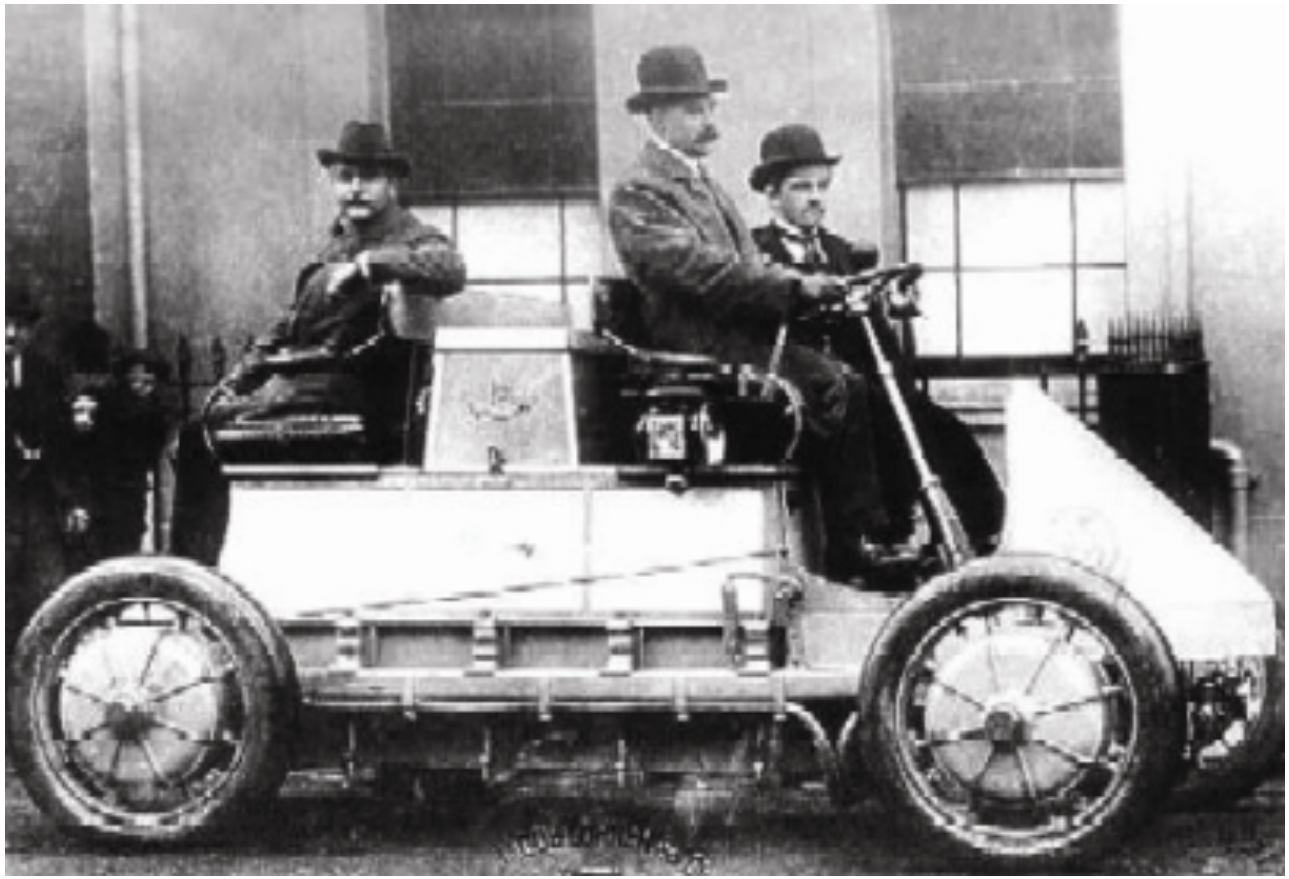
# First Hybrid Automobile



**1903 Lohner-Porsche Carriage**

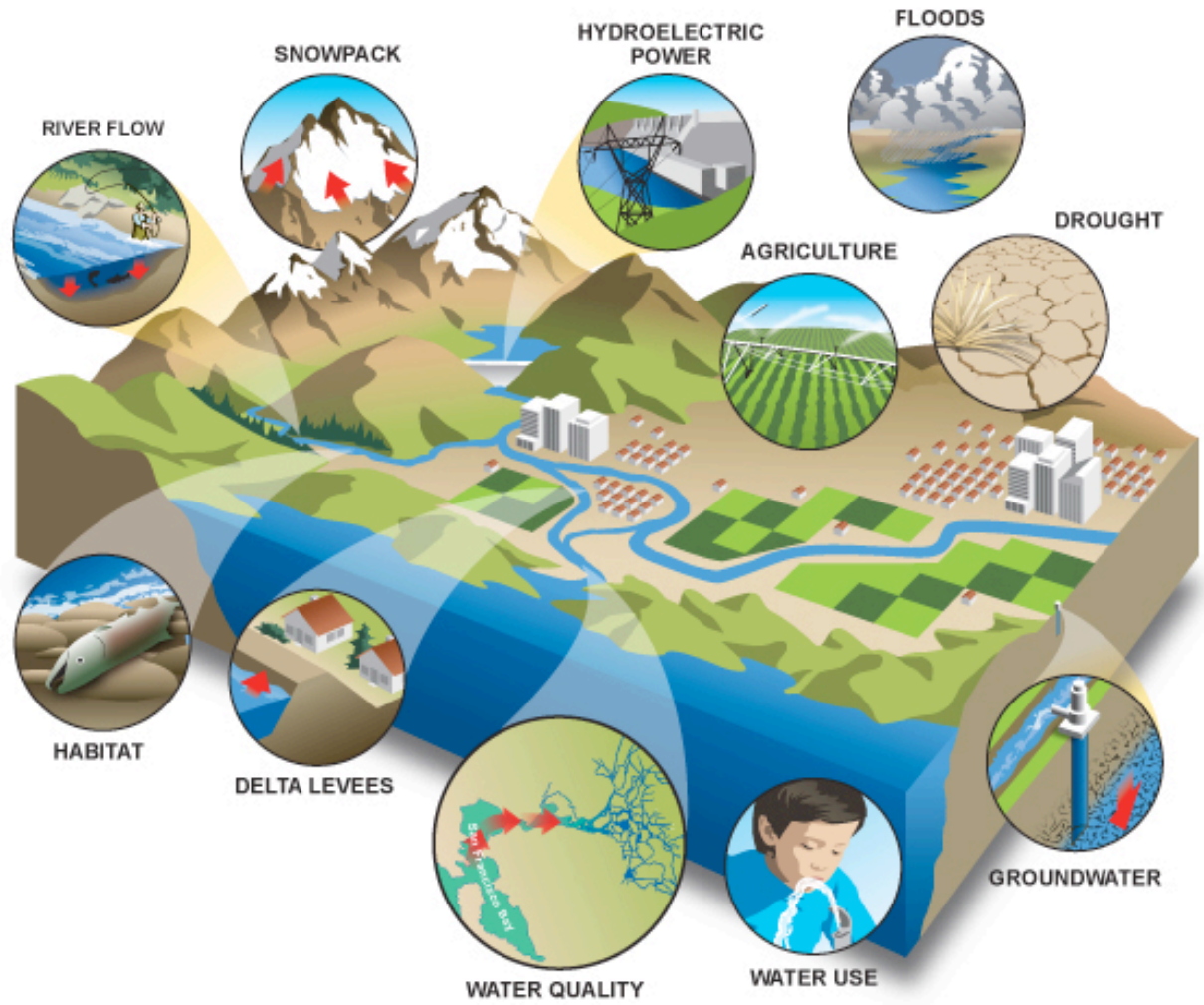
# The Third Industrial Revolution

**A Paradigm Change toward enabling policies and programs with visions such as:**
**Energy Independence and Carbon Neutral**

1. Efficient Renewable Energy Central Plants
2. Demand Side Management Contracts for conservation and efficiency
3. Renewable Energy Systems per campus (e.g. 1+ MW Solar and /or other renewable technologies)
4. Smart Green Grid – central plant systems and on-site power generation
5. Sustainable Development Curriculum – Career Education, Training, Entrepreneurship and New Ventures.

