BEARS | Berkeley Education Alliance for Research in Singapore

SinBerBEST | Singapore-Berkeley Building Efficiency and Sustainability in the Tropics

Singapore-Berkeley Building Efficiency and Sustainability in the Tropics

Annual Meeting, 2013

Costas J. Spanos

Andrew S. Grove Distinguished Professor

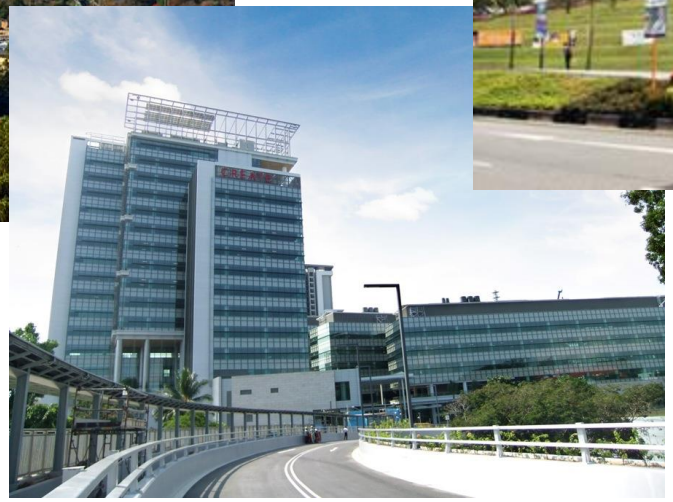
Department of EECS, UC Berkeley

Director and CEO, Berkeley Educational Alliance for Research in Singapore.

