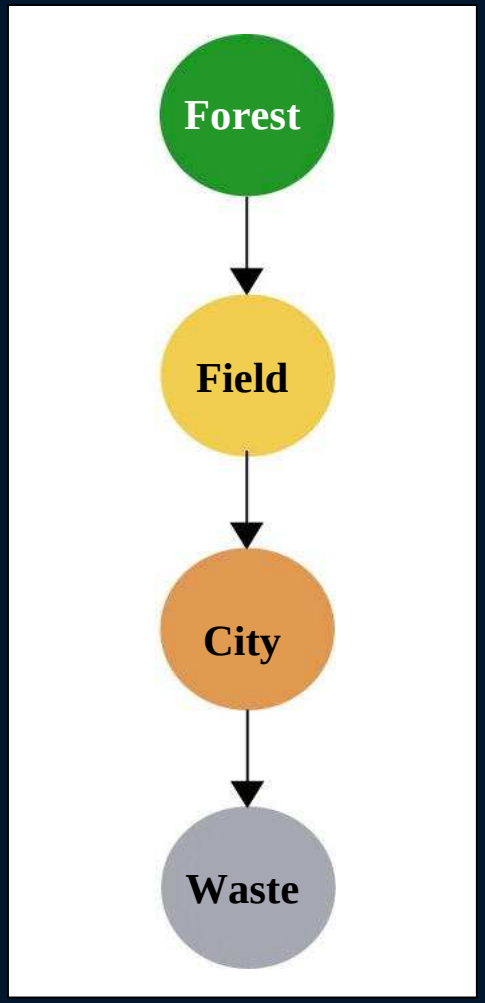
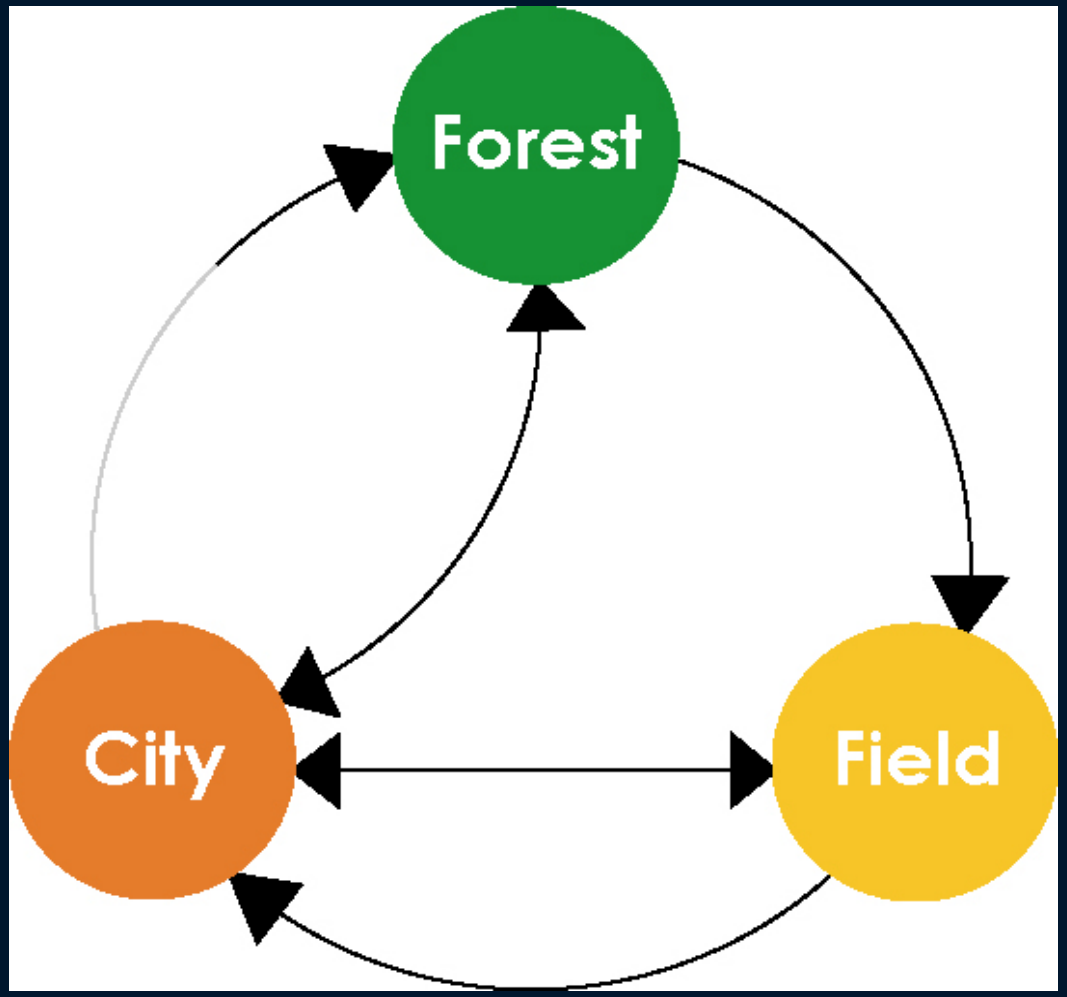
Two possible *RUrban* Transition Pathways

Business as Usual



Cities as Ecosystems



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Goa 2100: Key insights

- A Sustainability Transition is technically, financially and economically viable in 30 to 50 years
- Socio-cultural and institutional constraints pose larger challenges than techno-economic concerns
- Invert conventional planning "design the ecosystem services first. Then locate settlements in the interstices"
- Water and energy are key concerns and opportunities
- Long-range planning requires an integrated view of key domains and a framework for unbundling risk
- Only then a dialogue between energy and urban planners and the infrastructure finance community emerge

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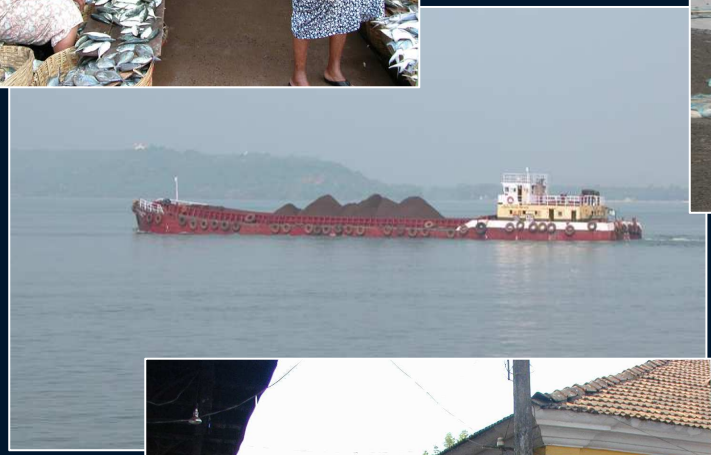
Goa 2100: Six core *RUrban* planning domains

- ❑Food
- ❑Water
- ❑Energy
- ❑Mobility
- ❑Work
- ❑Governance



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Goa 2030: Water Futures

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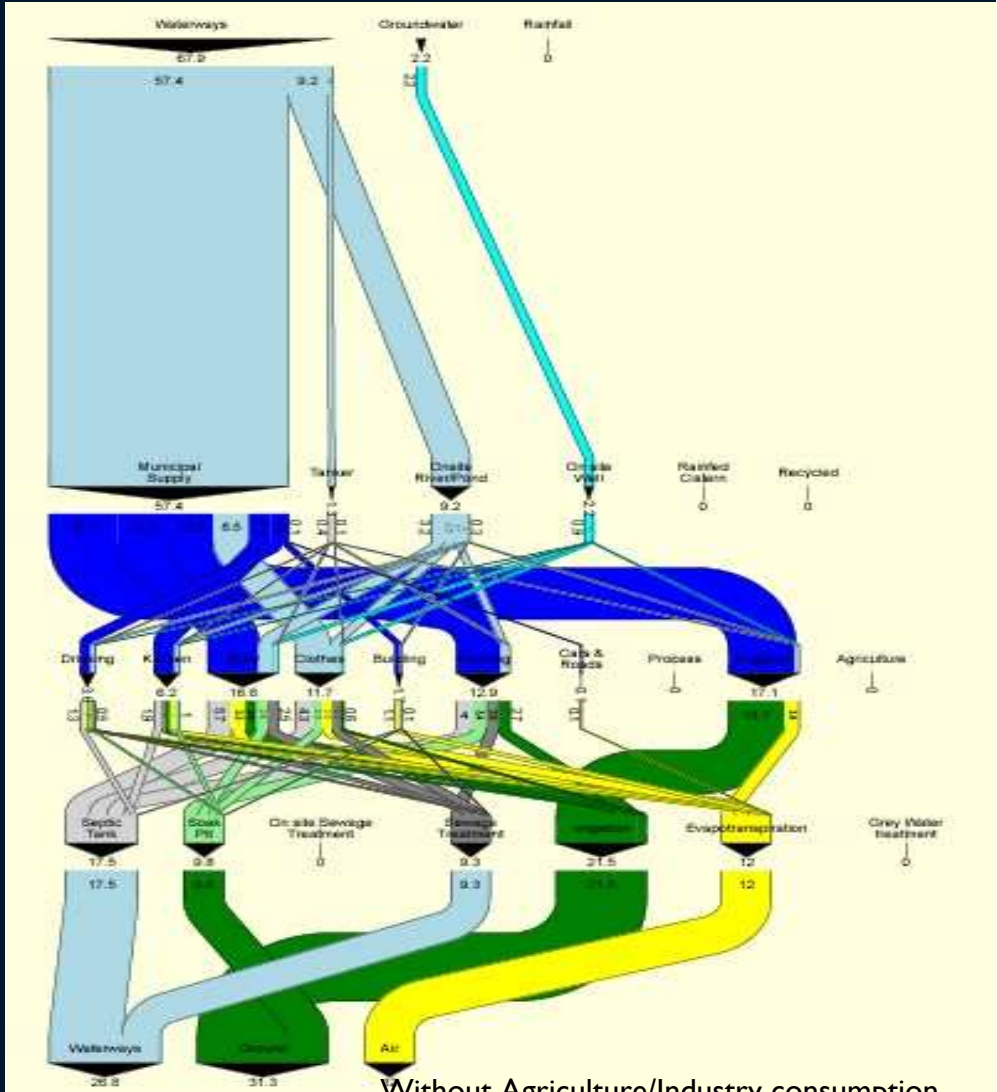
Goa Estimated (non-agri) Water Consumption (2005)