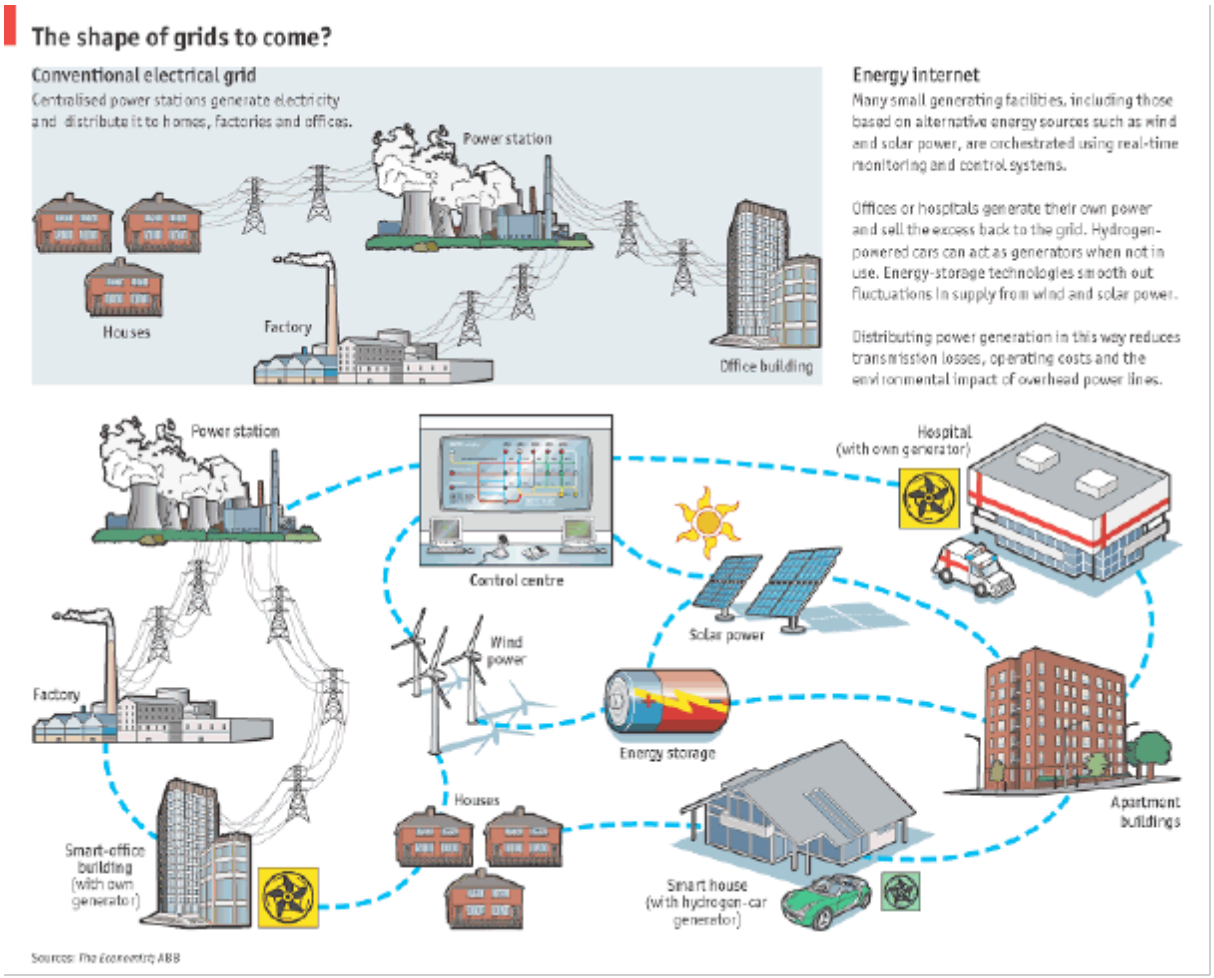
# Sustainable Communities:

