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# Alternative Energy Now and the Future CSIRO Energy Technology Research and its application in the Sustainable Built Environment

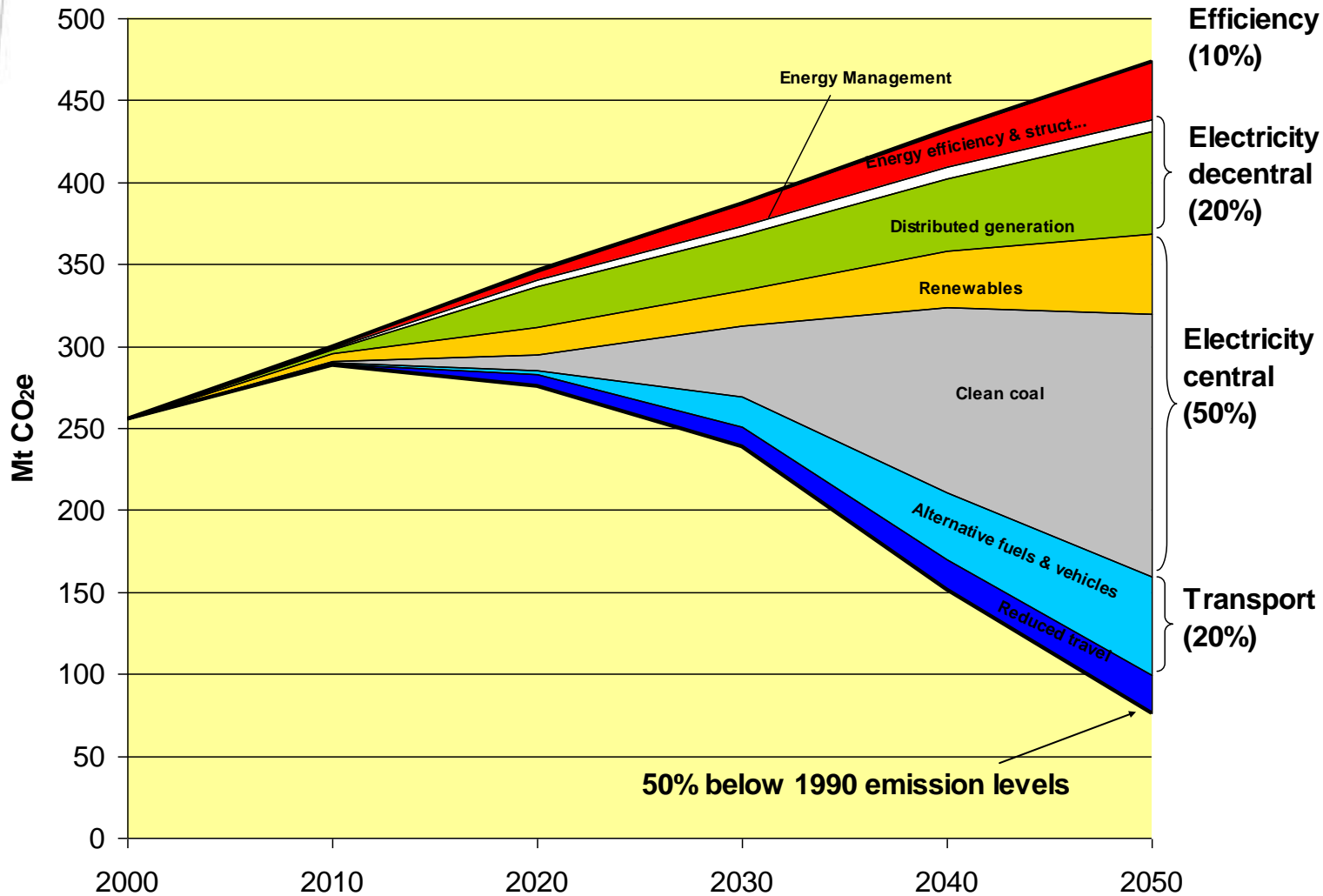
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**Energy Systems Manager**  
**CSIRO Division of Energy Technology**  
**29<sup>th</sup> September 2009**