- No concept of multiple water qualities
- Water stress forces pour flushing
- Recycling only through irrigation
- No significant bottled water use



Without Agriculture/Industry consumption

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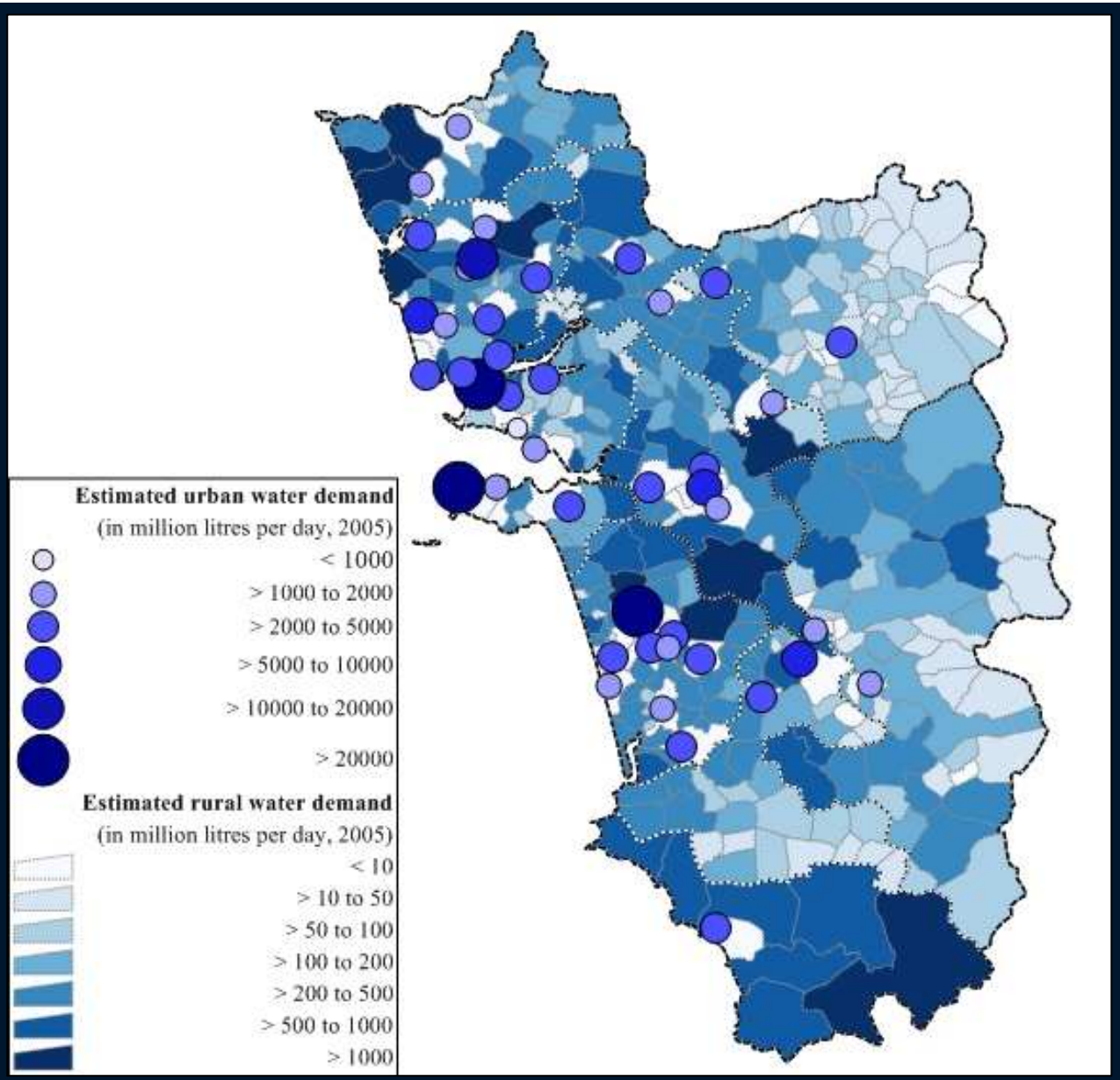
Estimated non-agricultural Water Demand Landscape (2005)

- Most people under 100 Lpcd
- Limited recycling, only through irrigation
- Demand in lowlands, supply located in uplands or mid-slopes



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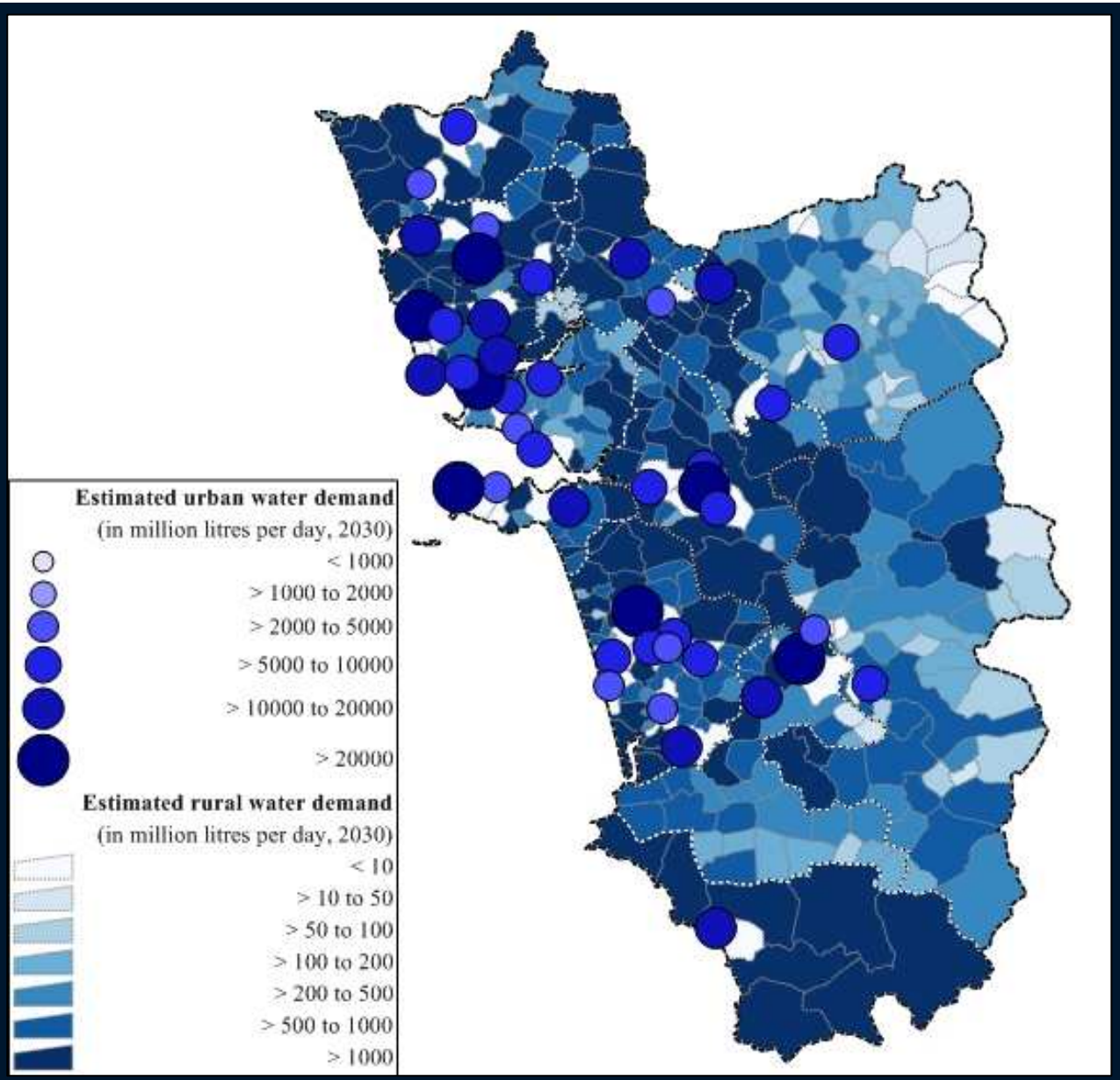
Estimated non-agricultural Water Demand Landscape 2030 (BAU Scenario)

- Demands shoot up, severe water stress as agricultural water is diverted to habitations
- No recycling