## Integration of basic infrastructures



# Agile Energy Infrastructures:

## Central grid and On-site generation

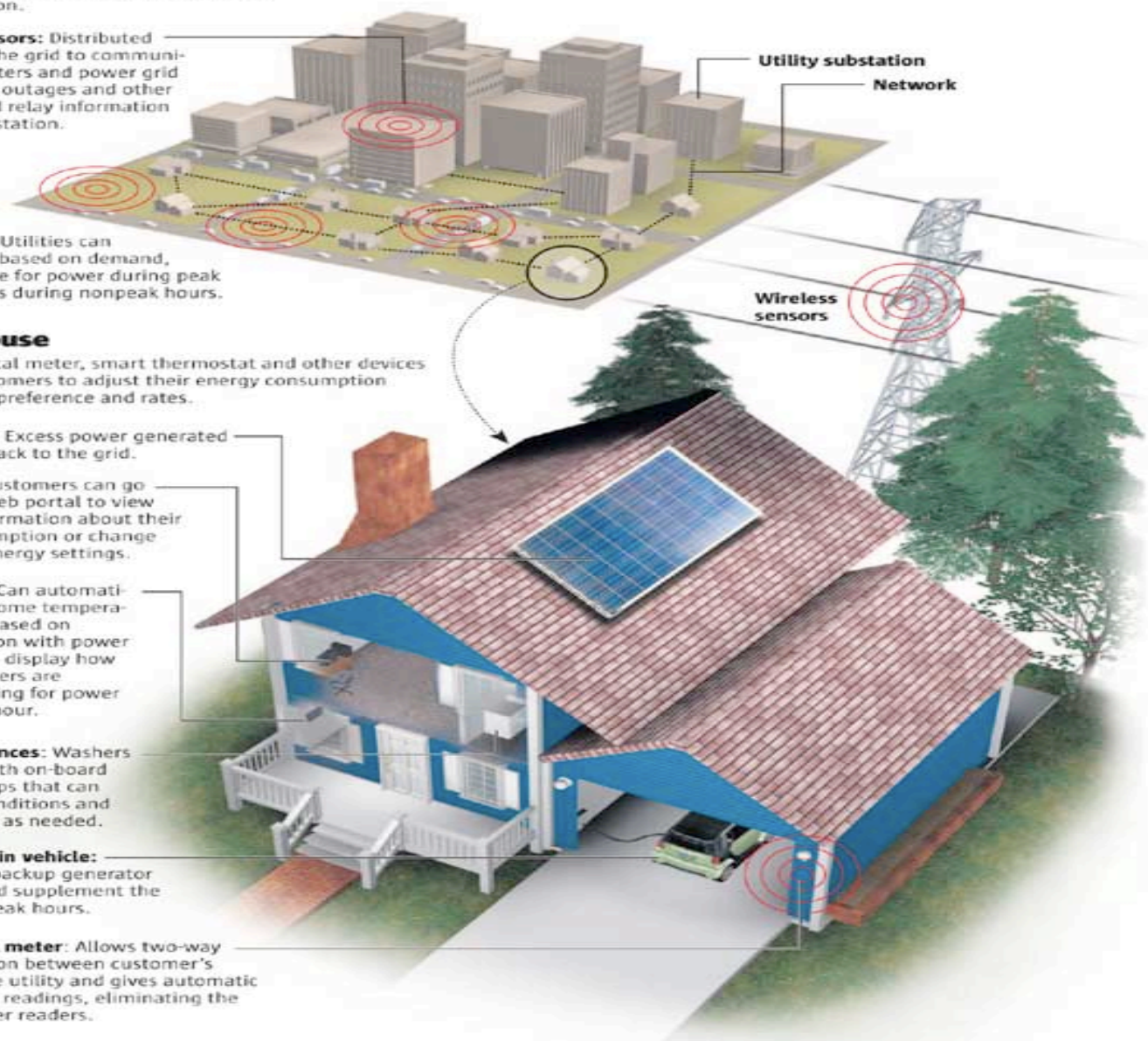


## Smart-grid city

Smart-grid technology is designed to allow customers and utility companies to collaboratively manage power generation, delivery and energy consumption in real-time two-way communication.

**Wireless sensors:** Distributed throughout the grid to communicate with meters and power grid to determine outages and other problems and relay information to utility substation.

**Tiered rates:** Utilities can change rates based on demand, charging more for power during peak hours and less during nonpeak hours.




## Smart house

Features digital meter, smart thermostat and other devices to allow customers to adjust their energy consumption according to preference and rates.

**Solar panels:** Excess power generated can be sent back to the grid.

**Computer:** Customers can go online to a Web portal to view real-time information about their power consumption or change their home energy settings.

