PIER ENERGY IN SUSTAINABLE COMMUNITIES PROGRAM PRESENTS:

HOW URBAN METABOLISM PROVIDES A NEW FRAMEWORK FOR ENERGY ASSESSMENT

UCLA Institute of the Environment and Sustainability
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History of Research Program Development
Genesis of PIER Urban Metabolism Program

PIER recognized:
- Land use planning decisions affect many sectors
  - Commercial, residential and civic building locations, roads and transit systems, water supply, building design, natural resources, open space, agriculture, and energy infrastructure
- The majority of California’s greenhouse gas emissions are the result (directly or indirectly) of land use decisions.
- Sustainable communities RD&D could provide decision-makers with the tools, information, and technologies needed to make California’s communities energy smart.
Existing and Planned UM Research Projects

2. Roadmap (2010)
3. LCA of Transit Infrastructure (2010 – 2012)
5. California Center for Sustainable Communities Research (2012-2015)
Urban Metabolism Framework
Energy is the Basis of Urban Systems

- Energy is like a heart: it pumps blood for the activities of our society
- Historically cheap fossil fuels and materials has allowed for high level of use
- Today’s energy requires large infrastructures (buildings, roads, power grids, petrochemical complexes)
- Over time this has created a complex system that is hard to unravel
Energy Systems and Cities

- Our built environment is a repository of materials humans have accumulated.
- Humans use approximately 60 billion tons of material every year, or the equivalent of the natural production of all plants on earth.
- UM: energy, materials, water, nutrients, waste.
Urban Metabolism:

- Approaches communities as systems that have interacting elements and impacts.
- Answers multiple interlinked policy questions:
  - GHGs
  - Criteria pollutants
  - Land use and energy
  - Energy and equity
Community Energy Systems in California

Urban metabolism can quantify:

1. Flows into cities or communities (electrons, water, wood, air, other materials, food etc.)
2. Flows out as pollution, other waste or losses in the form of heat and distribution losses
3. What remains within city boundaries as infrastructure and built environment
4. Impacts on ecosystems near and far
Updating UM for the Changing Energy Landscape

- Traditional Aggregated Accounts at a High Level
  - Energy
  - Materials
  - Water
  - Nutrients
  - Waste
The Addition of Place and People to Energy Systems Analysis

*Who is using energy? Where and why is as essential to curbing use as knowing how much is being used.*

- Yet, little is known about the spatial and socio-demographic distribution of energy use in California.
- UM can identify and analyze energy flows and sinks in California’s diverse communities:
  - By sector
  - By region and microclimate
  - By socio-economic
  - By land use type
  - By ecosystem
Example Outcomes of UM Approach

Policy Question: What sectors use the least water per job provided and where are they located?

Source: Economic Roundtable
Policy Question: What are the most water intensive business sectors in Los Angeles and where are they located?

Source: Economic Roundtable
A Few Potentials of UM Approach

- Develop fine grained info. (energy, transportation, GHG, water etc.) to get beyond one-size-fits-all programs
- Market the right energy reduction programs to the right communities
- Understand socioeconomic consequences of energy policies and programs
- Support green job programs and policies
- Support green infrastructure programs and policies
PROJECTS

LCA of Transit Change
Community Energy Baselines
Center for Sustainable Communities Research
Key Partners

This program reaches across the UC system to leverage expertise throughout the state and across multiple disciplines

PIER
- Phil Misemer, Transportation Systems Subject Area
- Dan Gallagher, Transportation Systems Subject Area

UCLA
- Stephanie Pincetl, Institute of the Environment and Sustainability
- Paul Bunje, Institute of the Environment and Sustainability
- Zoe Elizabeth, Institute of the Environment and Sustainability

UC Davis
- Mike McCoy, Urban Land Use and Transportation Center
- Tom Turrentine, Institute of Transportation Studies
- Mike Nicholas, Institute of Transportation Studies
- Jonathan London, Center for Regional Change

UC Berkeley
- Mike Chester, Institute of Transportation Studies
- Louise Mozingo, Center Resource Efficient Communities
- Bill Eisenstein, Center for Resource Efficient Communities
LCA of Transit Changes Project: Overview

- 2-year $550,000 project
- Led by UCLA, funded by PIER
- Researchers from UCLA and UCB
- Advised by experts across the state
- Will inform choices about transit infrastructure based on total energy costs and benefits
To inform policy decisions and infrastructure investments for improving the energy efficiency of transportation systems.

This project will provide:

- Real quantitative energy data for two public transit options
- A methodology to estimate the net energy, air quality, and greenhouse gas emission benefits from BRT and LRT & land use changes
- Analysis of options for addressing institutional and regulatory barriers when implementing these strategies.
- Policy options that could account for embedded energy for use at the state-level.
Community Energy Baseline Project
Overview

- 3-year $1M project
- Led by UCLA, funded by PIER
- Researchers from UCLA, UCB and UCD
- Advised by experts across the state
  - Key partner: LARC
- Develops community energy quantification and methodologies that can be transferred
- Pilots methods in LA to create regional energy profiles and also energy atlases
  - ATLAS
    - Geospatial grounding of energy use information
      - Socio-demographic
      - Land-use
      - Jobs
      - Pollution and wastes
The Los Angeles Regional Collaborative for Climate Action and Sustainability is a network designed to encourage greater coordination and cooperation at the local and regional levels by bringing together leadership from government, the business community, academia, labor, environmental, and community groups.

The purpose of this collaboration is to share information, foster partnerships, and develop system-wide strategies to address climate change and promote a green economy through sustainable communities.
Goal: To provide a means to evaluate the sustainability of community energy systems through an Urban Metabolism framework.

Deliverables:

1. Methods and tools to develop consistent, comprehensive, and accurate energy baselines (including waste)

2. An analysis of the relationship between socio-economics, economic activity and energy consumption

3. An updated PECAS model

4. A regional energy atlas for Los Angeles County.
Challenges in Sustainable Communities Research

Existing and emerging legislation (AB32, SB 375 etc.) requires new knowledge and tools to increase the sustainability of land use patterns.

Implementation is limited by:

1. Disparate sustainable communities research programs across the state
   - Some state commissioned, some academic, some by consultants

2. Poor communication of research findings to decision-makers
   - Policy-makers, decision makers and practitioners are overwhelmed by the number of studies
   - Research does not inform practice and is not informed by practice

3. Lack of coordination and communication between researchers
   - Research remains siloed
This New Framework Addresses Challenges

Urban Metabolism:

1. Creates a means of synthesizing across sectors and disciplines
2. Creates common metrics so there is clarity and commensurability across regions
3. Creates coordination and collaboration
The Center’s Goals and Activities

1. Create a statewide information hub to identify redundancies in research
2. Develop communication tools and forums for sharing research findings
3. Improve insights into the relationships between land use and energy flows
4. Develop a network of research experts and improve their means to collaborate
5. Initiate synthesis and assessment analyses of sustainable communities research
Summary

The Urban Metabolism Research Program:

- Is systematic, strategic and coordinated
- Uses urban metabolism as the framework for evaluating existing research & for future research
- Depicts the energy flows and impacts in California communities and on the state’s environment
- Leverages research expertise across the state
- Provides insight into the state’s energy vulnerabilities based on knowing its existing patterns
- Analyzes the equity implications of energy use patterns
- Will help shape future energy use and land use
CONTACT US

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Discussion Questions

- What does your agency need out of a new research center?
- What ideas do you have for the center?
- What questions do you have for us?
- How does this relate to your work?
- Do you know of similar projects happening within the state?

- THANK YOU!