NANYANG TECHNOLOGICAL UNIVERSITY

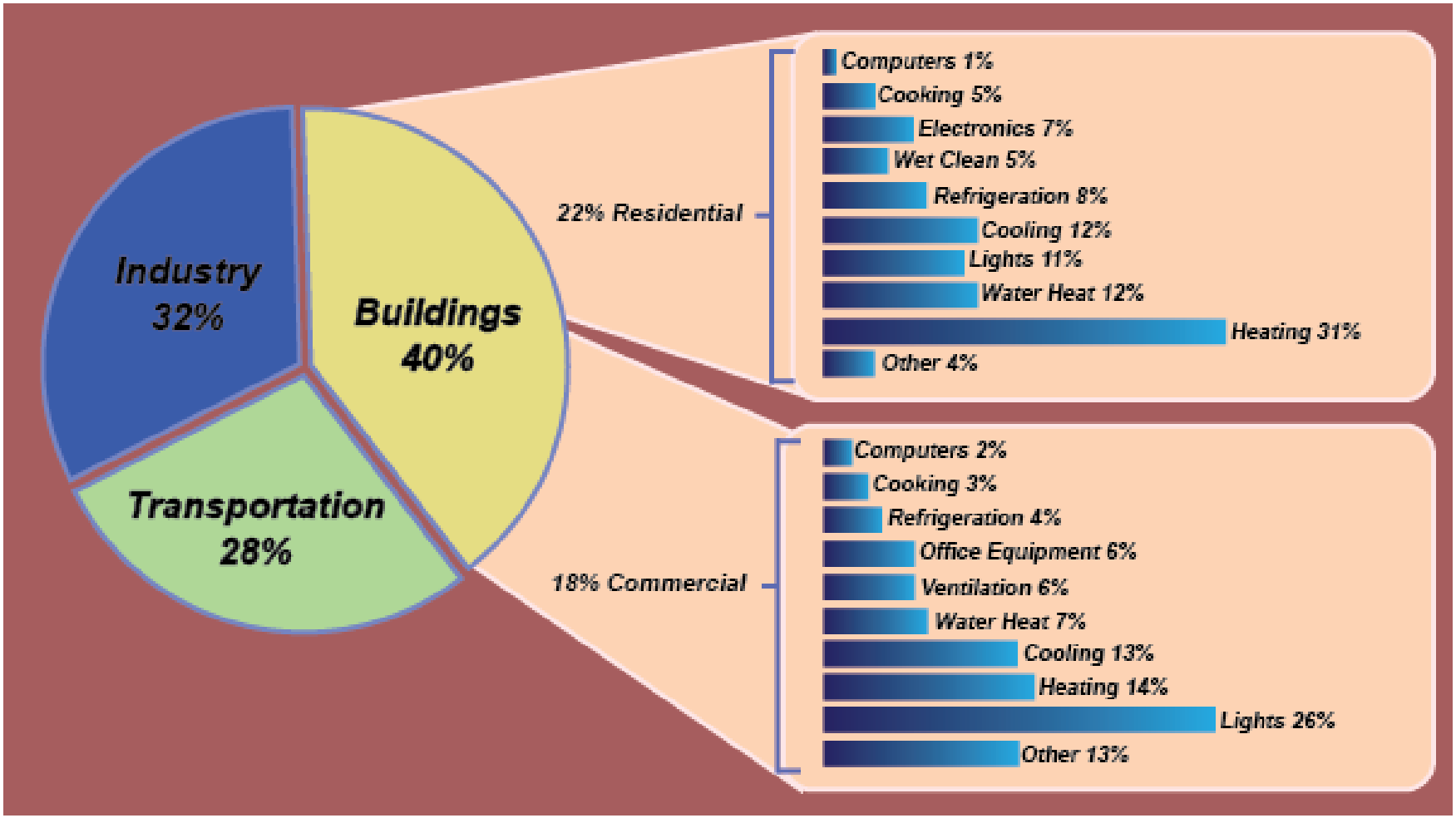
NUS National University of Singapore

A Partnership

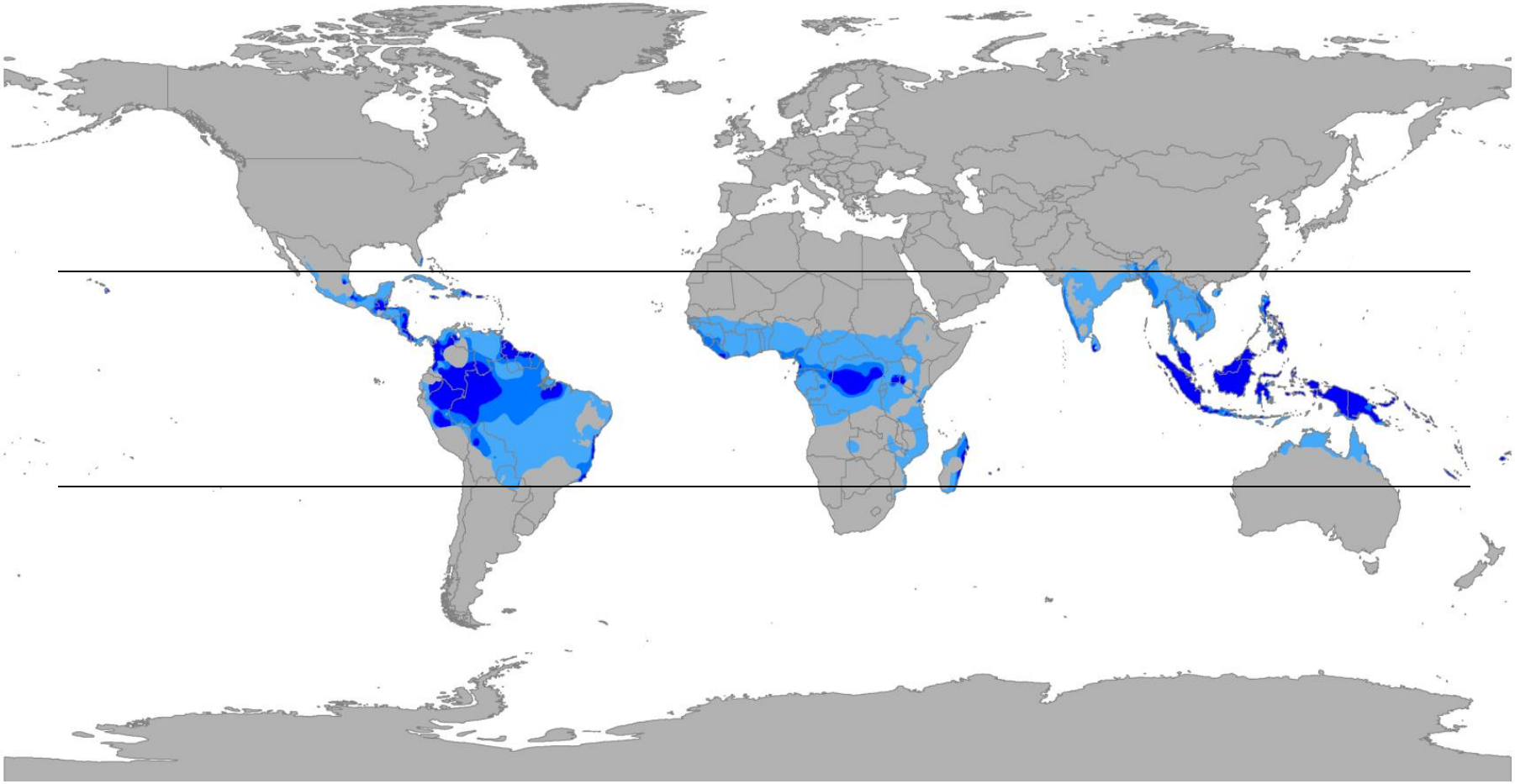



The Problem

Our Part


Industry
32%
Buildings
40%
Transportation
28%
22% Residential
Computers 1%
Cooking 5%
Electronics 7%
Wet Clean 5%
Refrigeration 8%
Cooling 12%
Lights 11%
Water Heat 12%
Heating 31%
Other 4%
18% Commercial
Computers 2%
Cooking 3%
Refrigeration 4%
Office Equipment 6%
Ventilation 6%
Water Heat 7%
Cooling 13%
Heating 14%
Lights 26%
Other 13%

Why Focus on the Tropics?



Tropical climate zones where all twelve months have mean temperatures above 18 °C (64 °F).

Expanding Tropics

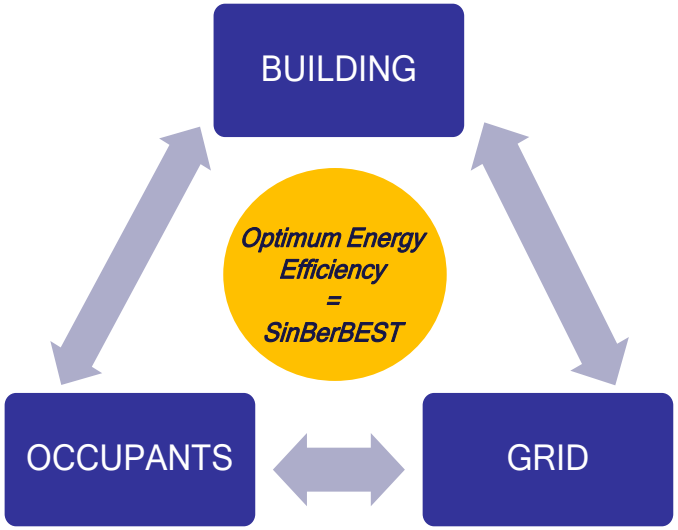
- 40% of the world's population lived in the tropics in 2008.
- By 2060 60% of the population will be in the tropics, due to high birth rates and migration.
- Since 1980 the climate-based “tropical” region has expanded towards the poles by ~172 miles, adding 8.5 million square miles.

GeoHive population statistics". http://www.geohive.com/default1.aspx.

http://www.independent.co.uk/environment/climate-change/expanding-tropics-a-threat-to-millions-761326.html

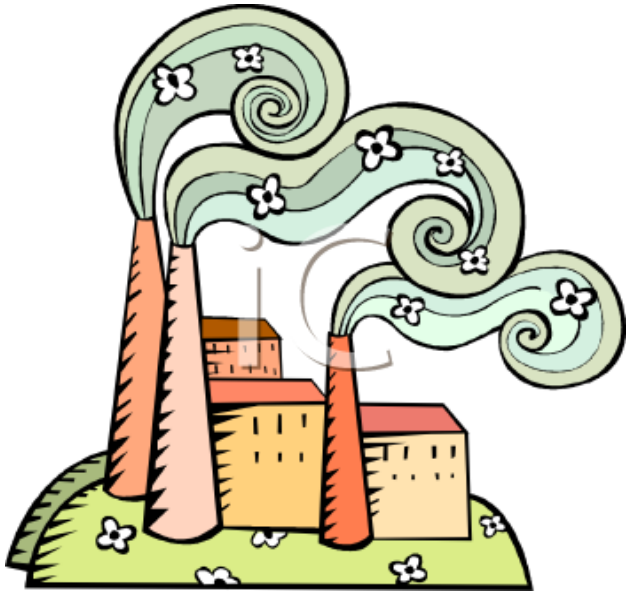
What is SinBerBEST?

- Emphasizes the cooperative optimization of the interactions between the ***Grid*****,** the ***Building*** and its ***Occupants,*** as an ***Ecosystem.***
- Enables flexible, constrained optimization of energy consumption, CO_2 emissions, productivity, safety, comfort, healthfulness, and the entire building lifecycle.