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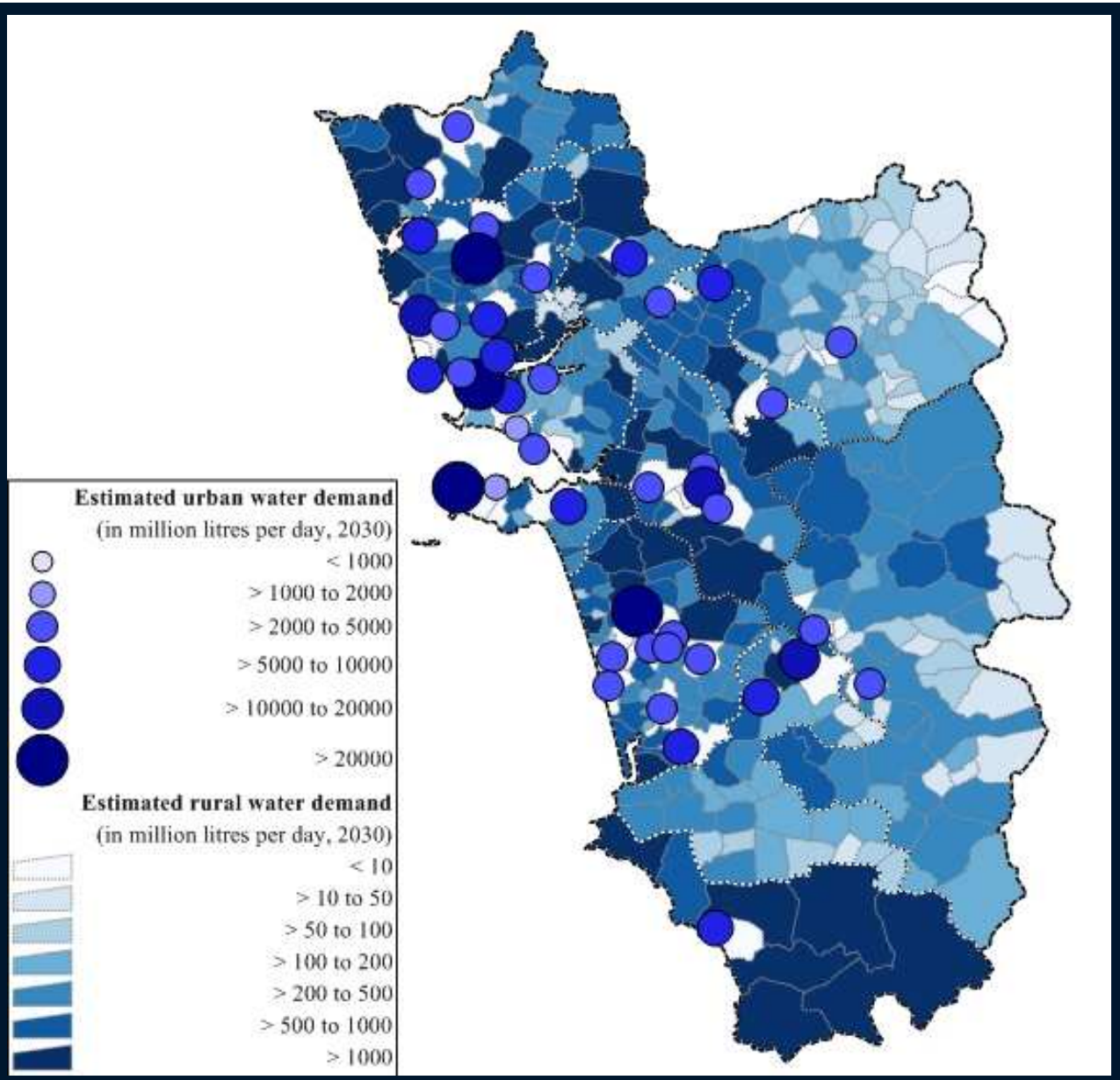
Estimated non-agricultural Water Demand Landscape 2030 (Sustainability Scenario)

- Demand contained by decentralized rainwater harvesting and storage
- Extensive recycling, for irrigation and flushing
- Urban-rural co-evolution



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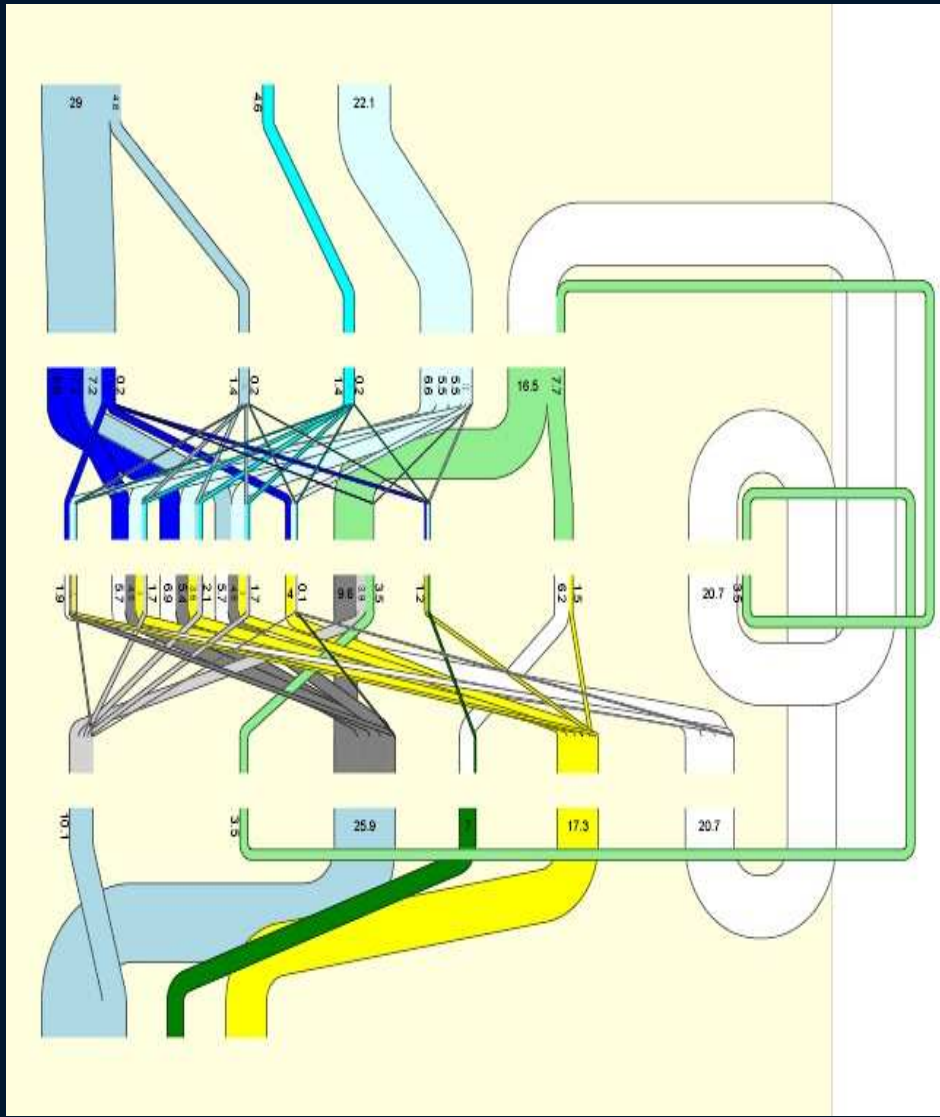
Goa Estimated Water Consumption (2030)

- Primarily treated piped water, but rainfall harvesting also kicks in
- Predominant use: Gardens, bathing and flushing
- Multiple water qualities
- Most people above 100 lpcd
- Reduced dependence on pipes, more on recycling through flushing and irrigation
- No significant bottled water use



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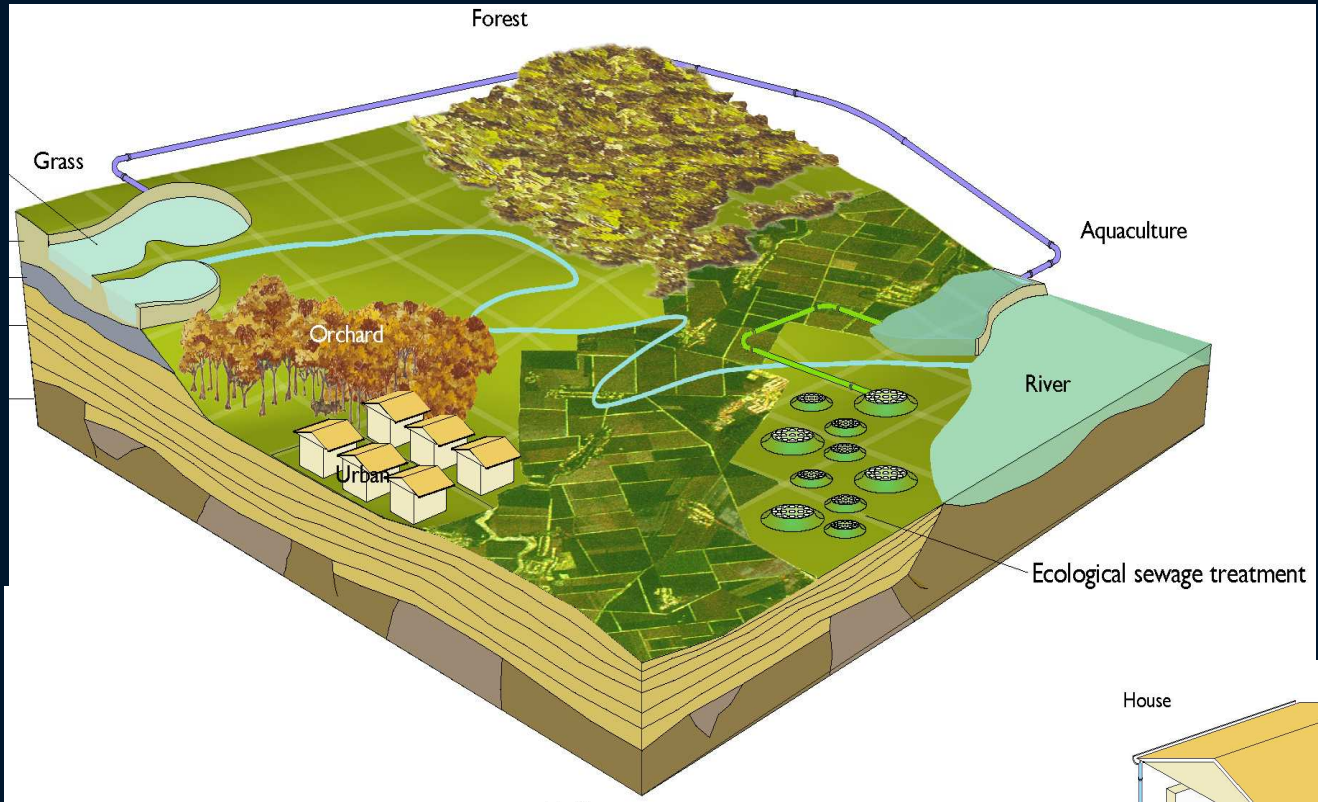
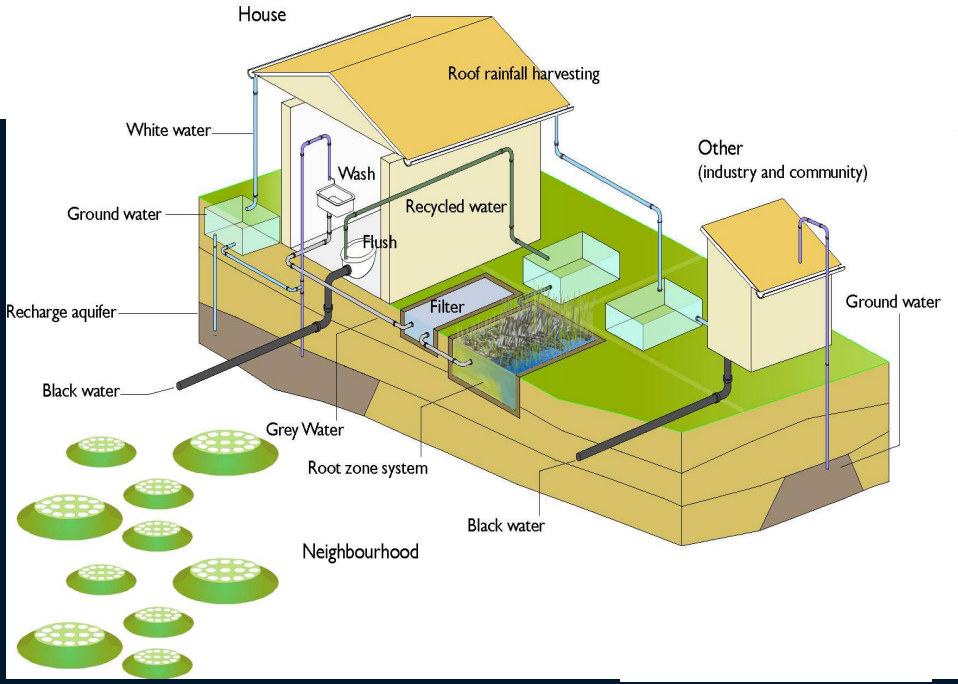
Ecosystems design: Water at RUrban scale