# Overview

- **Emissions reduction pathway for Australia**
- **CSIRO's Energy Research**
  - **Renewable Energy Systems**
    - Solar Thermal
    - Solar Cooling
    - Vibration Energy Harvesting
    - Organic Photovoltaics
  - **The Intelligent Grid**
    - The Virtual Power Station
    - Self Learning Smart Agent Technologies

# Emission reduction pathway for Australia



Source: Energy Futures, Paul Graham, CSIRO

# National Solar Energy Centre, Newcastle



# Solar Turbine

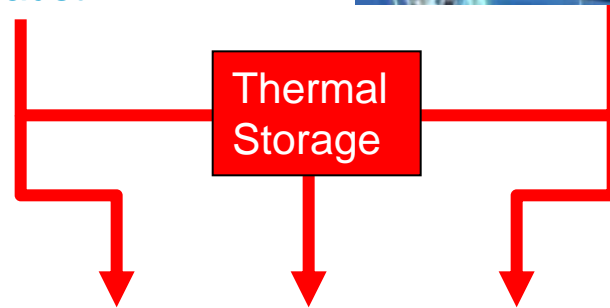


- Diesel efficiency improves

- Thermal storage readily integrates with other heat sources such as diesel exhaust and solar collectors

- Aiming for cost half that of PV's

Exhaust



## Polygeneration

- Electricity
- Heat
- Cooling
- Desalination
- Water pumping

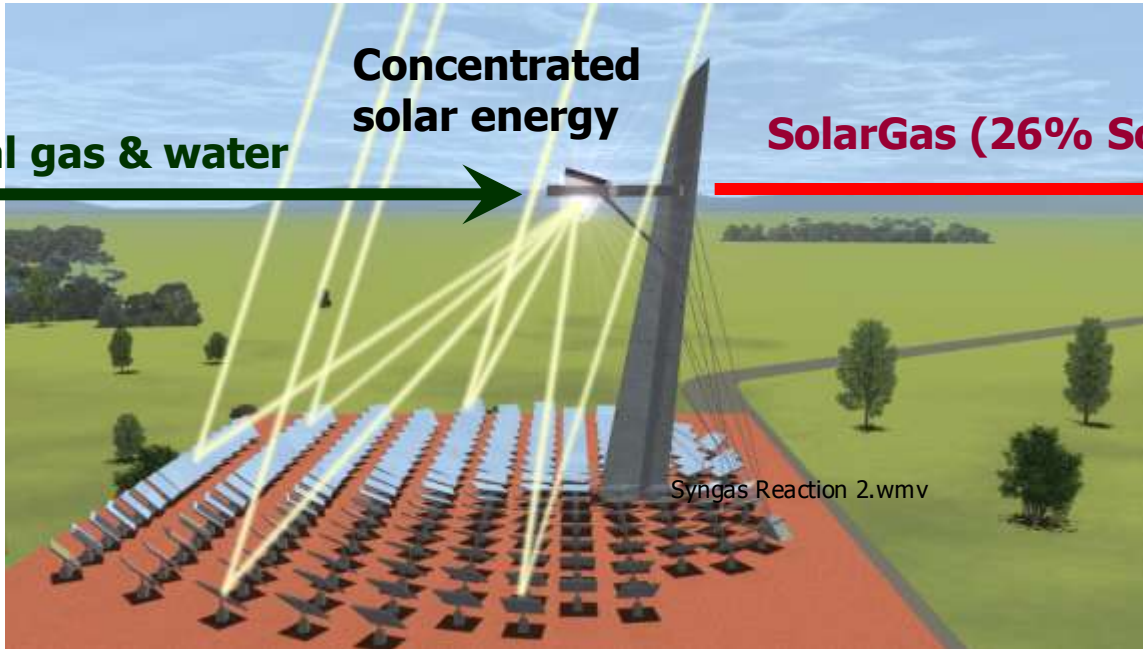
# CSIRO's Solar H<sub>2</sub> Technology