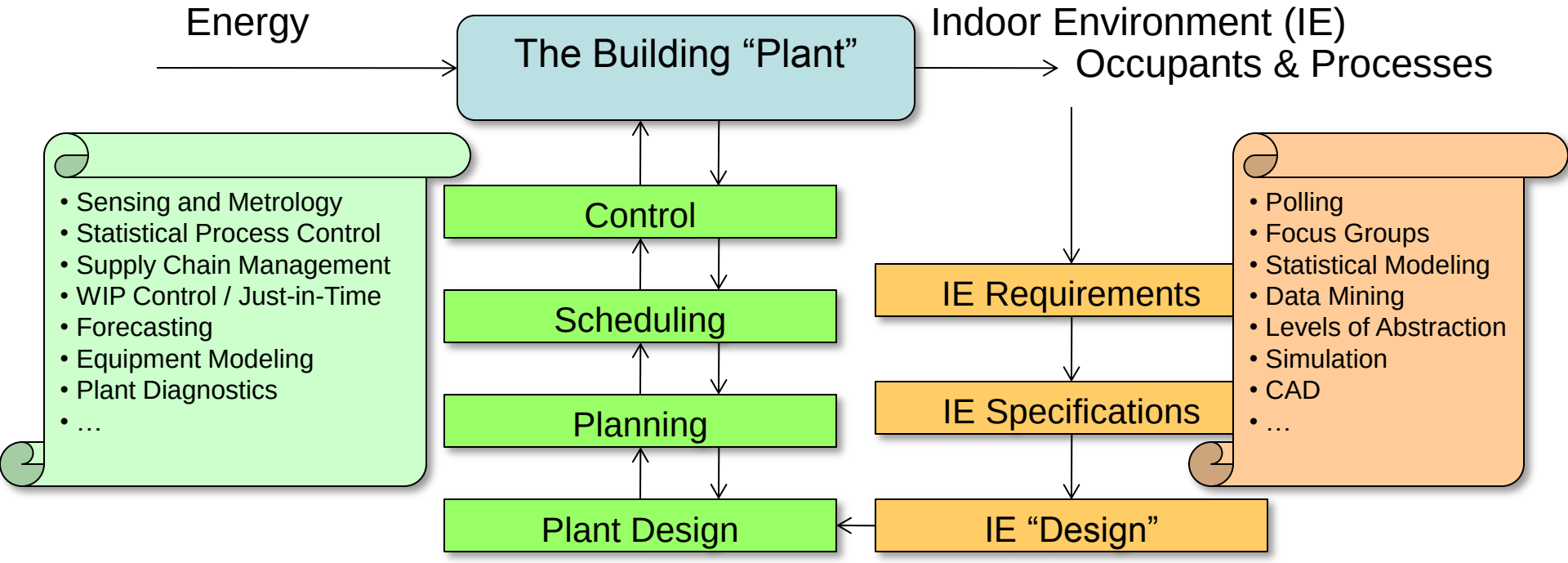
The SinBerBEST View

=

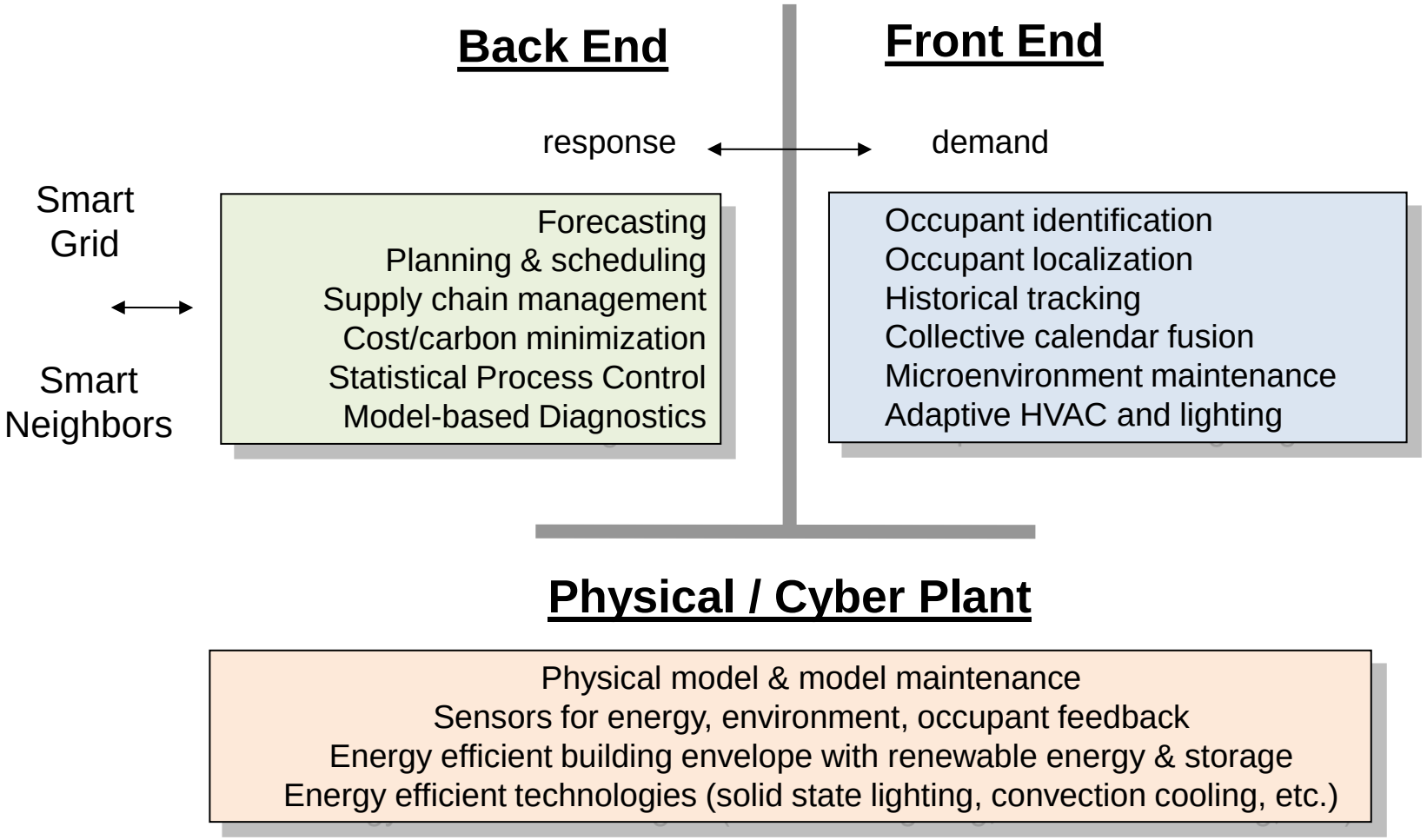


The SinBerBEST Vision

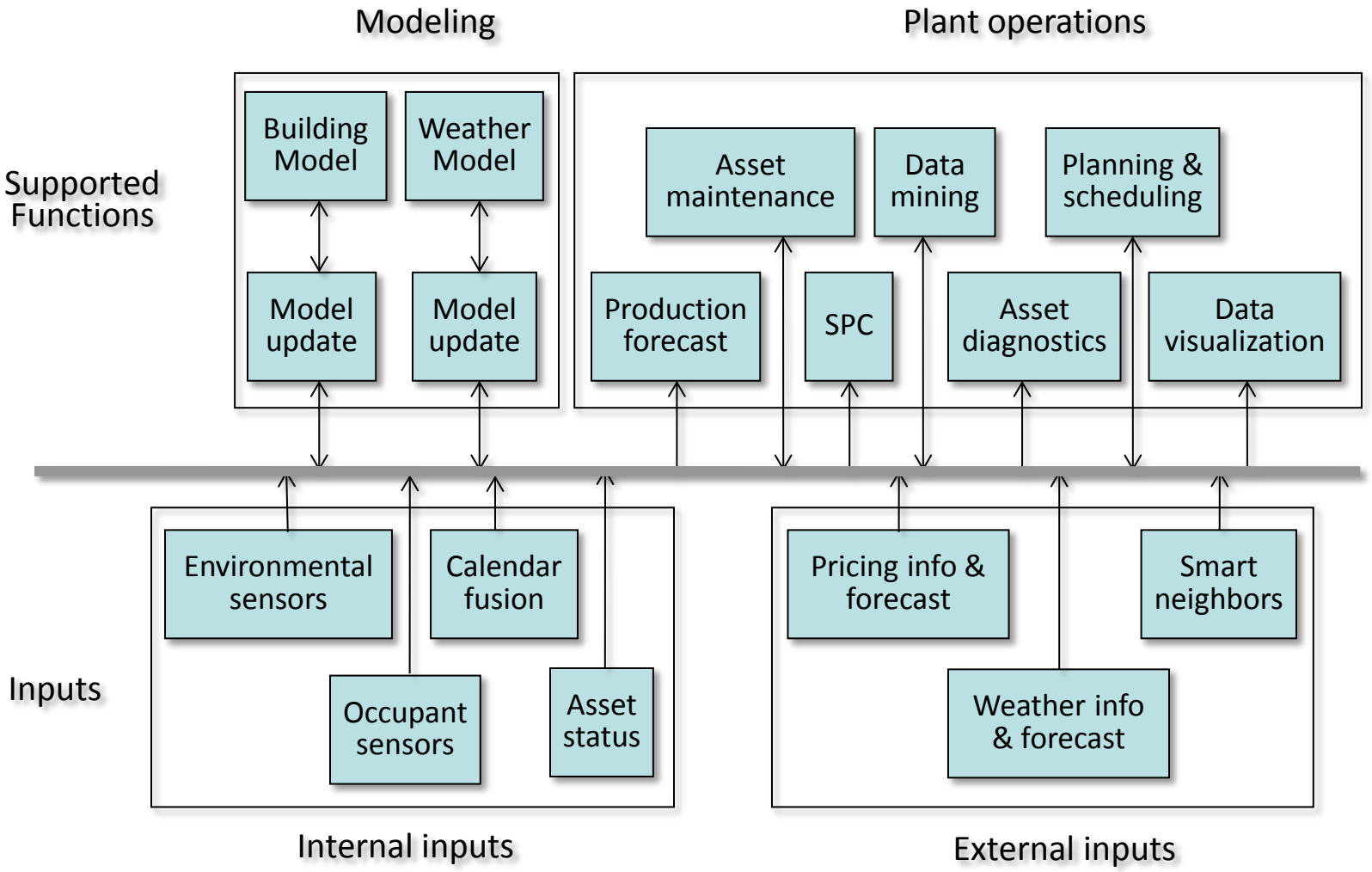
A *building* responding to *demand* from *occupants & processes*



