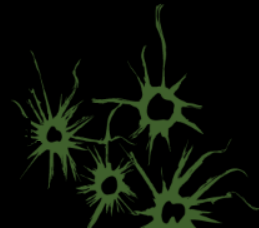
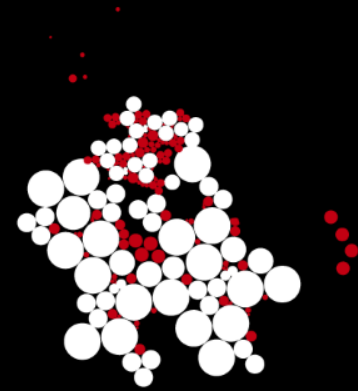


UNIVERSITEIT TWENTE.

**SMART CITIES  
UNIVERSITY OF TWENTE**

JUNE 2014. MISSION BRAZIL.



# OUTLINE

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- Grand societal challenges for cities
- Need for smart cities
- University of Twente: society & technology
- Focus on smart and sustainable energy systems
  - Green Energy Initiative
- Smart Grids
- Energy, behavior and society
- Living labs
- Integrated approach for Smart Cities

# GRAND SOCIETAL CHALLENGES FOR CITIES

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- Cities are facing complex and widespread problems.
- Cities face grand societal challenges such as:
  - Demographic transformations;
  - Resource depletion and climate change;
  - Unequal social participation;
  - Congested transport networks;
  - Difficult trade-offs in land use decisions.

Grand challenges can only be addressed sufficiently if appropriate strategies are applied.



# NEED FOR SMART CITIES

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- To use ICT technology to support strategies to cope with grand societal challenges:
  - To improve data exchange on the need and wants for public utilities:
    - E.g. energy, water, waste, and other (public) services;
  - To detect social, environmental, riskful (to health) situations, and to enable public authorities and other organisations to act quick and responsively;
  - To construct smart infrastructures, buildings and offices to support end-users in their growing needs (e.g. comfort, access to internet services).

# UNIVERSITY OF TWENTE: SOCIETY & TECHNOLOGY

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- The Innovative and Research University;
- University for both Technical and Social Sciences;
- Excels in combining beta and gamma disciplinary approaches in research projects on key societal challenges;
- Excellence and innovation through multi-disciplinary collaboration;
  - E.g., on-going research: Smart Grids, Bio-energy;
- University Board identified 'energy' as one of its main strategic subjects – links to Dutch Government Policy.
  - Green Energy Initiative (cross-faculty collaborative to support multi-disciplinary research collaboration).

# TOWARDS A SMART AND GREEN ENERGY SYSTEM

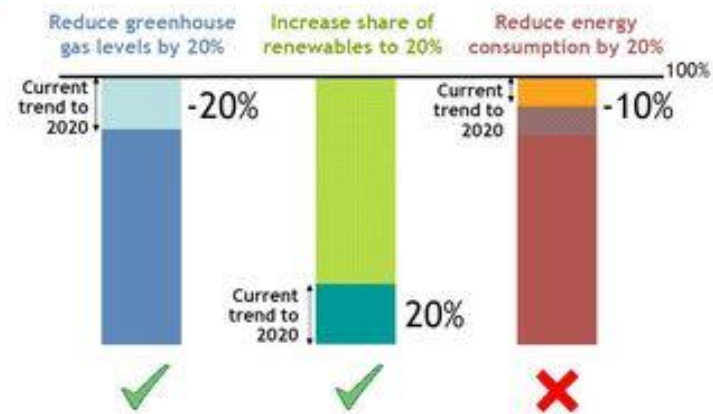
## ENERGY SUPPLY YESTERDAY



Energy Autonomous Smart Microgrids



# NEW DEVELOPMENTS



# ELEMENTS OF THE ENERGY TRANSITION

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- Non-controllable production