**Thermostat:** Can automatically adjust home temperature setting based on communication with power grid. Can also display how much customers are currently paying for power per kilowatt hour.

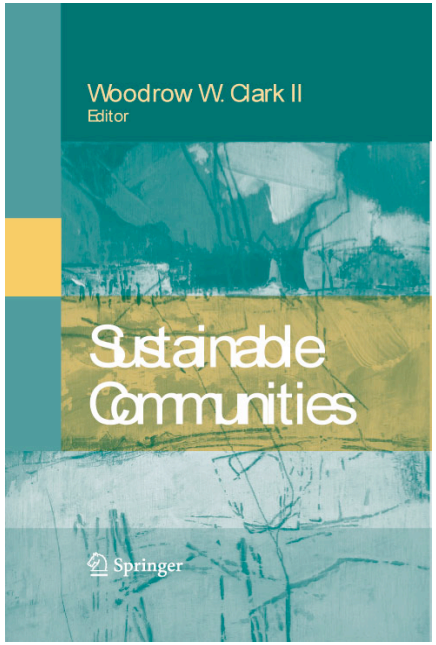
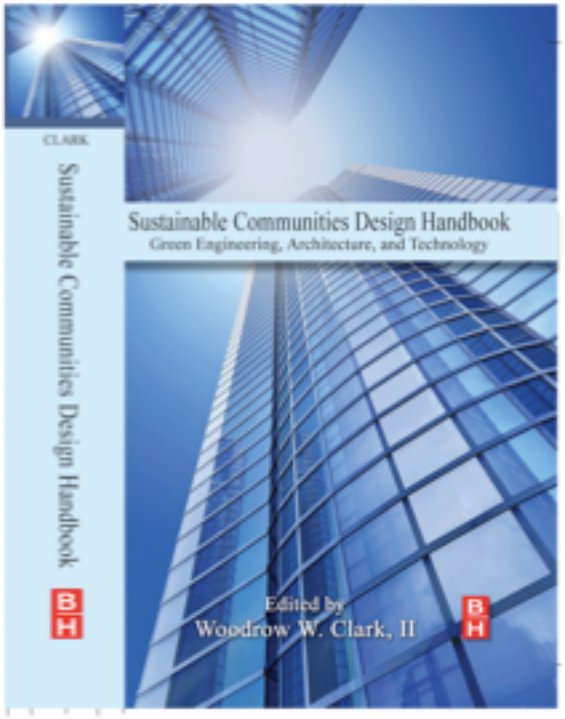
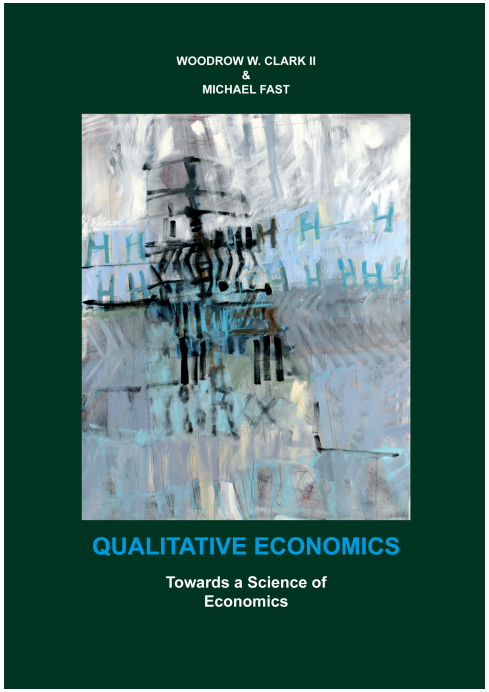
**Smart appliances**: Washers and dryers with on-board computer chips that can sense grid conditions and turn off or on as needed.

**Electric plug-in vehicle:** Can act as a backup generator for homes and supplement the grid during peak hours.

**Smart digital meter**: Allows two-way communication between customer's home and the utility and gives automatic energy usage readings, eliminating the need for meter readers.

*Source: Xcel, Denver Post research*

*Jonathan Moreno, Severiano Galván and Jeff Goertzen, The Denver Post*

# Sustainable Communities:

## Energy Independent and Carbon Neutral