Three Aspects of a SinBerBEST Building

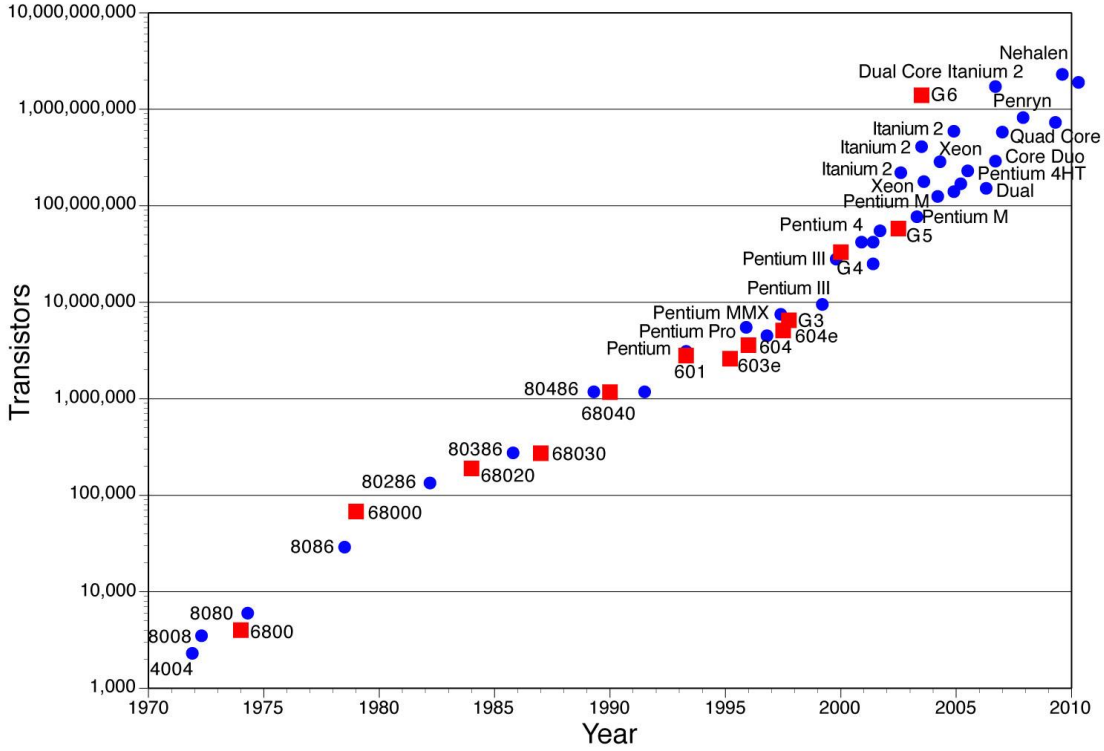


There is an App for that…

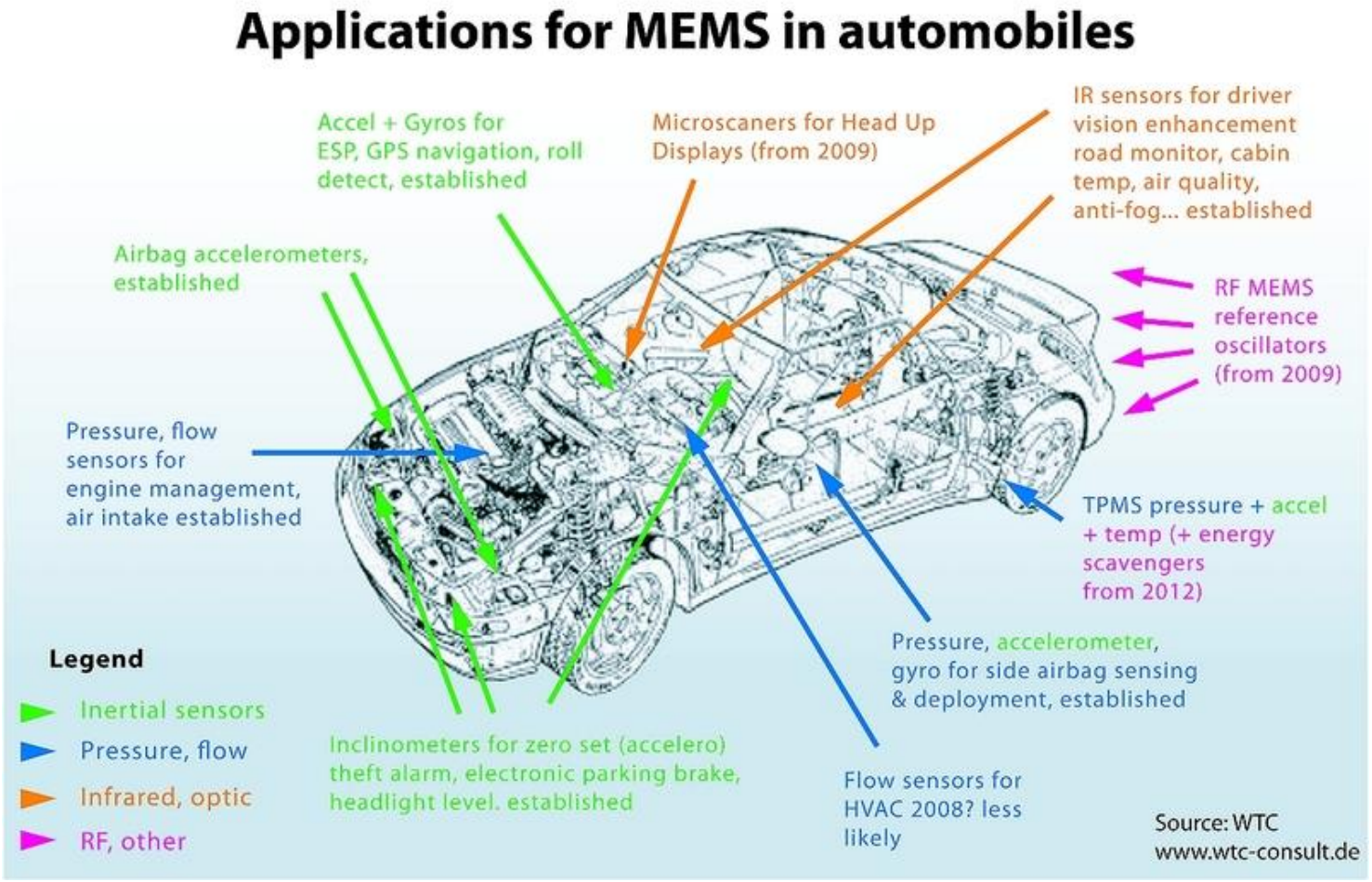


How is our approach related to Moore's law?

- Information technology does not just “inform”, it also drives action *and* technology.
- ICs, MEMs, Nanotechnology, ubiquitous electronics, (big) data mining are just few examples.