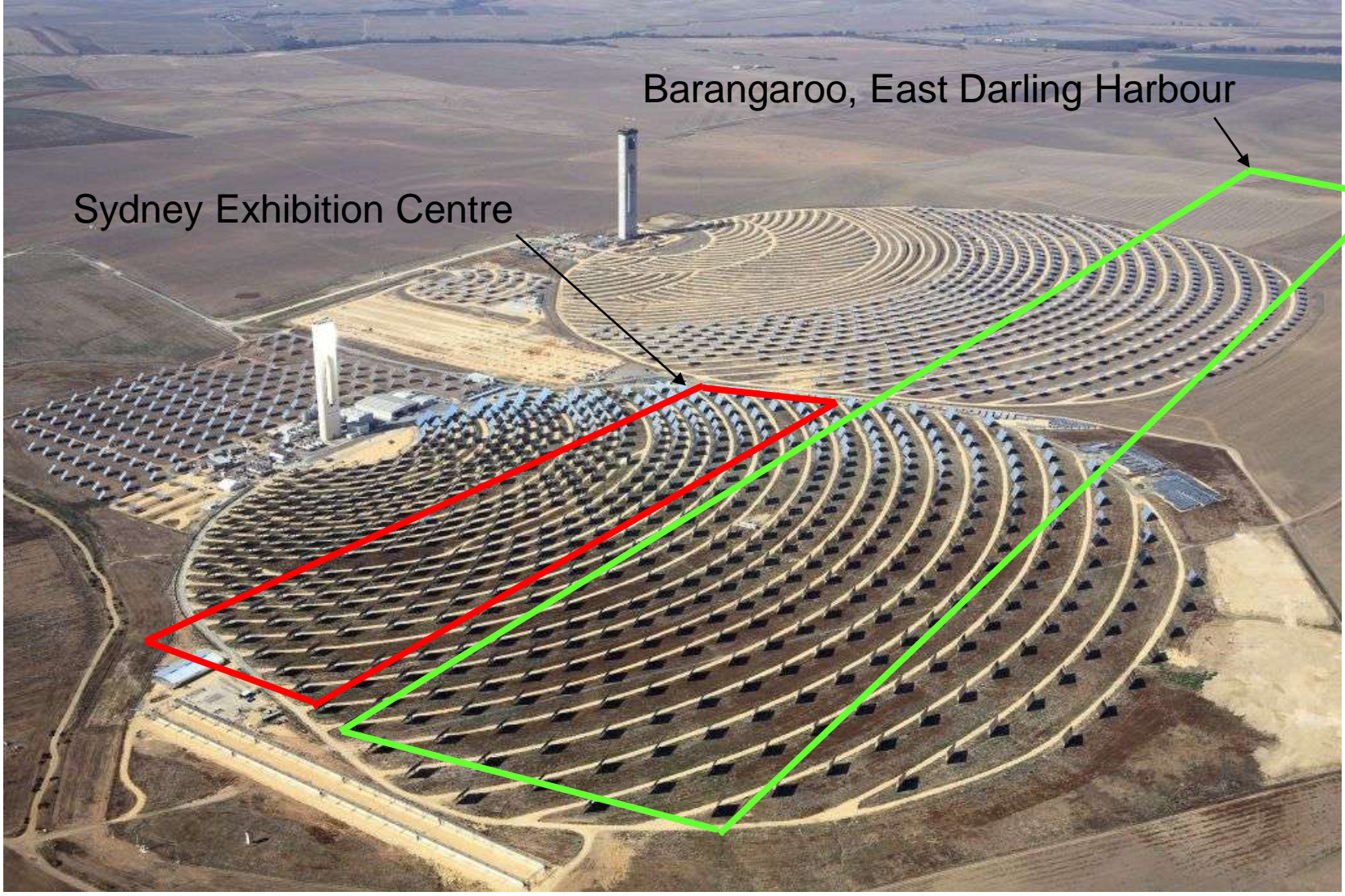
"Transitional and modular - bridging the gap to sustainable hydrogen"

Natural gas & water

Concentrated solar energy

SolarGas (26% Solar Energy)





