Modeling City Scale Decarbonization Pathways

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Importance of Integrated Analysis

- Integrated analysis is valuable in understanding city decarbonization choices.
    - Covers many sectors and explores connections between these sectors and the environment, including climate impacts
    - Highlights tradeoffs of different policies and explores "what-if" scenarios
    - Helps identify the most beneficial decarbonization pathways at the city and national level
- These factors allow cities to explore socioeconomic and environmental consequences of policies and cross-sector implications.
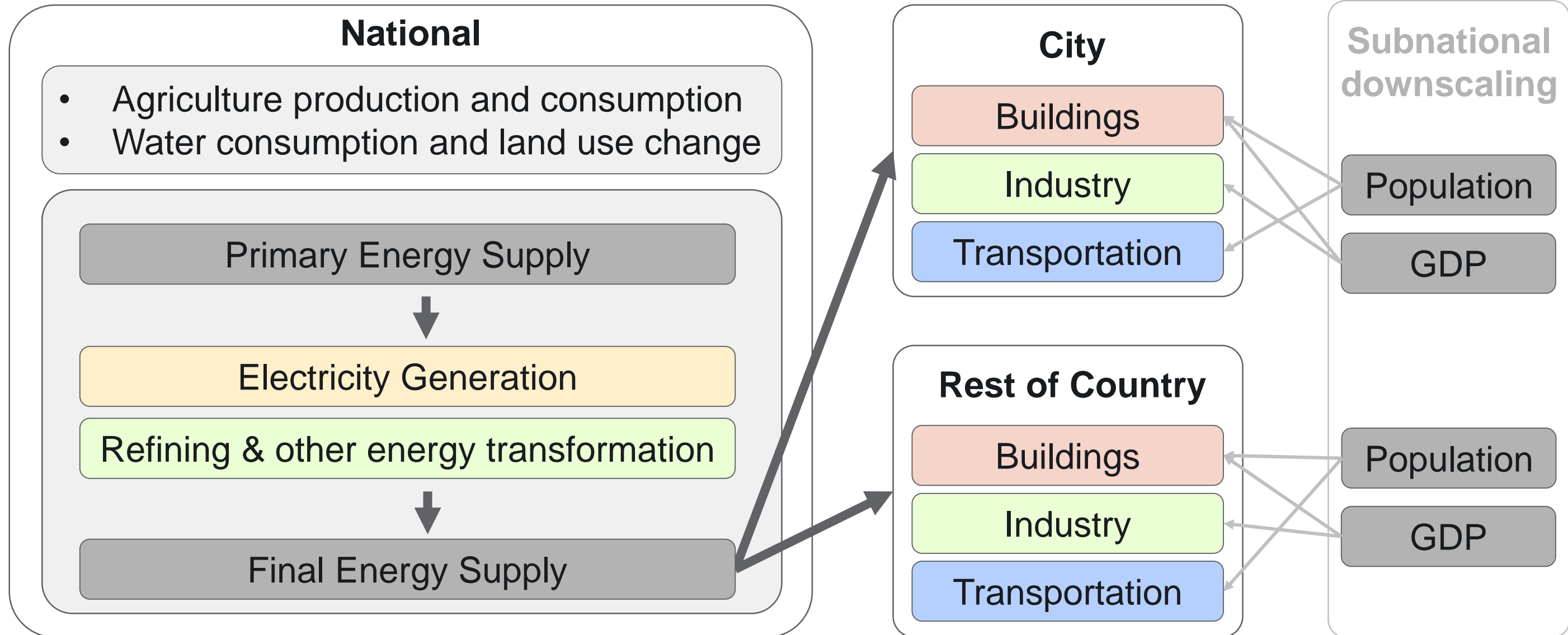- This contributes to informed, sustainable decision making at the city level.
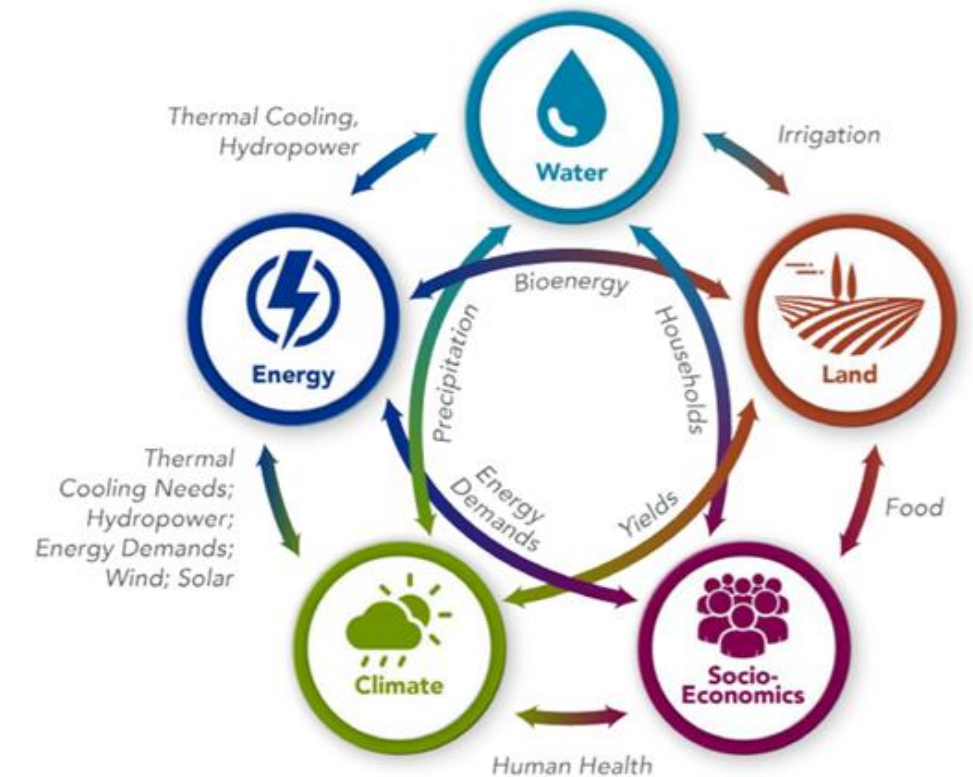
An overview of the systems within the Global Change Analysis Model. *(Image source: https://gcims.pnnl.gov)*