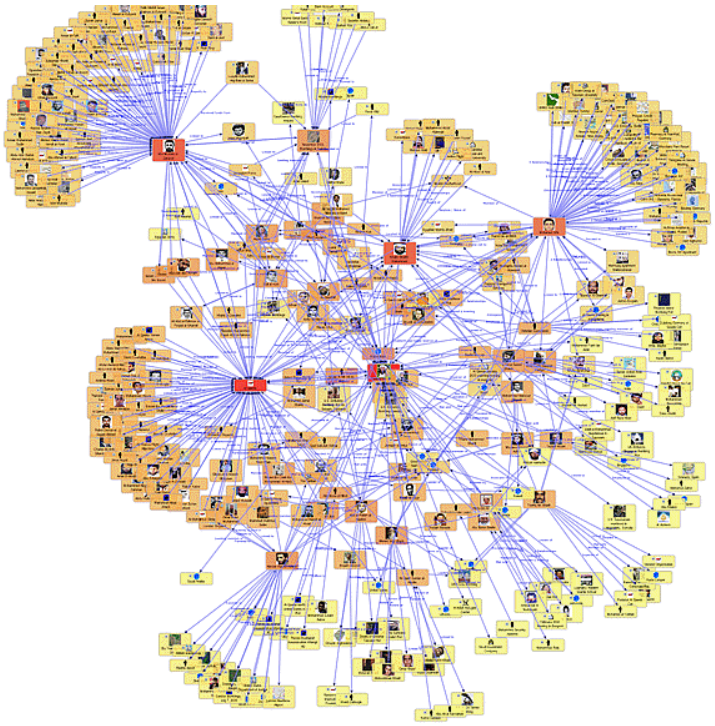


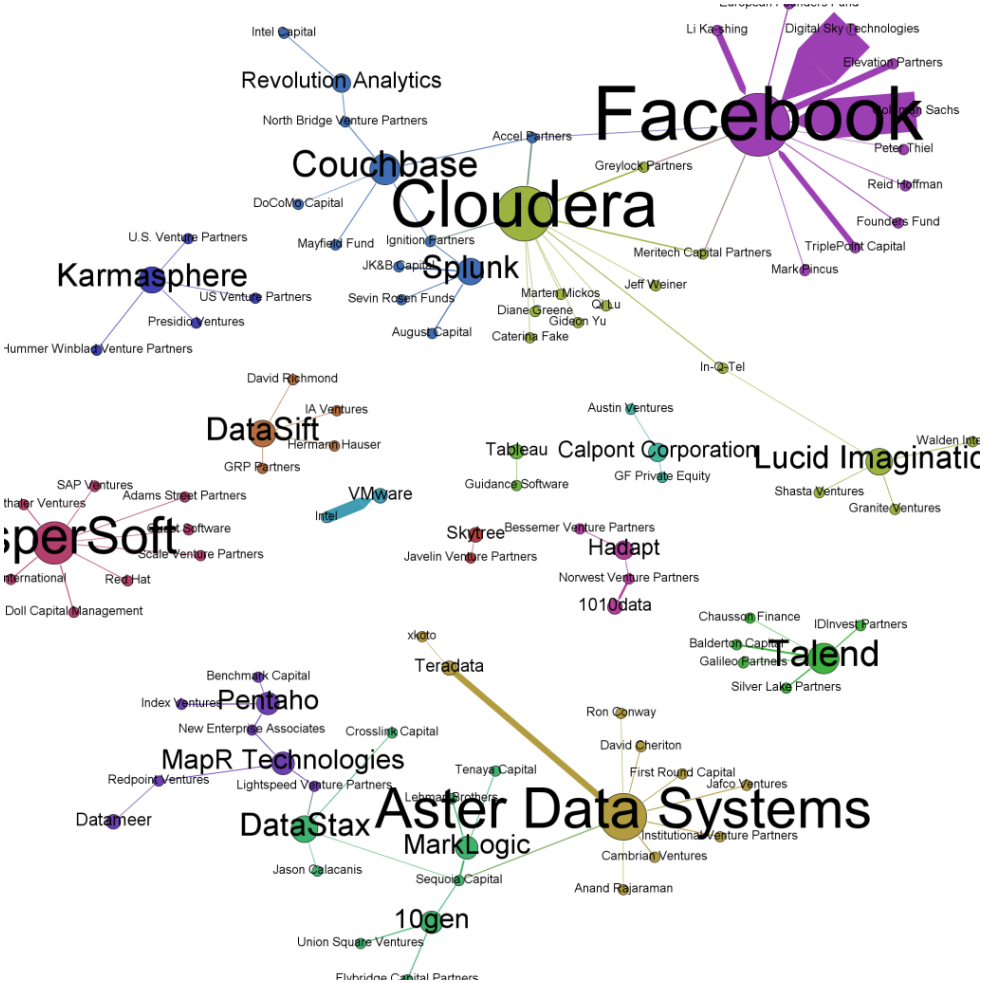
An Example where Computation and Actuation Meet…



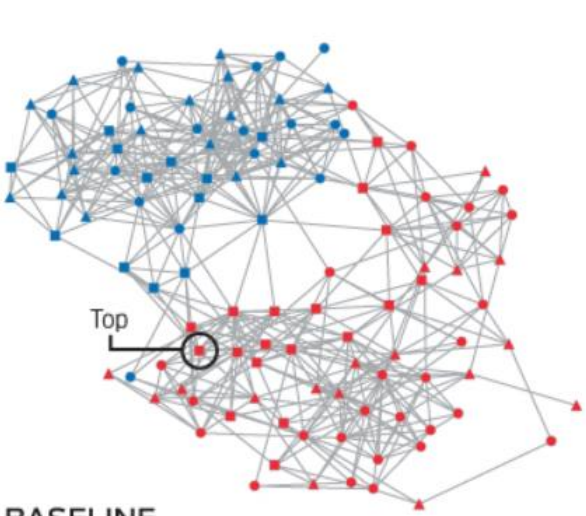
Closer to our living spaces…

…and towards an Expanding Ecosystem…

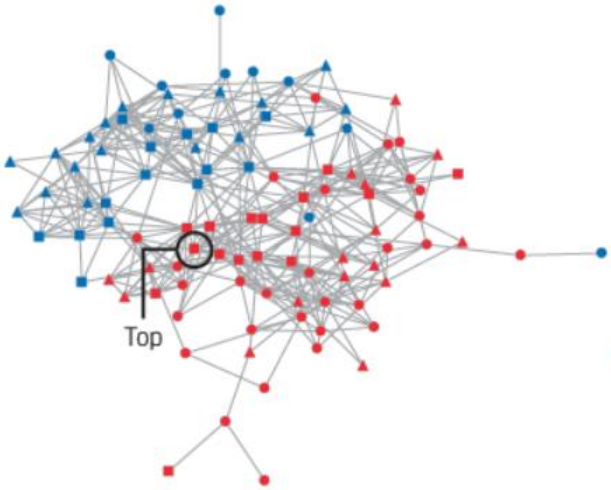




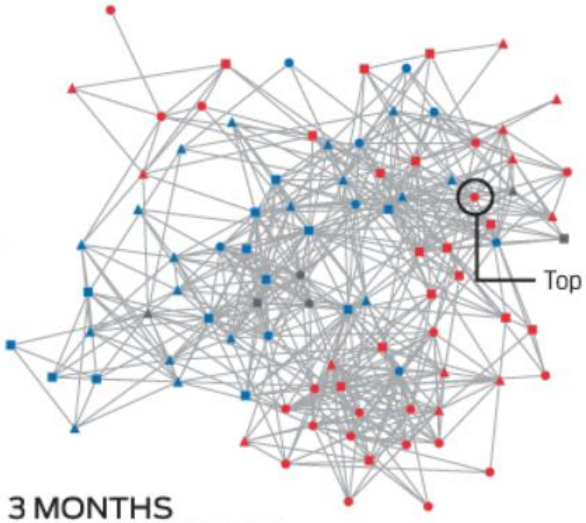
…that includes People



BASELINE
Average distance to top: 5.9 steps



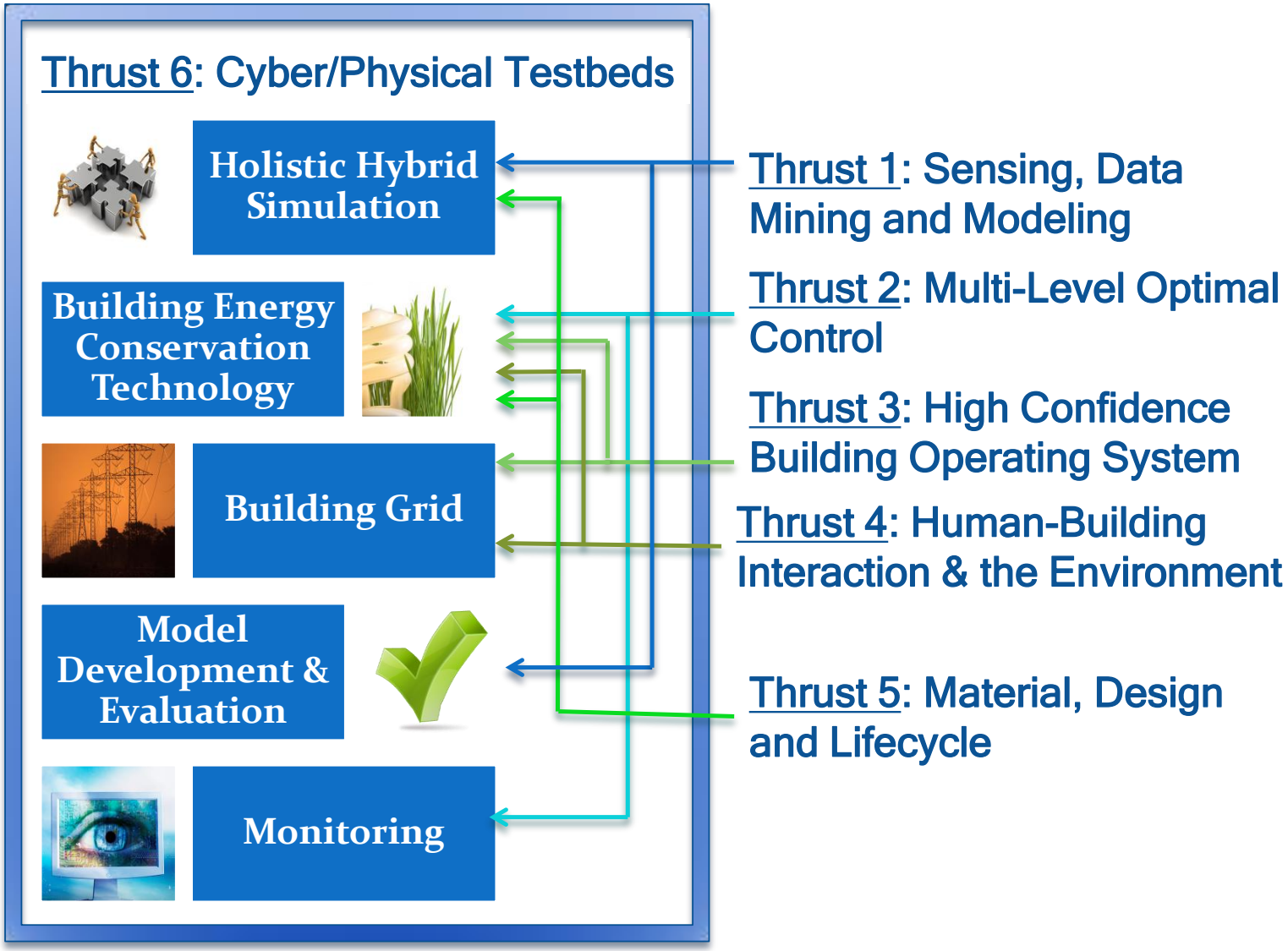
1 MONTH AFTER FEEDBACK
Average distance to top: 5.0 steps