- Distributed small scale production





# ELEMENTS OF THE ENERGY TRANSITION

## NEW POSSIBILITIES

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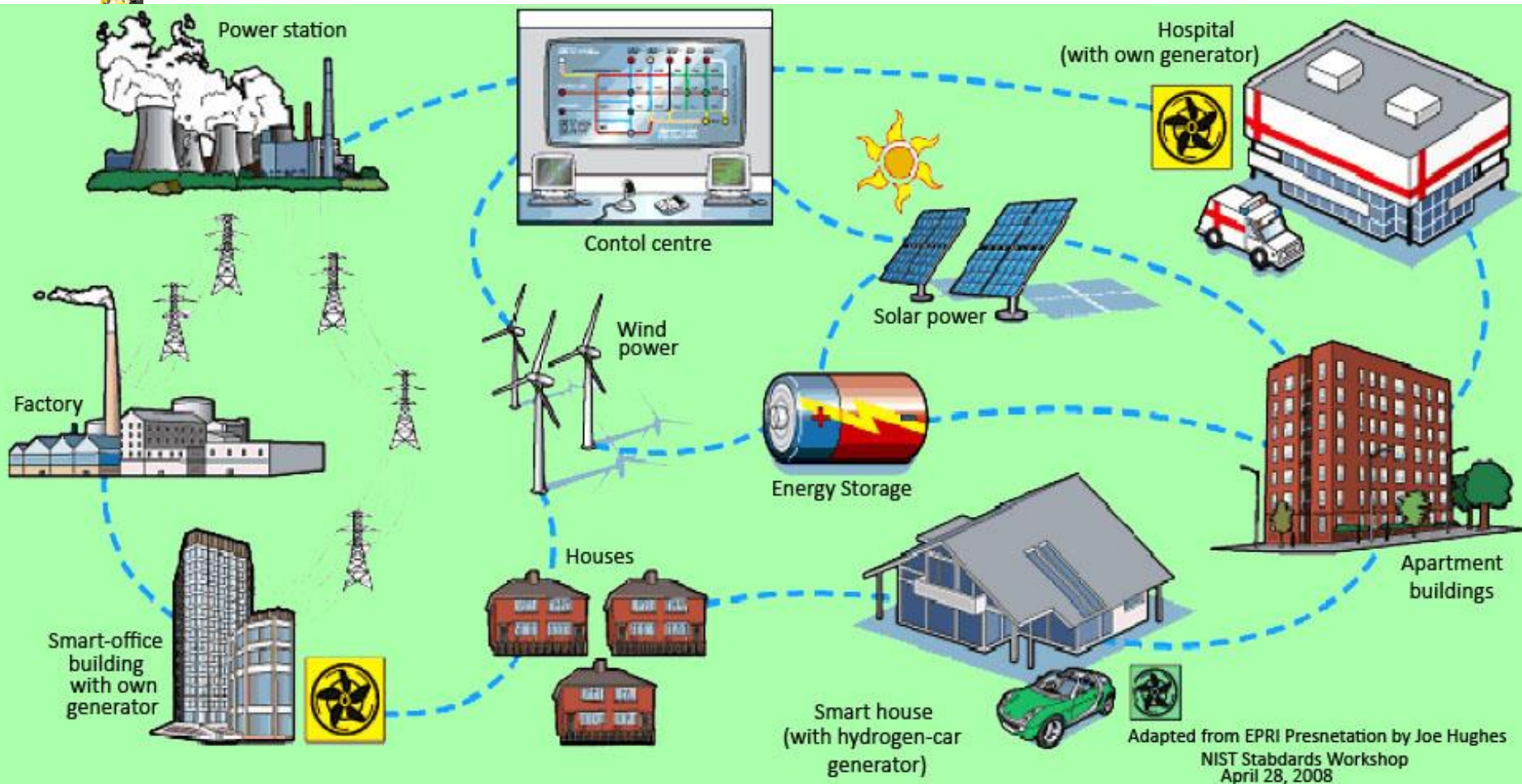
- Controlable demand