Water management at Urban Nucleus scale



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Goa 2030: Energy Futures

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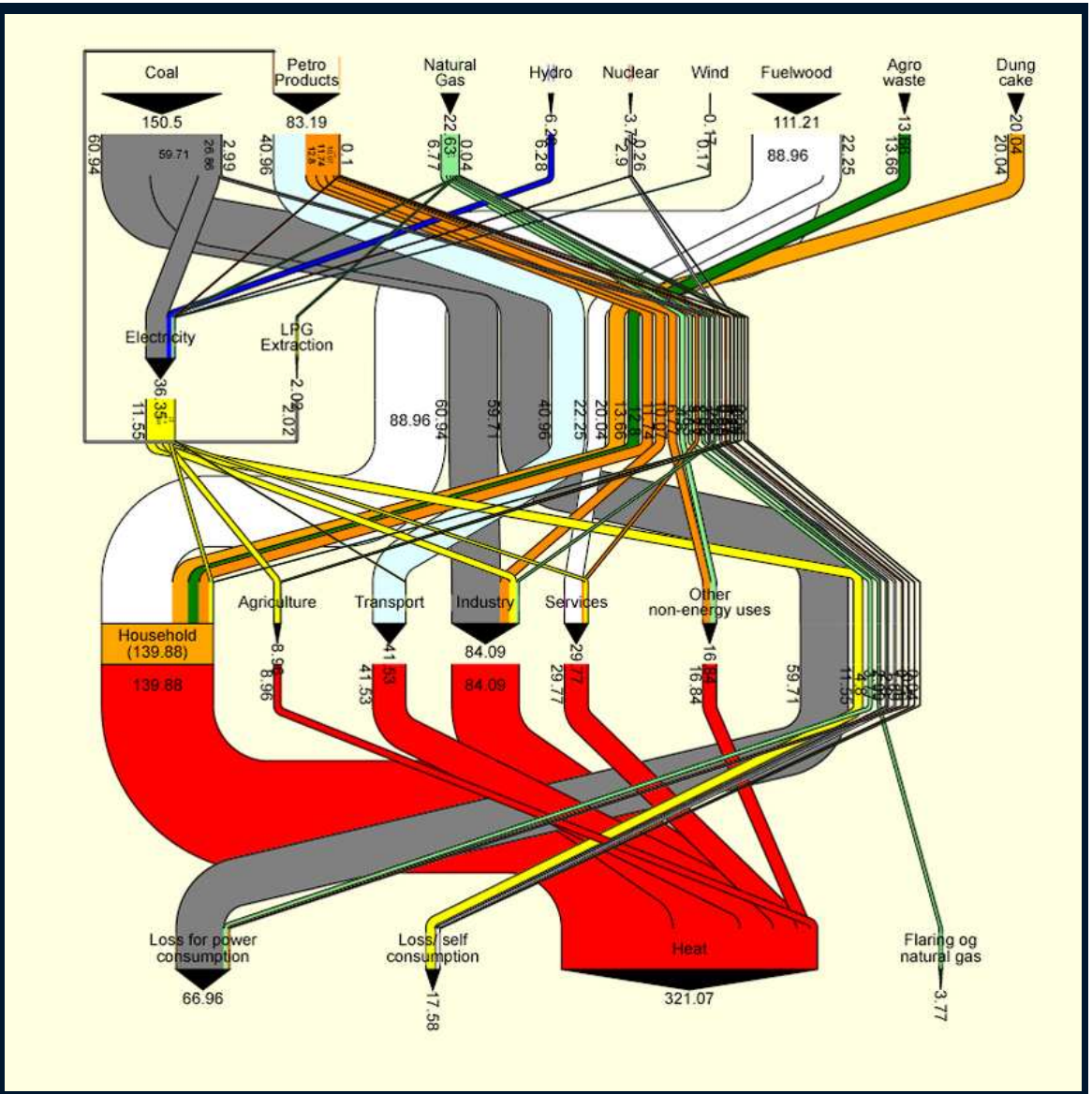
India Energy Flux (1997)

- Primarily: coal, oil, and informal biomass
- Predominant use: Manufacturing goods
- Low electricity supply
- Very high specific emissions, though low per capita consumption
- Poverty as polluter



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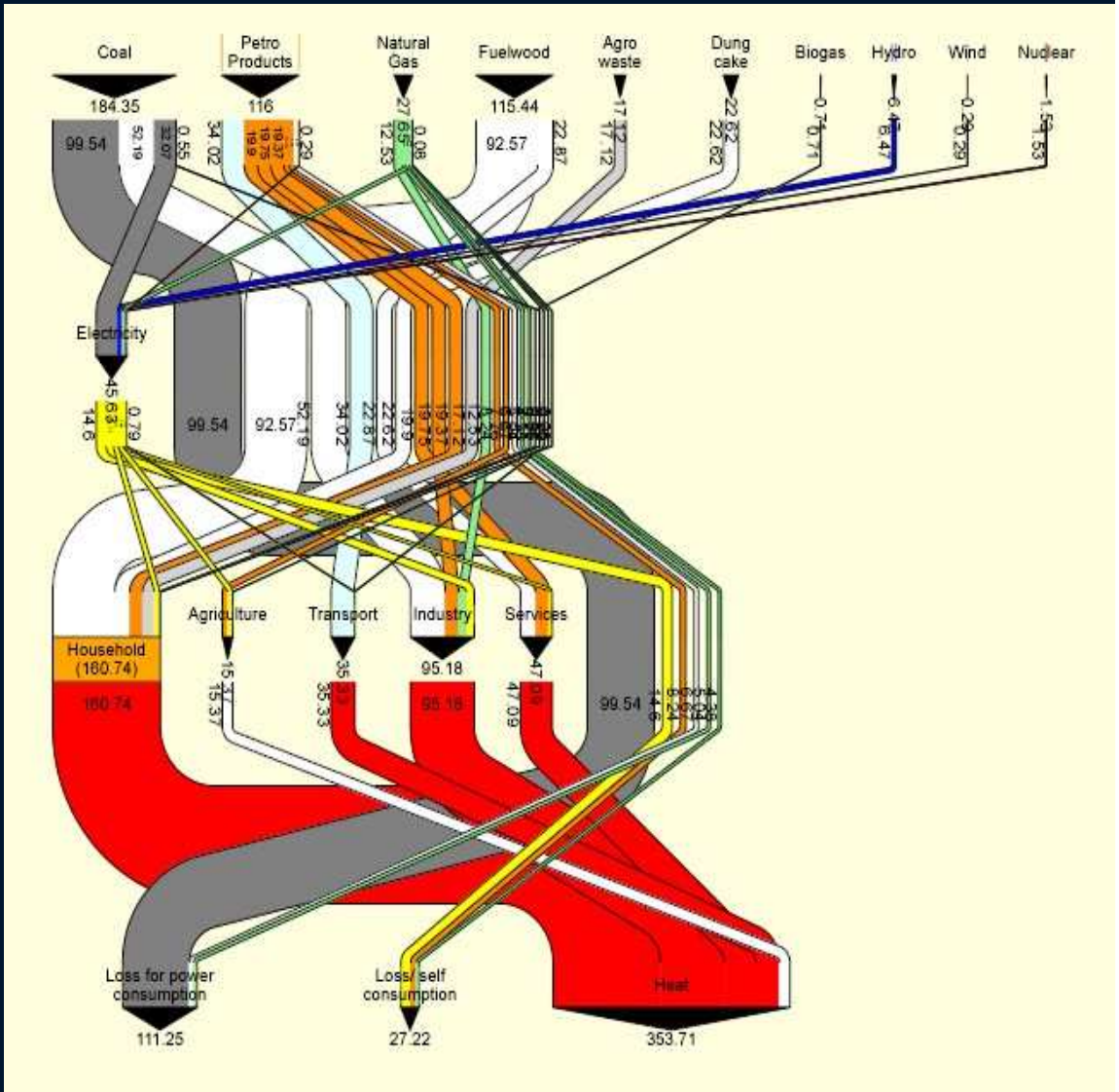
India Energy Flux (2003)

- No change in status of coal, oil, and informal biomass, but wind energy entering
- Manufacturing goods still maximum, electricity production still low
- Very high specific emissions and poverty as polluter continues