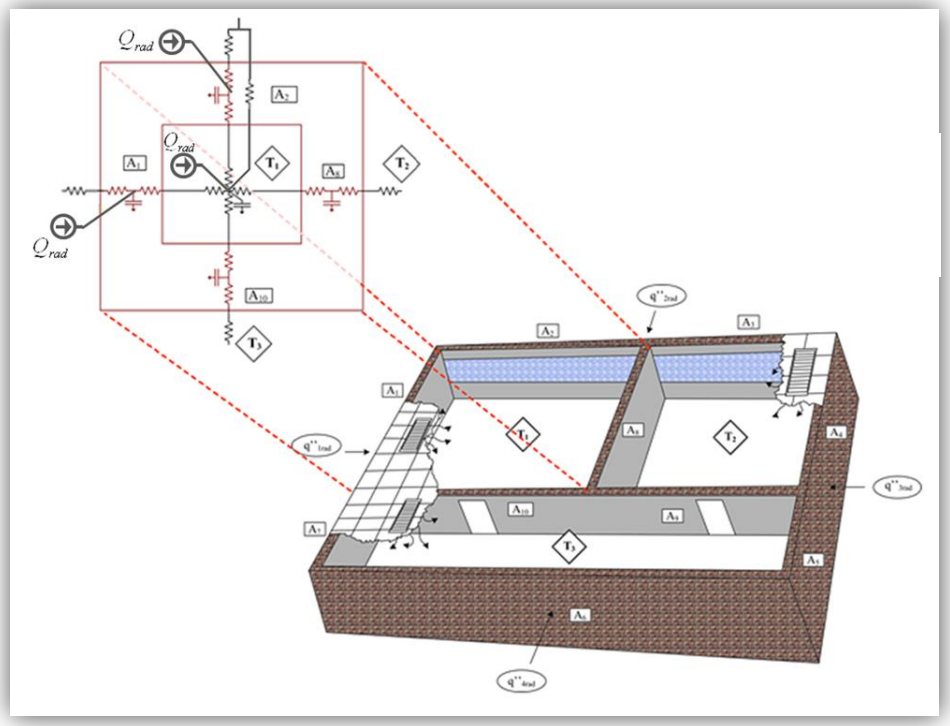
3 MONTHS AFTER FEEDBACK
Average distance to top: 3.7 steps

Can Technology Make You Happy?
Yes, and it can make your office a better place to work, too
By Kazuo Yano, Sonja Lyubomirsky, Joseph Chancellor /
IEEE GRID, December 2012

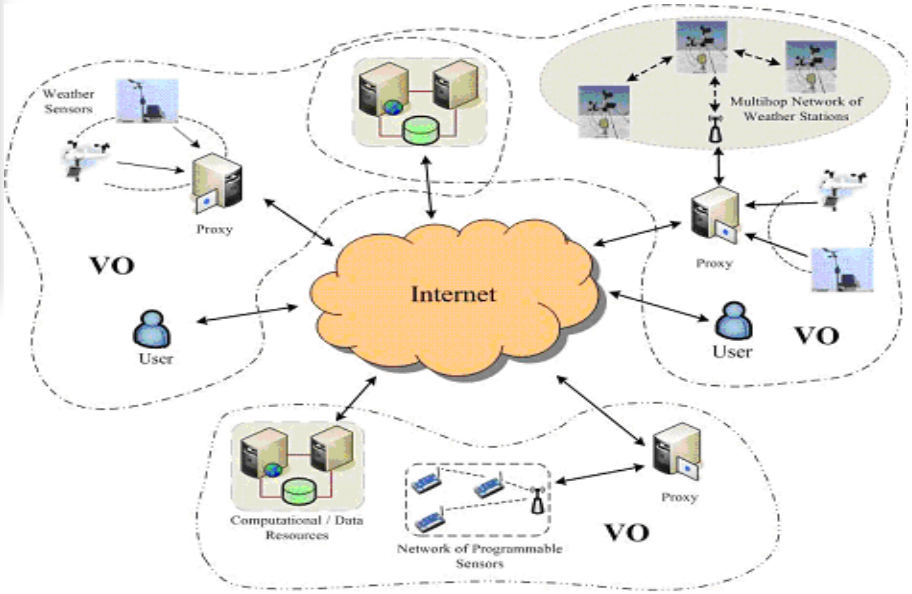
SinBerBEST Research Thrusts



BEST Successes - Examples

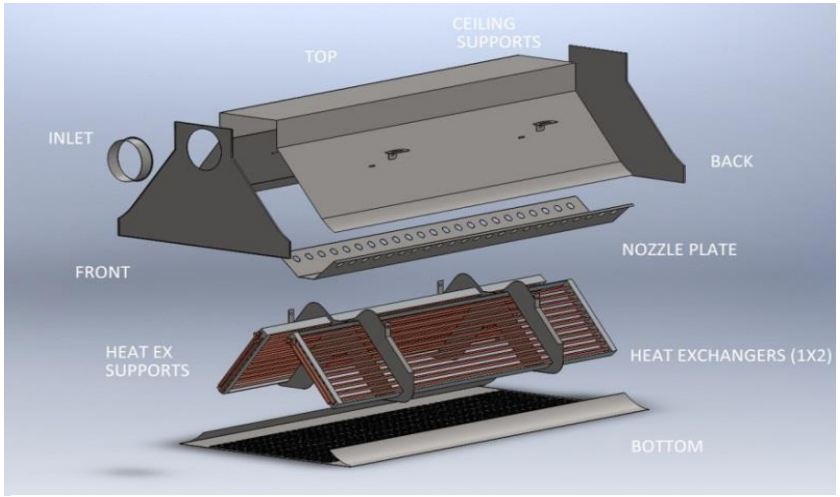


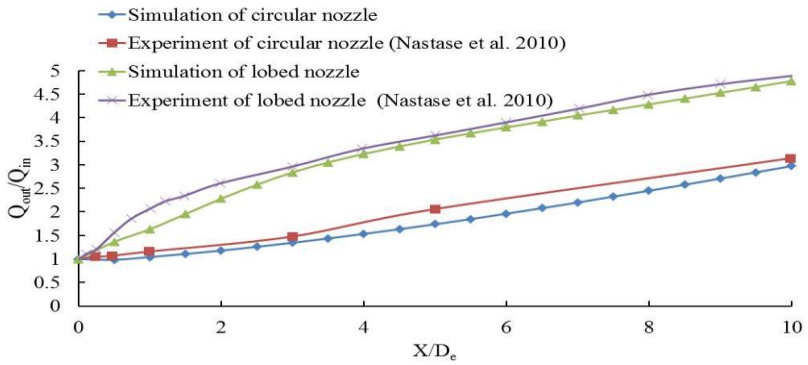
Linking and Modeling Smart Spaces
(Thrust 1 &2, with Intellisys/NTU)



