



Workshop
**Energy, Cities & Control of
Complex Systems**

Key to Global Sustainability

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- **Monitoring Planetary Emergencies (Panels)**

ENERGY – 1 of 16 panels

(Pollution, Water, Security, Food, Limits of Development, Climatology, etc.)

Permanent Monitoring Panels (PMP) Plenaries in August (2 reports)

- *The Control of Complex Systems: Energy In Cities*
- *Policies for an Energy System Transformation*

<http://www.federationofscientists.org/PMPanels/Energy.asp>

3 Themes – Energy, Cities, System Control

- **Energy**
 - Human Needs - Food, then Shelter, then Energy
- **Cities**
 - All population growth in urban areas
 - 10 cities reach 7 million, every year
 - 50% of GDP from 22% of population in 600 cities
 - Energy systems can have greatest economic and environmental impact (sustainability)
- **Systems**
 - Energy demand-side management (<20% efficient)
 - Future grids will have passive response to faults, signals, etc.
 - Information can inform policy, economic, etc. decisions

UN Forecasts (2011)

	2011	2050	Annual Change Rate (1970-2011)
World Total	6.97 billion	9.31 billion	+ 1.55 %
Urban	3.63 billion	6.25 billion	+ 2.41 %
% Urban	52%	67%	



Fundamental Question

- **Can complex network theory (CNT) tell us where the key control points are in these complex energy-cities networks?**

Goals of This Workshop

- **Explore application of complex network theory to our systems (infrastructure and social networks)**
- **Identify priorities and limitations of RD&D**
- **Consider applications/expansion to many natural systems**
- **Develop an outline for developing and propagating management tools for mayors, city managers, providers of energy services**
- **Identify next steps**

Round Table Questions

Key questions

- 1. Are there applications of CNT (Complex Network Theory) to the Energy system that can be applied today? What sub-system should be the priority?**
- 2. Are there critical limitations of CNT?**
- 3. Going forward, what should be our research priorities? (Also RD&D?)**

Key Questions (con't)

- 4. What tools do city managers and providers of energy services need? And fold the government system in early?**
- 5. What are next steps (immediate and intermediate) to move forward? Goals – Implementation?**

Backups

$$\text{Impact} = \text{P}_{\text{opulation}} \cdot \text{A}_{\text{ffluence}} \cdot \text{T}_{\text{echnology}}$$

(Ehrlich & Holdren, 1970)

The **Kuznets (1951) hypothesis** relates to income inequality. It suggests that inequality increases during the early stages of economic development but, after a certain point, declines.

The **environmental Kuznets hypothesis** applies a similar framework to environmental damage – it suggests that it first increases then decreases with rising income.

The **carbon Kuznets hypothesis** takes the principle into the specific area of carbon dioxide emissions. It postulates that emissions growth will follow a roughly S shaped curve – that is, emissions will grow slowly in economies below a certain level of GDP, then increase rapidly once a threshold is passed, then flatten off again as economies reach a given level of wealth.