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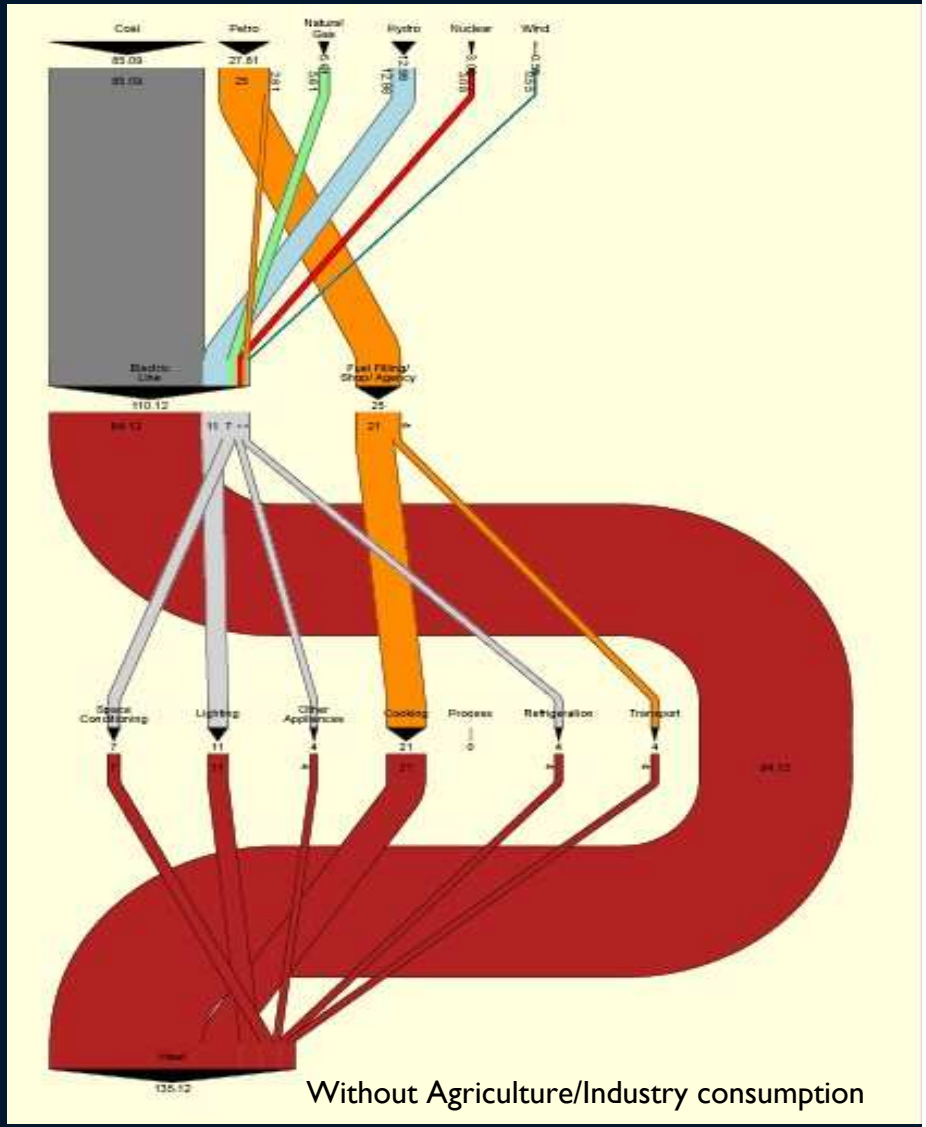
Goa Rural Energy Consumption (2005)

- Main sources: Electricity and LPG
- Very frugal demands
- No heat recovery or efficiency



Without Agriculture/Industry consumption

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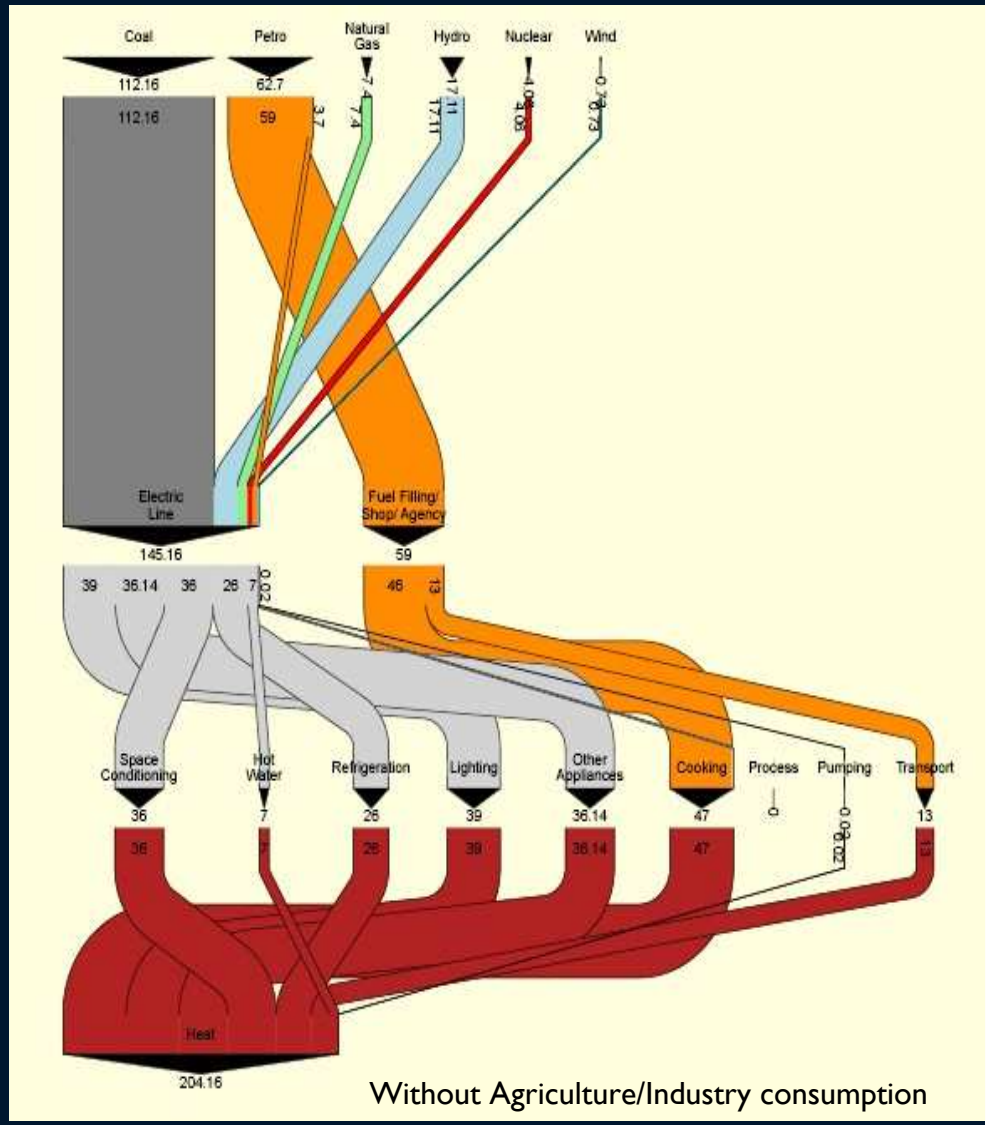
Goa Urban Energy Consumption (2005)

- Main sources: Electricity and LPG
- Relatively high demands
- No heat recovery or efficiency



Without Agriculture/Industry consumption

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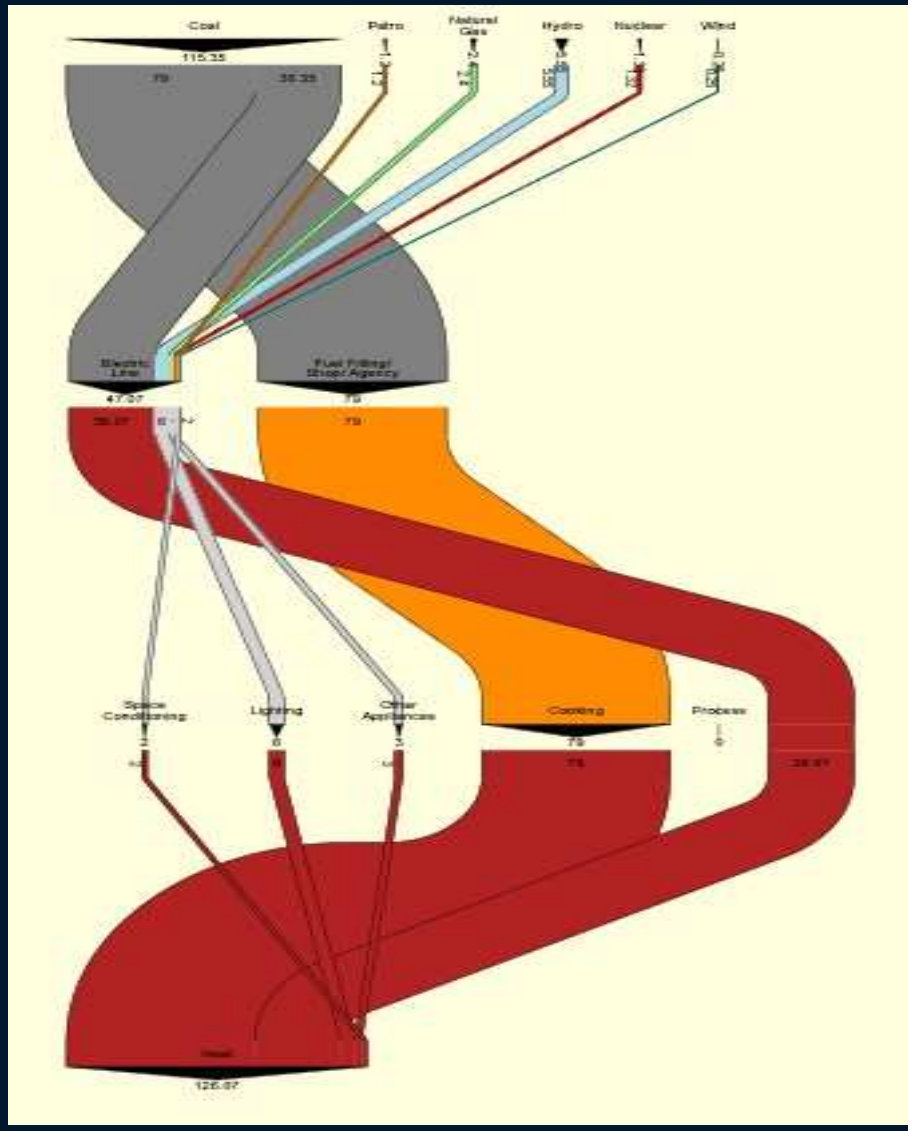
Goa Urban Slum Energy Consumption (2005)