Sydney Exhibition Centre

Barangaroo, East Darling Harbour

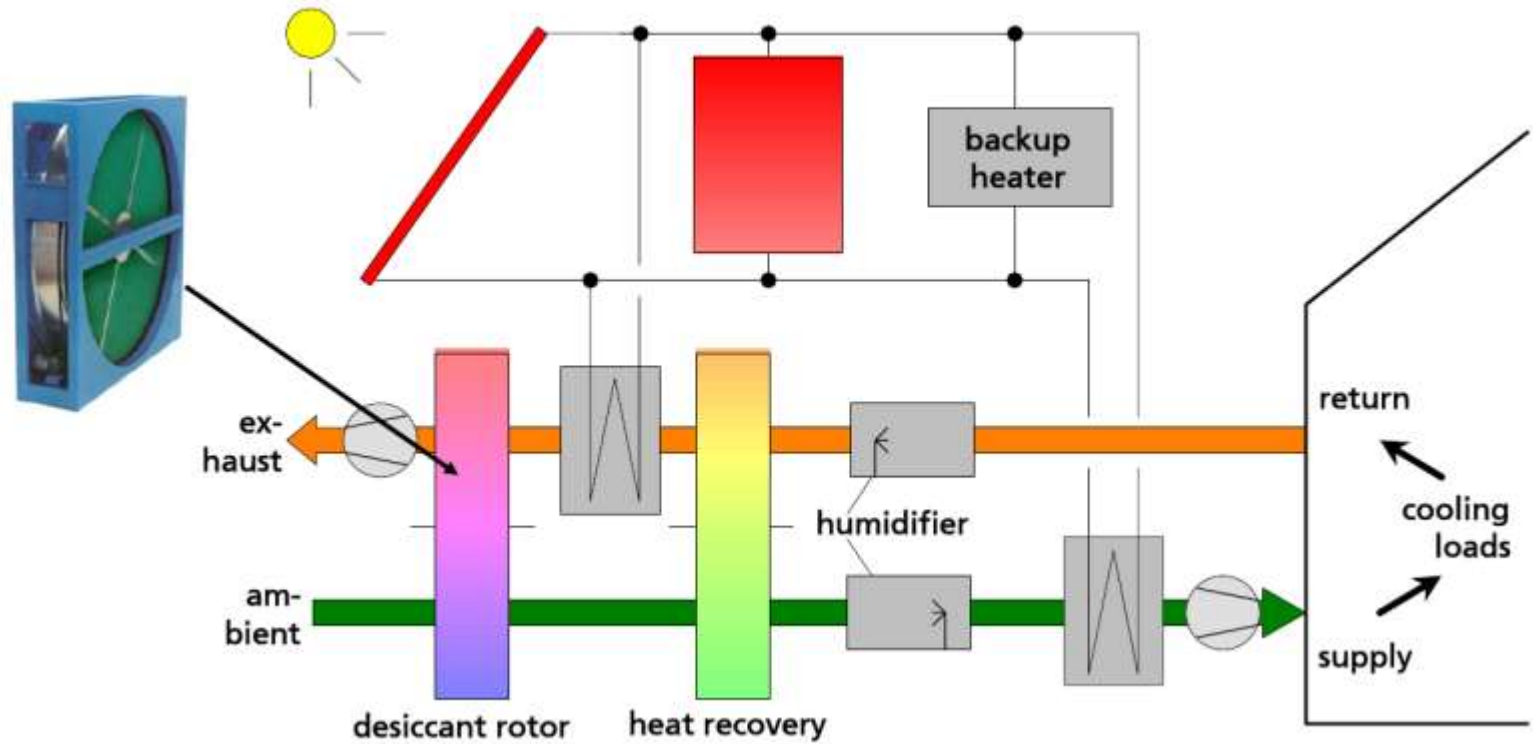
# Multi-tower Solar Array



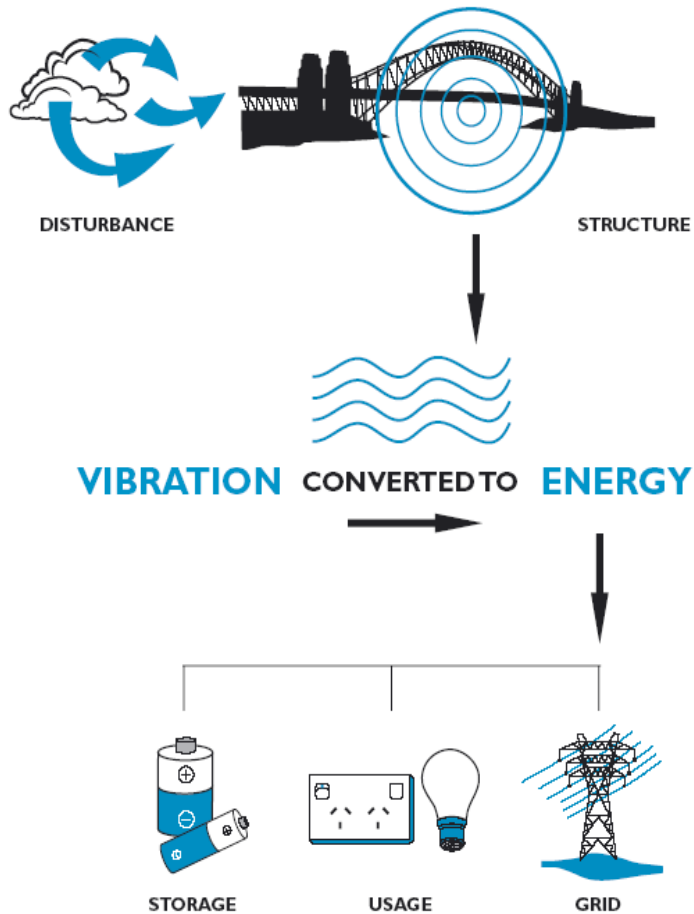


# Solar Cooling

## Desiccant system schematic



# Vibration Energy Harvesting

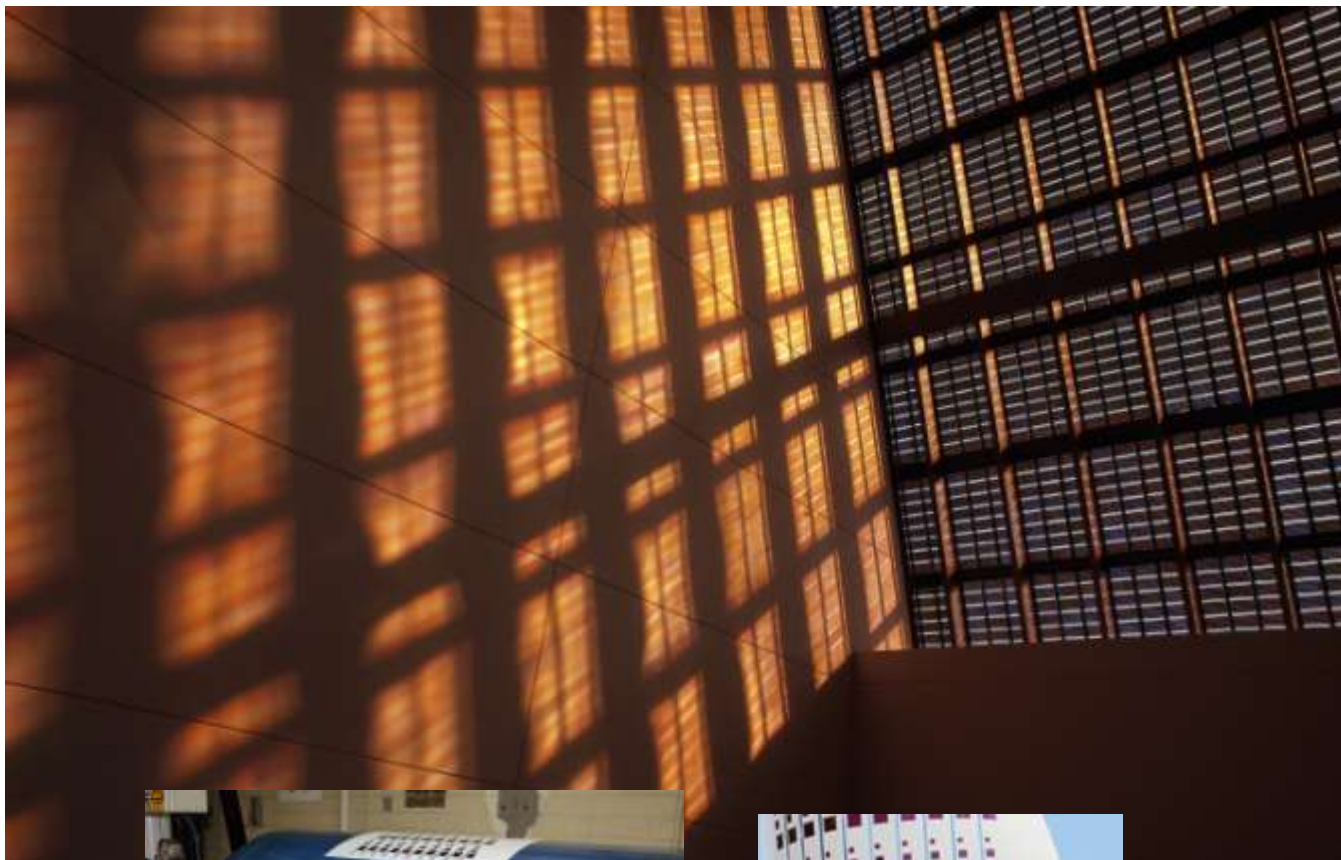


- Sydney Harbour Bridge vibration = 6.6MW