What Questions Can City Scale Modeling Address?

- What will happen to energy prices if only my city adopts these policies, or if the whole region/country does so?

- How much impact will climate change have on our energy and water systems? Can we learn about other elements of resiliency?

- Are my electrification plans realistic given the likely availability of water and other resources?

- Will the plans create net jobs and have other positive economic impacts?

- How can I have consistent scenarios that reflect possible socio-economic development paths, including density of new construction?

GCAM City Scale Modeling Framework

National

- Agriculture production and consumption
- Water consumption and land use change

Primary Energy Supply

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Electricity Generation

Refining & other energy transformation

↓

Final Energy Supply

City

Buildings

Industry

Transportation

Rest of Country

Buildings

Industry

Transportation

Subnational downscaling

Population

GDP

Population

GDP

Applications for Regional Analysis

- This pilot project, supported by the U.S. Department of State, focuses on Kuala Lumpur, Malaysia and Bangkok, Thailand. The framework of this analysis can be applied to additional cities in ASEAN member states and worldwide.

- This type of analysis can help inform city leaders in long term decision-making as they outline future climate and energy system goals.

- Cities play an important role in decarbonization, and through meaningful stakeholder engagement and capacity building, this project helps enable smart city development in a net-zero context.
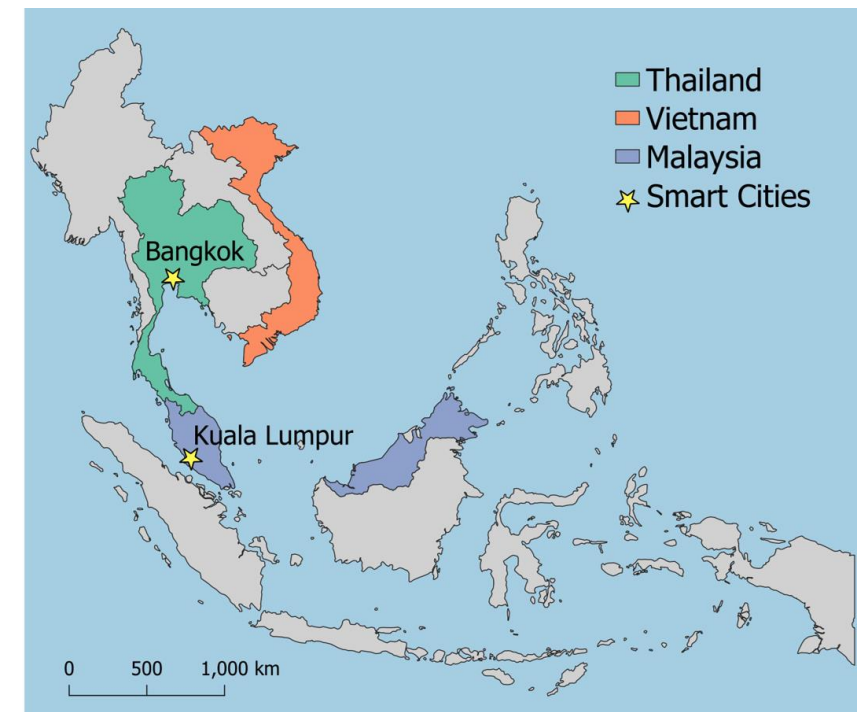
A map showing the location of the Smart Cities included in this pilot project. *(Figure by Taryn Waite | Pacific Northwest National Laboratory)*