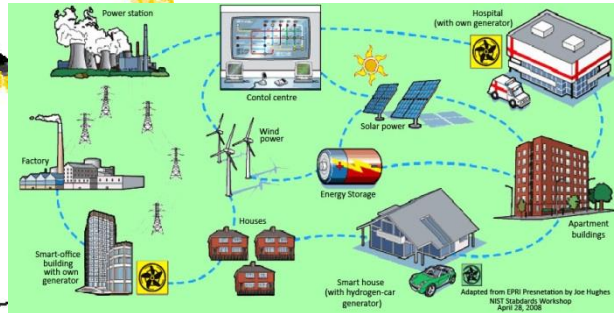
- Storage



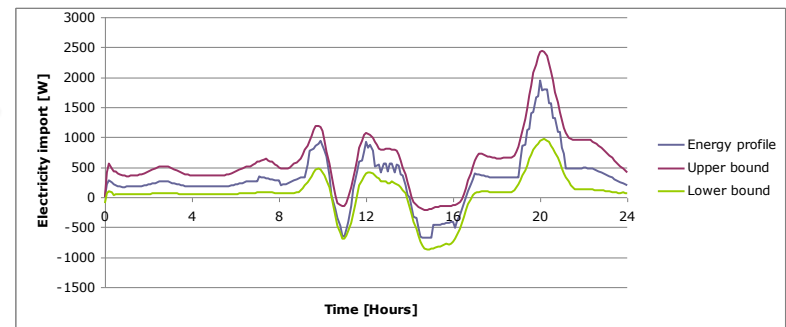
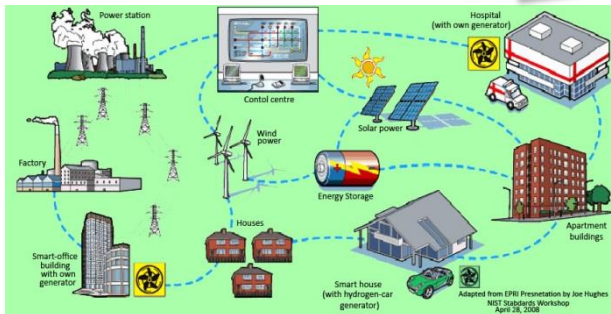
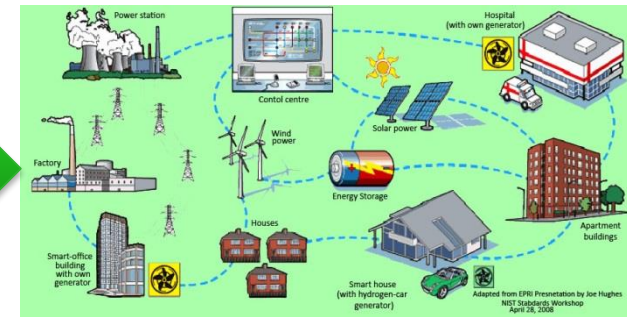
# FROM ONE BIG MACRO GRID



# TO A COLLECTION OF SMART (AUTONOMOUS) MICROGRIDS



Global control





# SMART GRIDS

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- The smart grid will serve as the information technology backbone that enables widespread penetration of new technologies that today's electrical grid cannot support.
- These new technologies include cutting-edge advancements in *metering, transmission, distribution, and electricity storage technology*, as well as *providing new information and flexibility* to both consumers and providers of electricity.
- Ultimately, access to this information will improve the products and services that are offered to consumers, leading to more efficient consumption and provision of electricity.

# ENERGY AUTONOMOUS SMART MICRO GRIDS: ASSUMPTIONS AND CHALLENGES

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- However, Smart Grid technology depends on many assumptions:
  - End users have to become responsive to energy pricing (which incentives trigger responsive behavior?);
  - Energy storage at neighborhood level needs to become feasible technologically and economically;
  - Many regulatory changes are needed (e.g., in Electricity Act(s);
  - Financial-economic models need change;
  - Social acceptance of smart technology at household level (privacy issues);
  - Response to Smart Grid developments by large energy sector stakeholders;
  - Need for Smart Grid Innovation agenda.



# ENERGY, BEHAVIOR AND SOCIETY

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- Innovative green energy innovations do not automatically match the behaviour, rules and routines of persons and organisations in society.
- Insights from behavioural and social scientific disciplines are essential to understand and design implementation of green energy innovations.
- Innovative business- and governance models are needed to manage transitional change to a green energy society.

**Buurkracht** ⚡

UNIVERSITEIT TWENTE.



# MULTIDICIPLINARY FOCI

- Behaviour.
- Organisations.
- Economy.
- Business.
- Law.
- Planning.
- Governance.
- Transition studies.
- Multidisciplinary research is not enough; trans- and interdisciplinary research is needed!



# LIVING LABS

- Experiments with smart (energy) technologies in 'real-life' settings, e.g. households, offices.



# INTEGRATED APPROACH FOR SMART CITIES

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- The UT is working to develop:
  - Integrated frameworks and models;
  - That combine multidisciplinary (beta-gamma) insights;
  - That contribute to cities becoming more intelligent;
  - And hence, support strategies to cope with Grand Societal Challenges.
  
- Thanks for your attention.