- Capturing say 10% = 660kW
- Enough power for 220 homes
- Vibration is clean renewable energy source



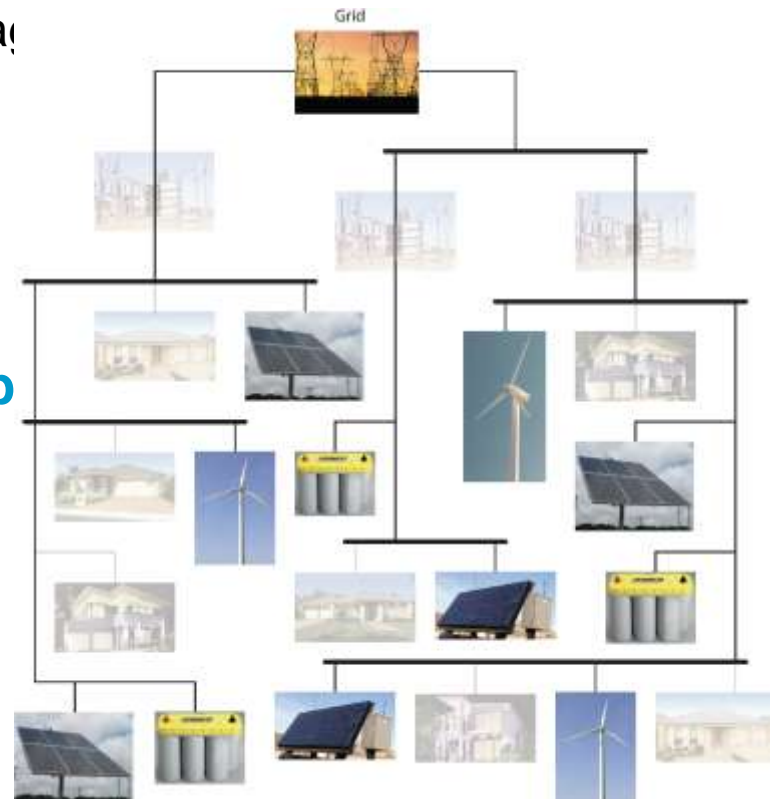
Vibration Harvesting

# Organic Photovoltaics



# The Virtual Power Station

- **Although individually small and unreliable, together DG can:**
  - Aggregate to a marketable package
  - Provide firm generation capacity
  - Use spatial awareness to improve forecasts – hence lower storage requirements
- **Foster a community ownership of energy & improve reliability**
- **Get more value from your existing renewables**
- **Overcome intermittency and become a valued part of the electricity generation mix**