- Main source: Coal based electricity and coal fired stoves
- Subsistence demands, no efficiency



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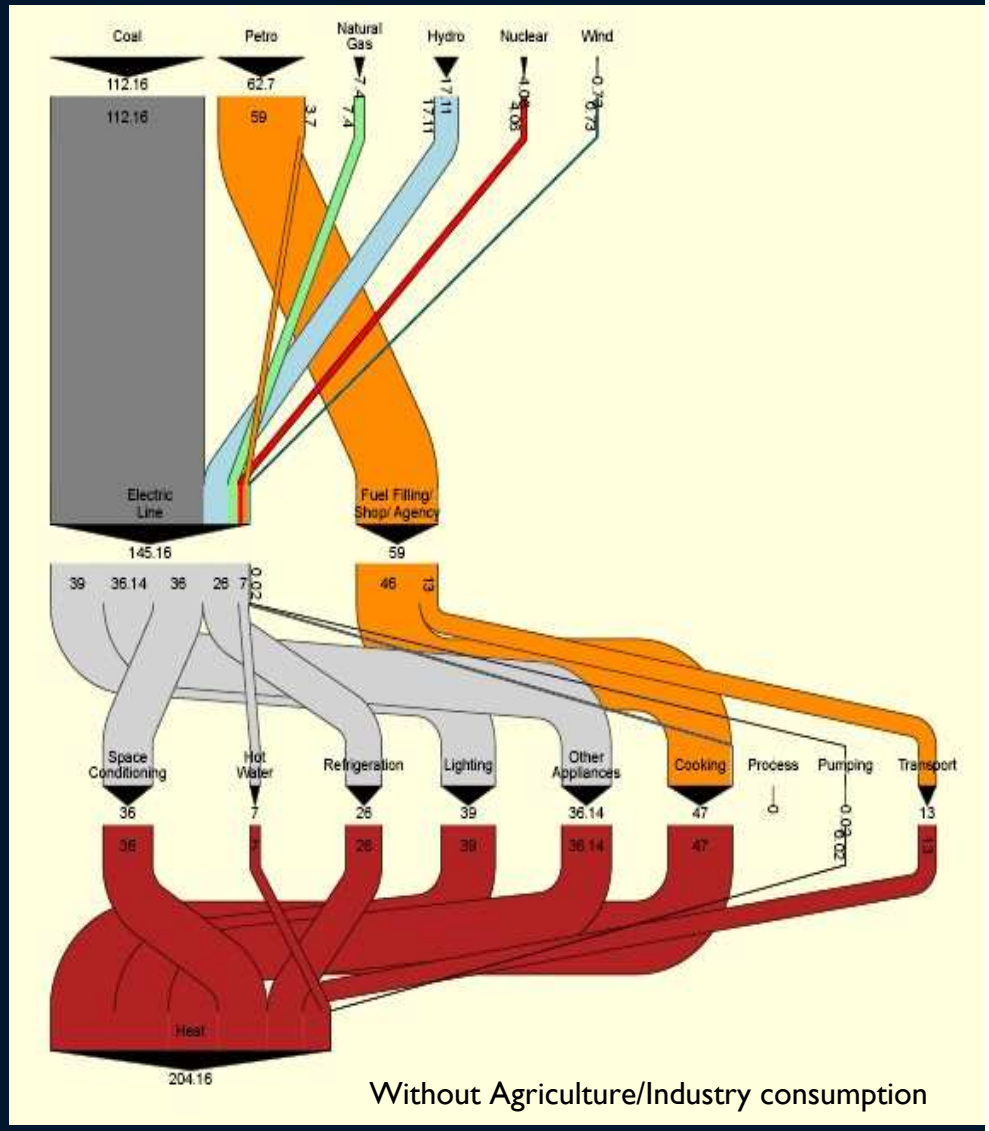
Goa Energy Fluxes (2005)

- Main sources: Electricity and LPG
- Moderate to low demand
- No heat recovery



Without Agriculture/Industry consumption

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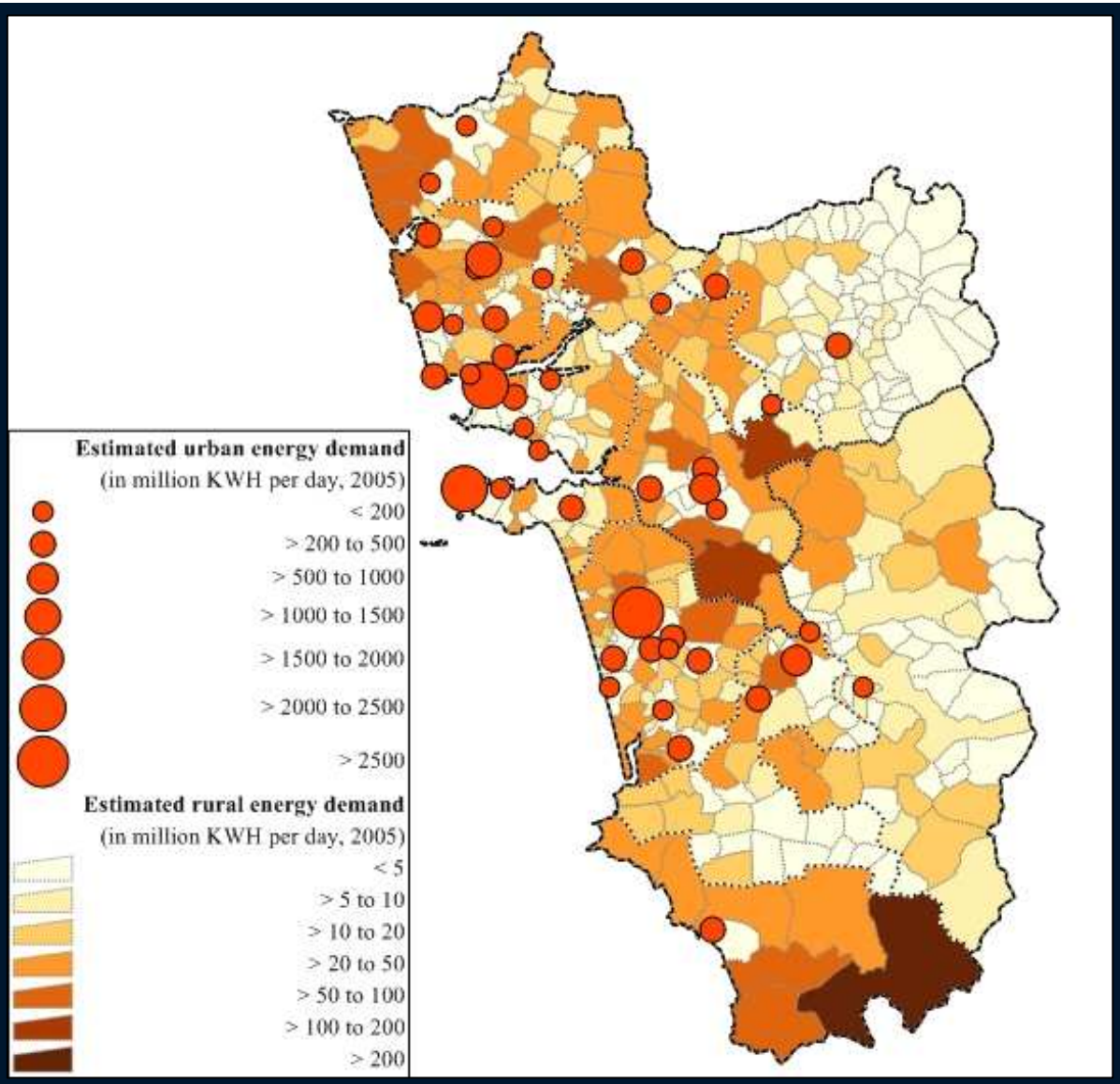
Consumption Energyscape Goa (2005)

- Great difference between rural and urban demands
- Specific energy consumption is low



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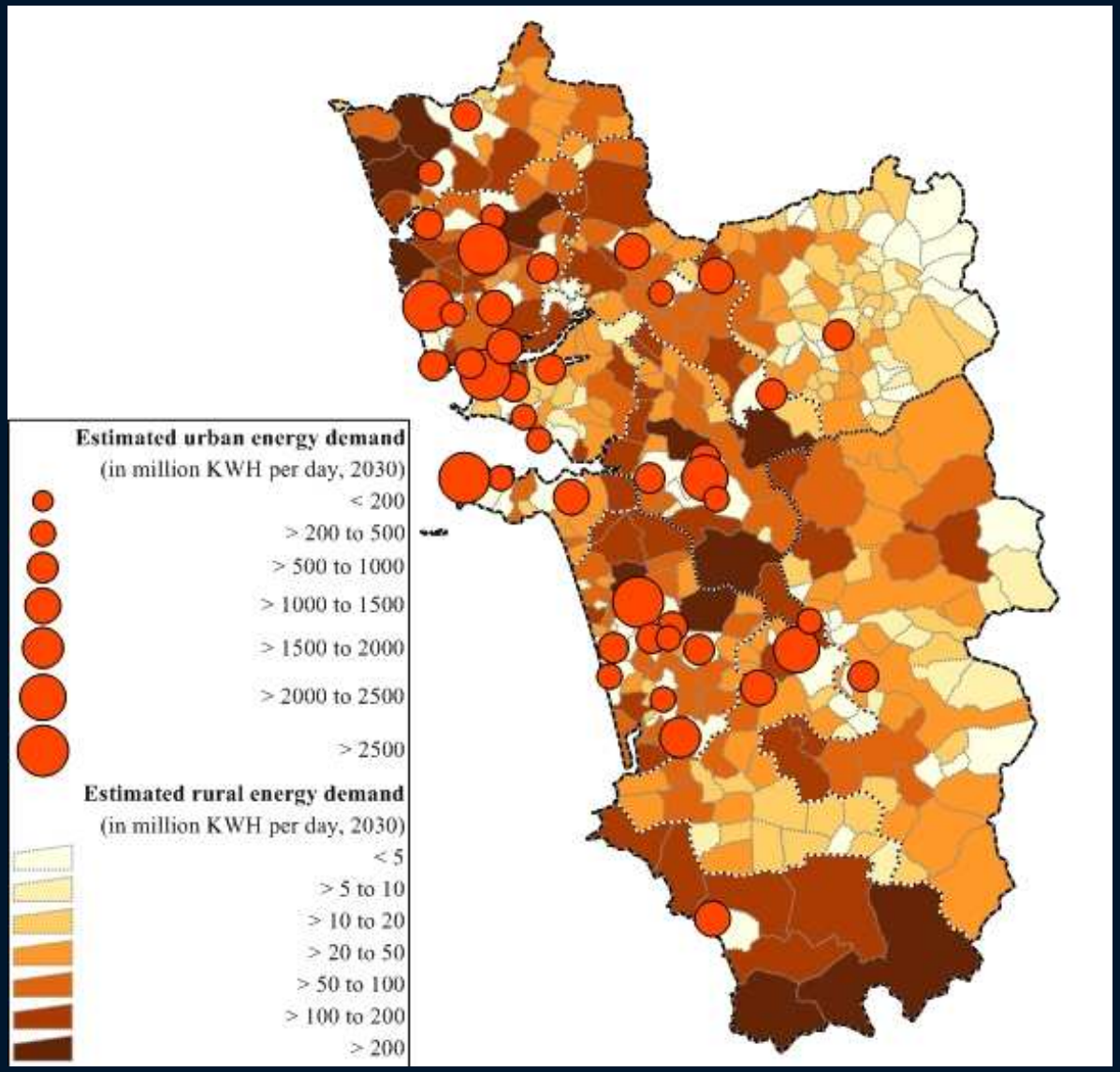
Consumption Energyscape Goa 2030 (Business as Usual Scenario)