Pilot City: Bangkok, Thailand

Stakeholder engagement

City level

- Bangkok Metropolitan Administration
- Metropolitan Electricity Authority
- Thammasat University

National level

- Energy Policy and Planning Office
- Electricity Generating Authority of Thailand

Key policies, plans, and goals

- Bangkok Master Plan on Climate Change
  - **10.15 MtCO$_2$eq reduction by 2030**
- Smart City Development Plans
- Smart Grid Development Plans

- Thailand Long Term Strategy
  - **Carbon neutral 2050; Net-zero GHG 2065**
- Power Development Plan
- Energy Efficiency Plan

Pilot City: Kuala Lumpur, Malaysia

Stakeholder engagement

- Kuala Lumpur City Hall
- University of Technology Malaysia

Key policies, plans, and goals

- Kuala Lumpur Low Carbon Society Blueprint 2030
- Kuala Lumpur Structure Plan 2040
- Kuala Lumpur Climate Action Plan 2050

Potential Insights from GCAM Results

- Informing on city development options and the implications of national trends for city decisions.

- Investigating potential decarbonization and net zero pathways by implementing policies from local climate plans + additional measures for increased emissions reductions.

- Using specific indicators to look into societal impacts, like job creation and changes in the costs of services.
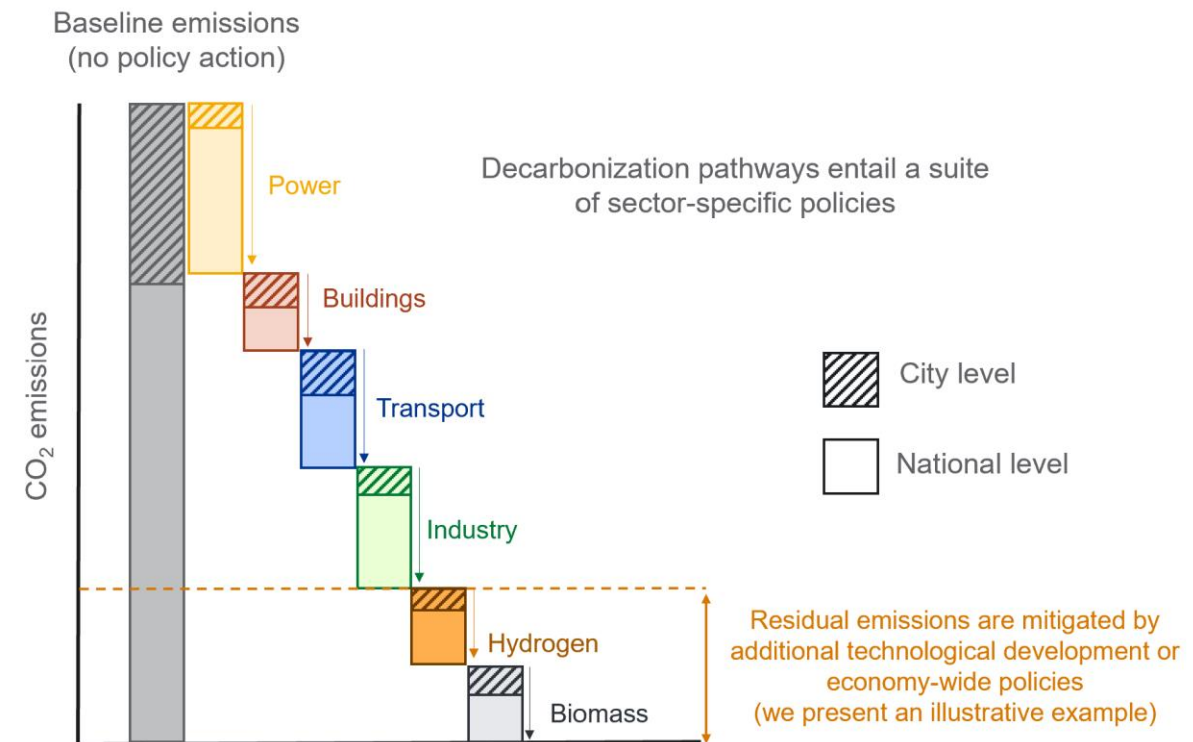
A conceptual framework for modeling net zero policies at the city and national level.
(Figure by Leeya Pressburger and Taryn Waite | Pacific Northwest National Laboratory)

Thank you