# Virtual Power Station

RENEWABLE AGGREGATED POWER

[Home](#) [View](#) [Interact](#) [Details](#) [Products](#)

## Interact with the Virtual Power Station



# Virtual Power Station

## RENEWABLE AGGREGATED POWER

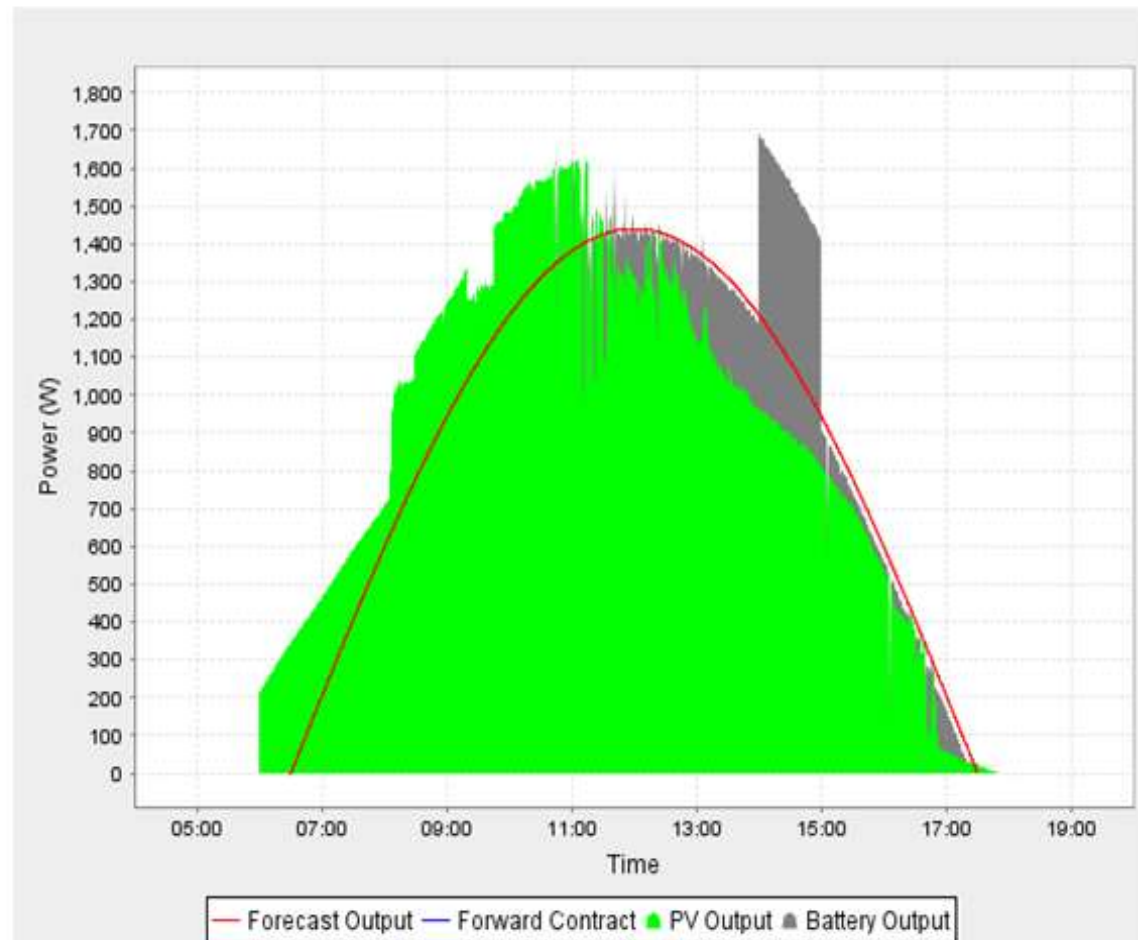
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### VPS Total Output