- Rural demands "catch up" with urban
- Specific energy consumption is moderate to high



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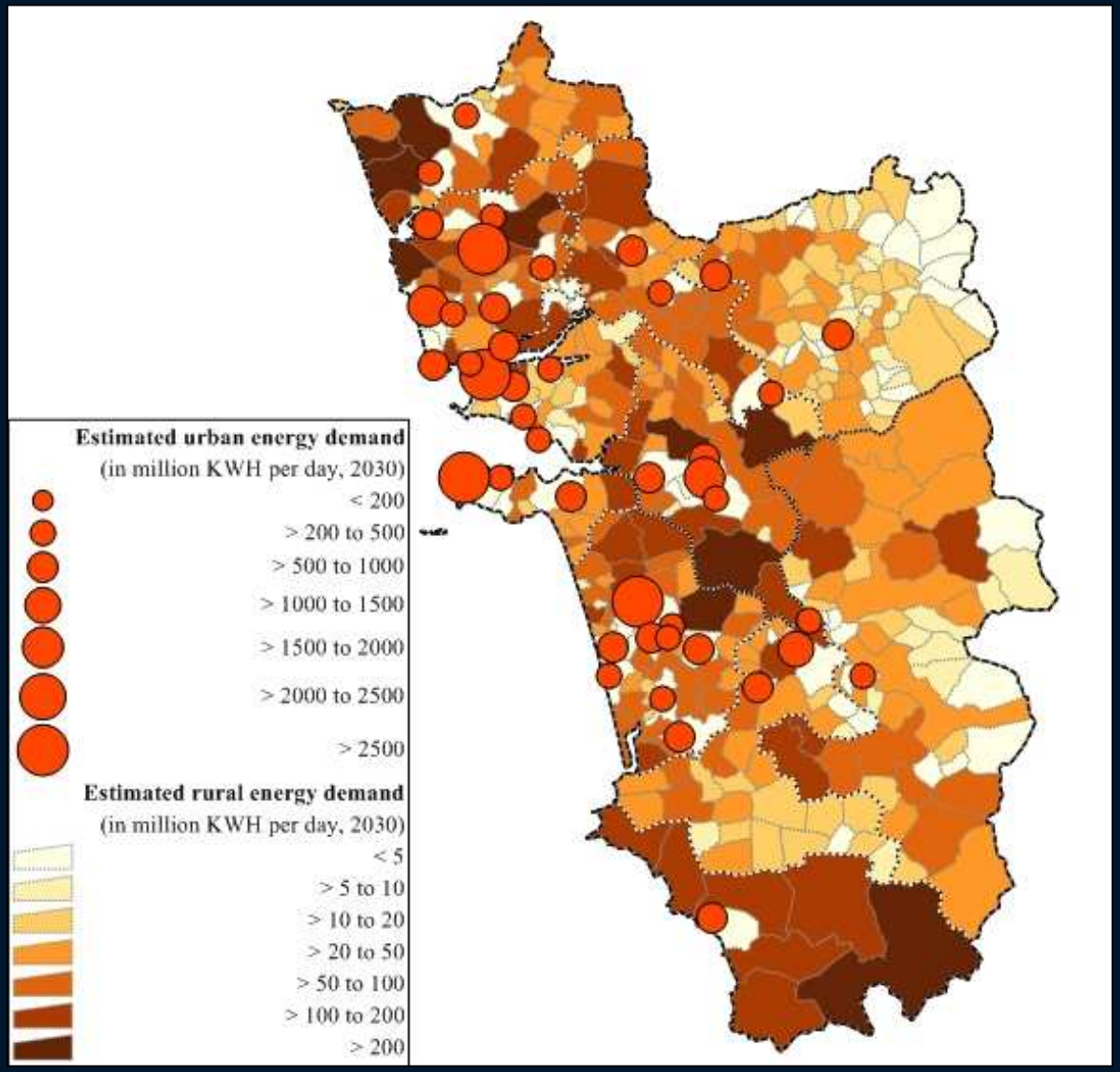
Consumption Energyscape Goa 2030 (Sustainability Transition Scenario)

- Rural demands "catch up" with urban
- Specific energy consumption remains low



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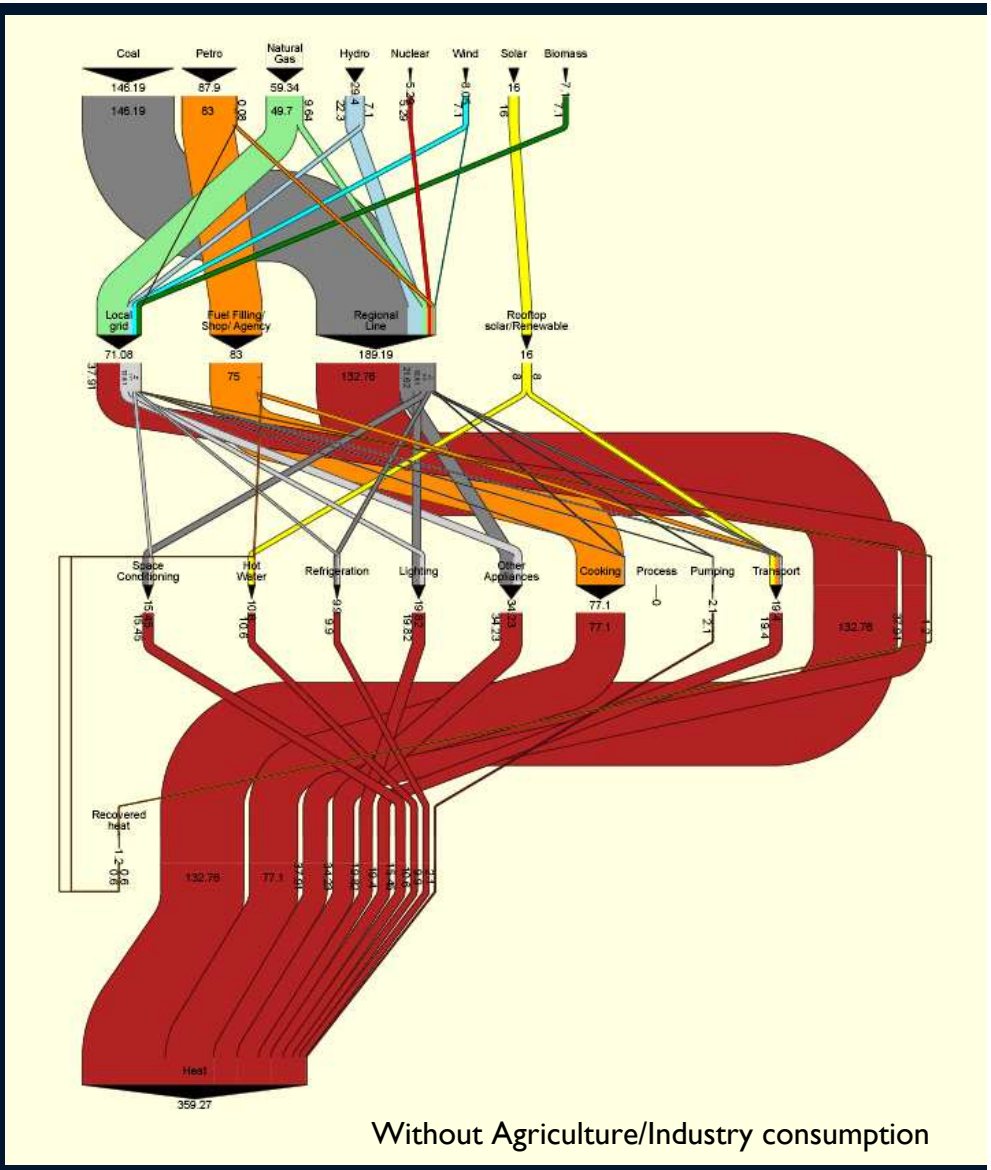
Sustainable Goa Energy Fluxes (2030)

- Two grids: Local and Regional
- Local Grid is Fed by Gas, Wind, and Biomass
- Increasing Demand with Conservation
- Moderate heat recovery
- Moderate rooftop harvesting