BEST Successes - Examples

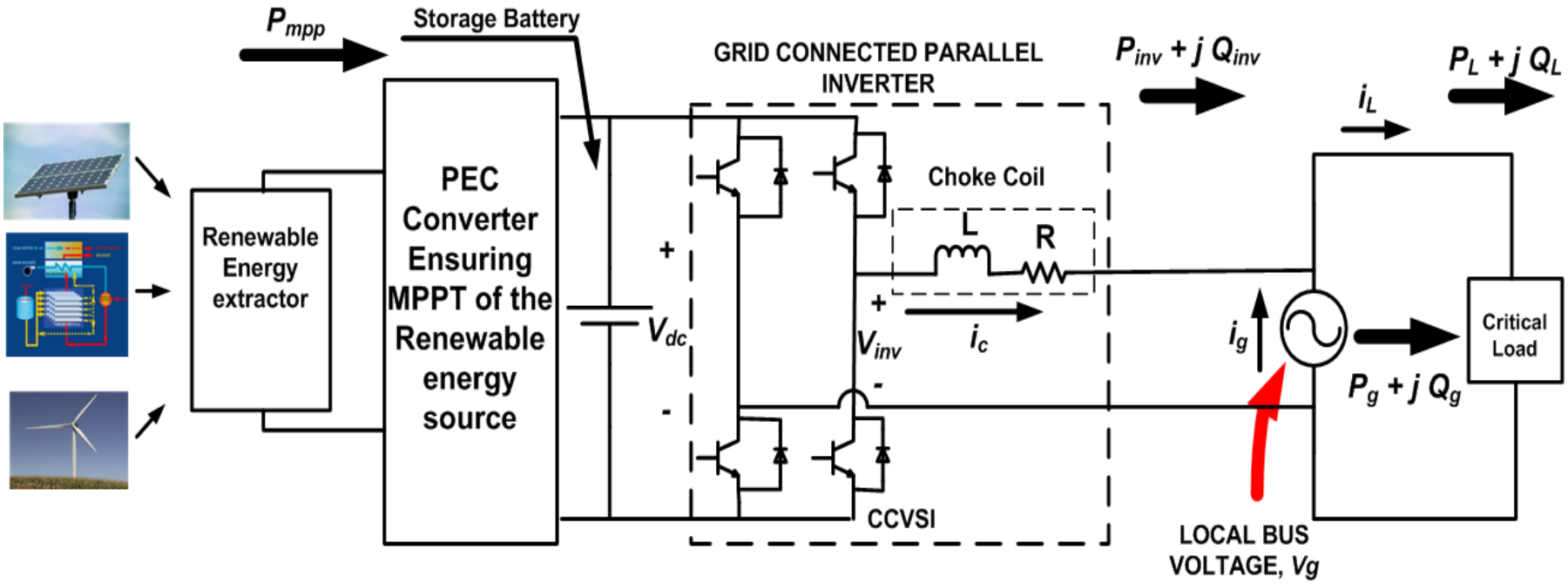
Design and Cooperative Control of Active Chilled Beam AC
(Thrust 2, with NTU)





BEST Successes - Examples

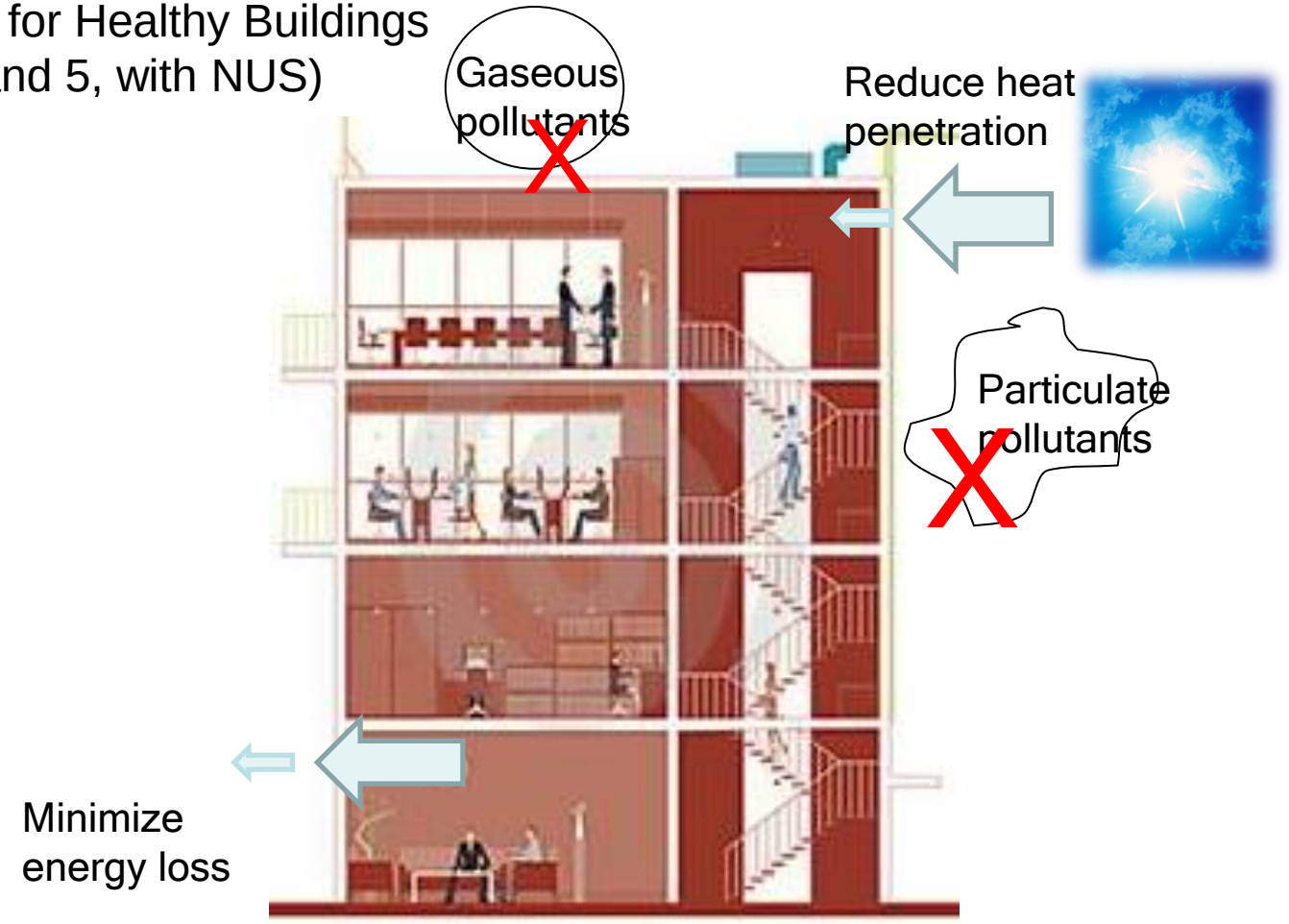
Grid – Building Interaction
(Thrust 3, with NUS)