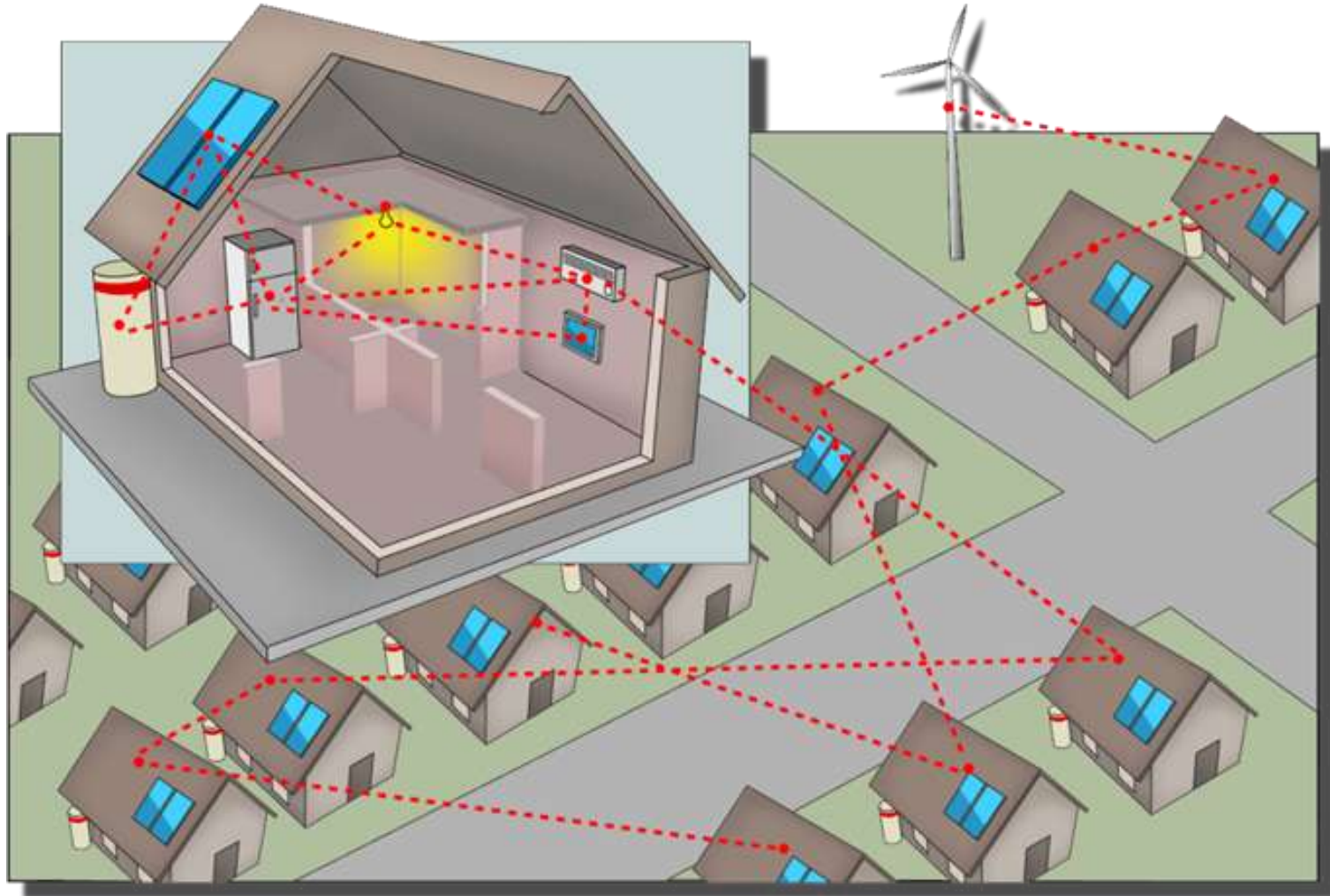
Change Date

October, 2008							
Today							
wk	Sun	Mon	Tue	Wed	Thu	Fri	Sat
39				1	2	3	4
40	5	6	7	8	9	10	11
41	12	13	14	15	16	17	18
42	19	20	21	22	23	24	25
43	26	27	28	29	30	31	

Select date



# Sustainable Building Energy End Use Intelligent Energy Management Technology



## Multi-agent Networks and Intelligent Grids

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Thank you

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