Without Agriculture/Industry consumption

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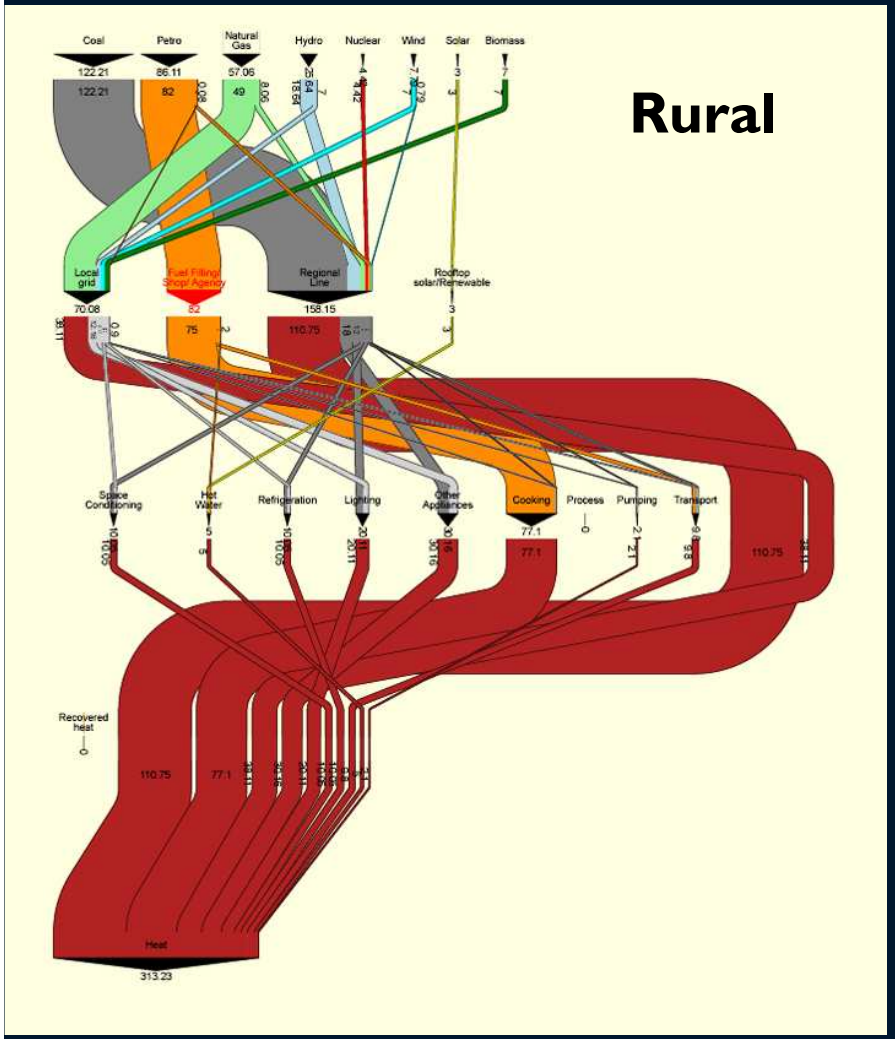
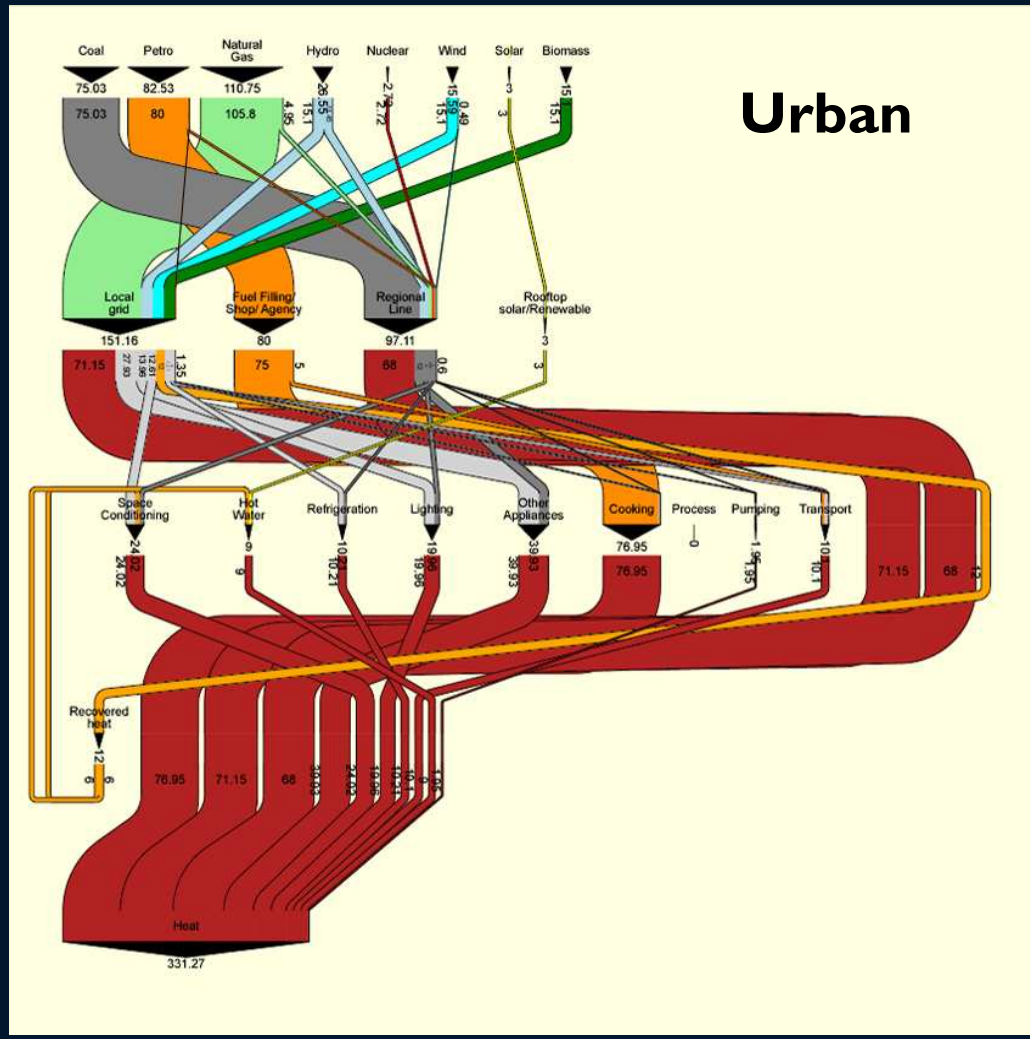
Sustainable Goa 2030: Demand archetypes collapse





- Rural or Urban, Tiled roof or Concrete, become closer in demand structure

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Goa: Future Energy Options

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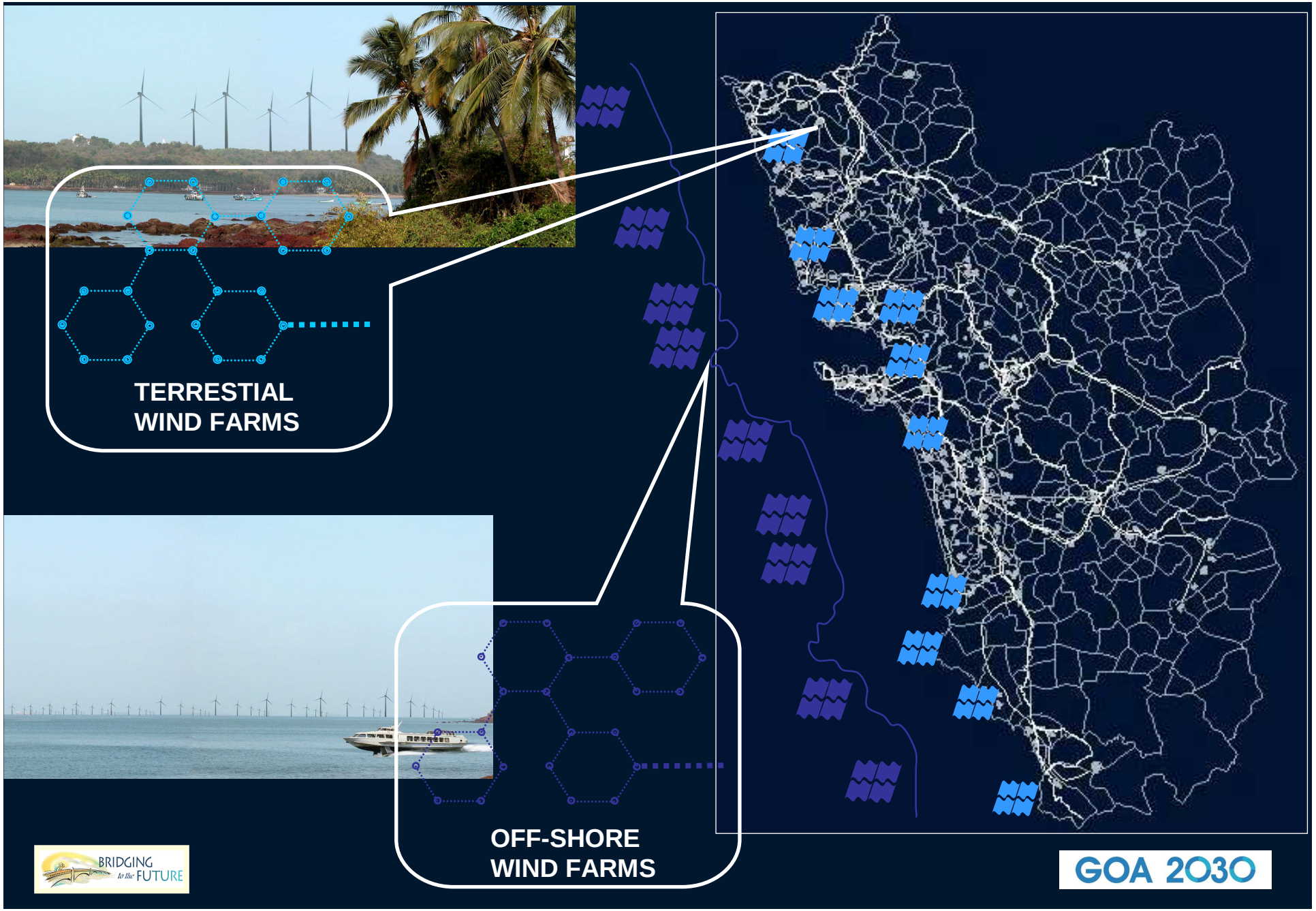
500 MW of terrestrial & 1000 MW off-shore wind power



Two way Power Grids & a possible Gas grid

BIO-GASIFIERS

LOCAL NETWORKS

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Alternative Power sources

SOLAR WATER HEATING

TRI-GENERATION

BIO-METHANATION

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Offshore and onshore wind turbines punctuate the Panjim skyline by 2030

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