Schematics of the grid connected PV inverter with MPPT tracking system

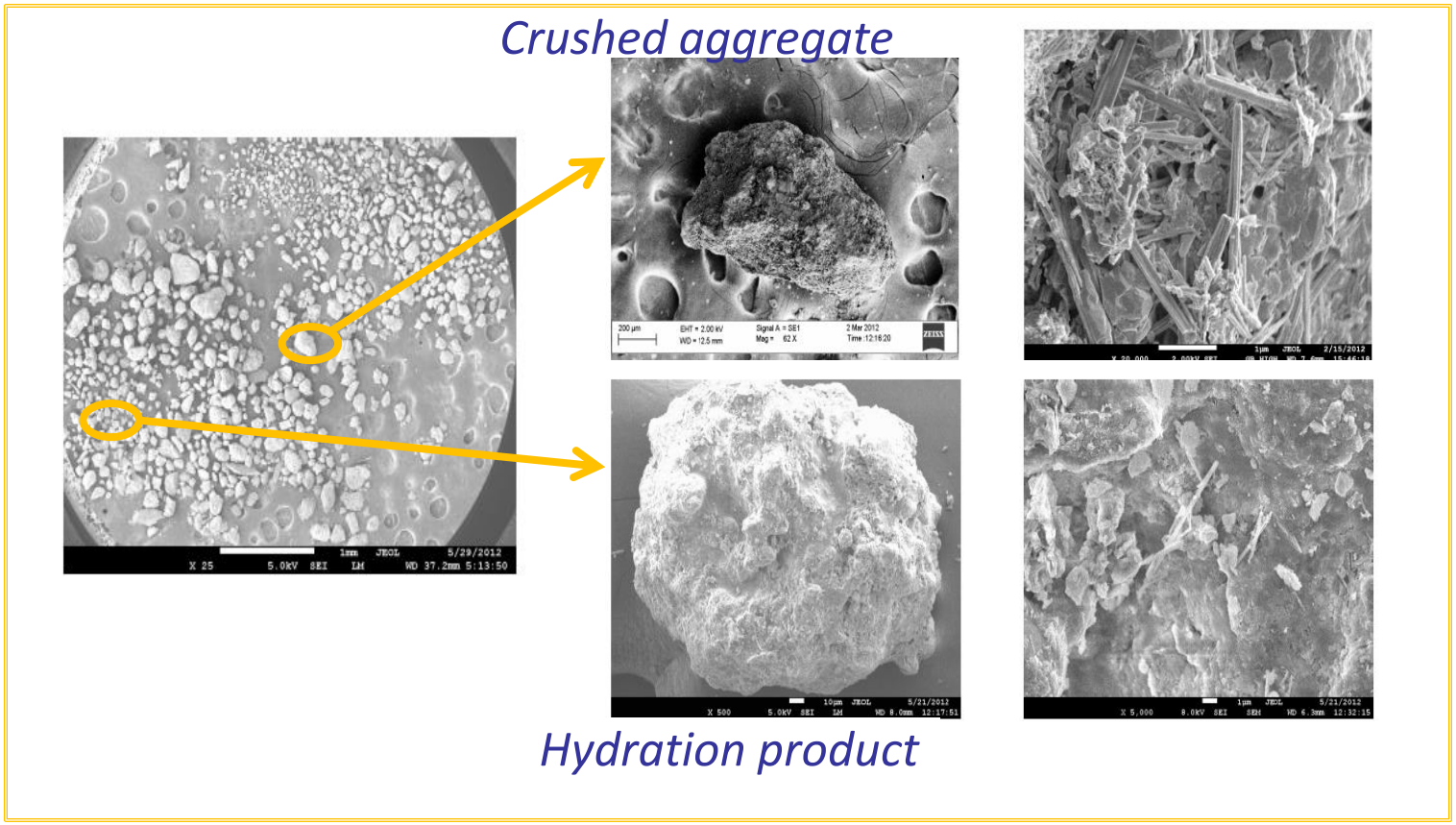
BEST Successes - Examples

Smart Materials for Healthy Buildings
(Thrust 4 and 5, with NUS)



BEST Successes - Examples

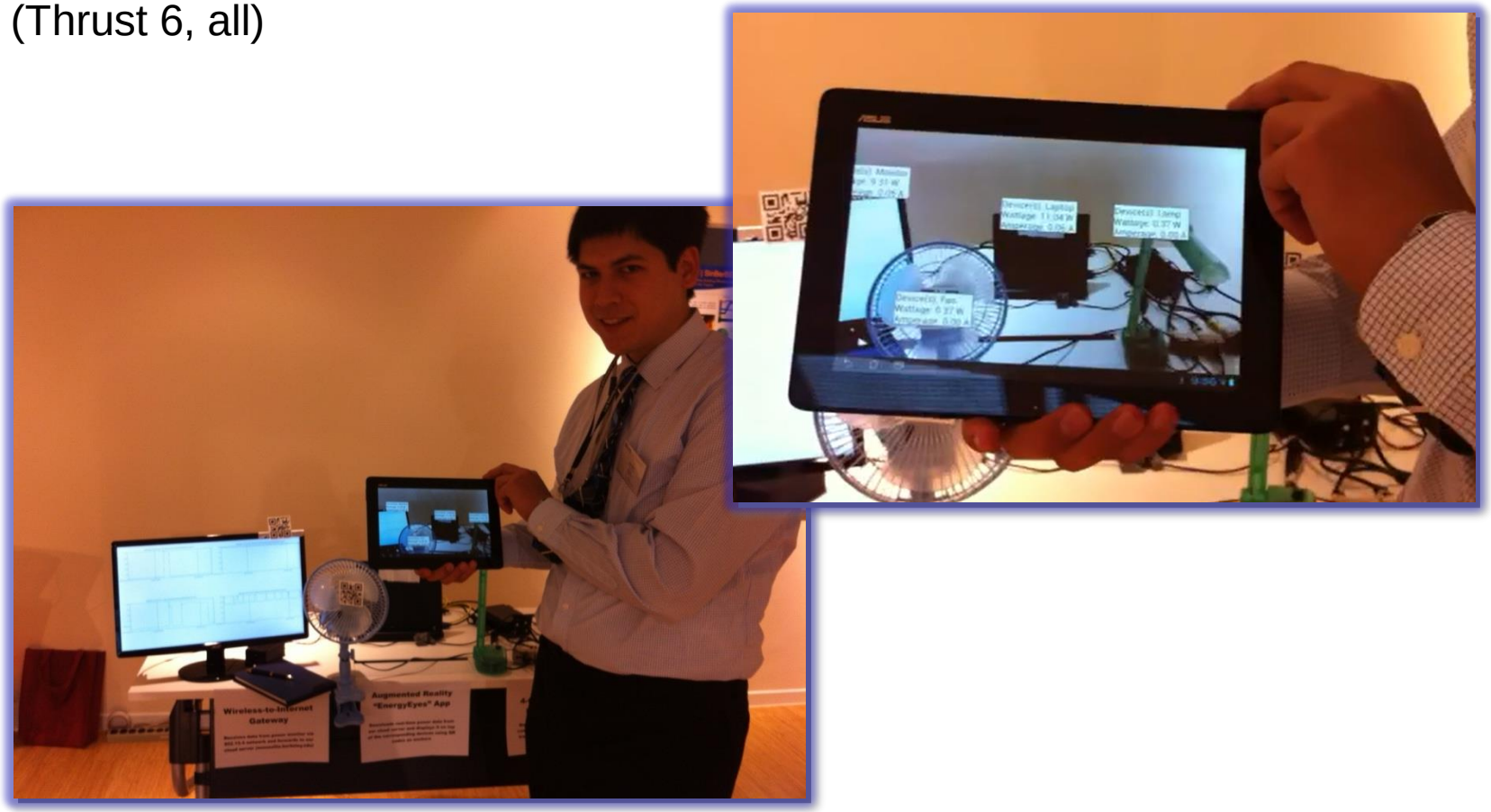
Reducing Lifecycle Environmental Impact
(Thrust 5, with NUS)



SEM micrograph of Recycled Concrete Fines

BEST Successes - Examples

Shared Test Bed, Enhanced Reality Data View
(Thrust 6, all)



Wednesday, 9 January 2013

8:45 – 9:15	Opening of Workshop Welcome Remarks and Overview by BEARS Director, **Costas Spanos**
9:15 – 9:45	Sensing, Data Mining, and Modeling **Alex Bayen**
9:45 – 10:15	Multi-level Optimal Control **Lihua Xie**
10:15 – 10:45	High Confidence Building Operating System **King-Jet Tseng**
10:45 – 11:00	Break
11: 00 – 11:30	Human-Building Interaction & the Environment **Bill Nazaroff, Victor Chang**
11:30 – 12:00	Materials, Design and Lifecycle **Khalid Mosalam, Sing Ping Chiew**
12:00 – 12:30	Cyber/Physical Test Bed **Khalid Mosalam, Sing Ping Chiew**
12:30 – 13:30	Lunch

Thank You!