Energy Efficiency Solutions for Buildings

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Outline

Honeywell

- Energy Efficiency Research in Honeywell
  - Honeywell Automation and Control Solutions (ACS)
  - Energy efficiency technologies
- Energy Efficiency in Buildings
  - Control approach: HVAC Control
  - Service approach: Remote Analytics
  - Building Information Model (BIM)
- Smart Grid Enabled Solutions
  - Home Energy Management

Automation and Control Solutions

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Process Solutions	Building Solutions	Sensing and Control	ECC*	Security	Life Safety
Process Controls	Buildings	Speed and Position Sensors	Thermostats	Motion / Human Presence Sensors	Fire/Smoke Sensors
Distributed Control	Instant Alert	Accelerometers	Building Automation	CCTV/ DVR User Interfaces	System Panels
EXPERION PKS Process Knowledge System		Pressure Sensors	Water Control	Control Systems	Home Medical Care
			Gas Valves		

[Buildings management systems]

[Controls for homes and buildings]

*ECC = Environmental Combustion Controls

Energy Efficiency Technologies

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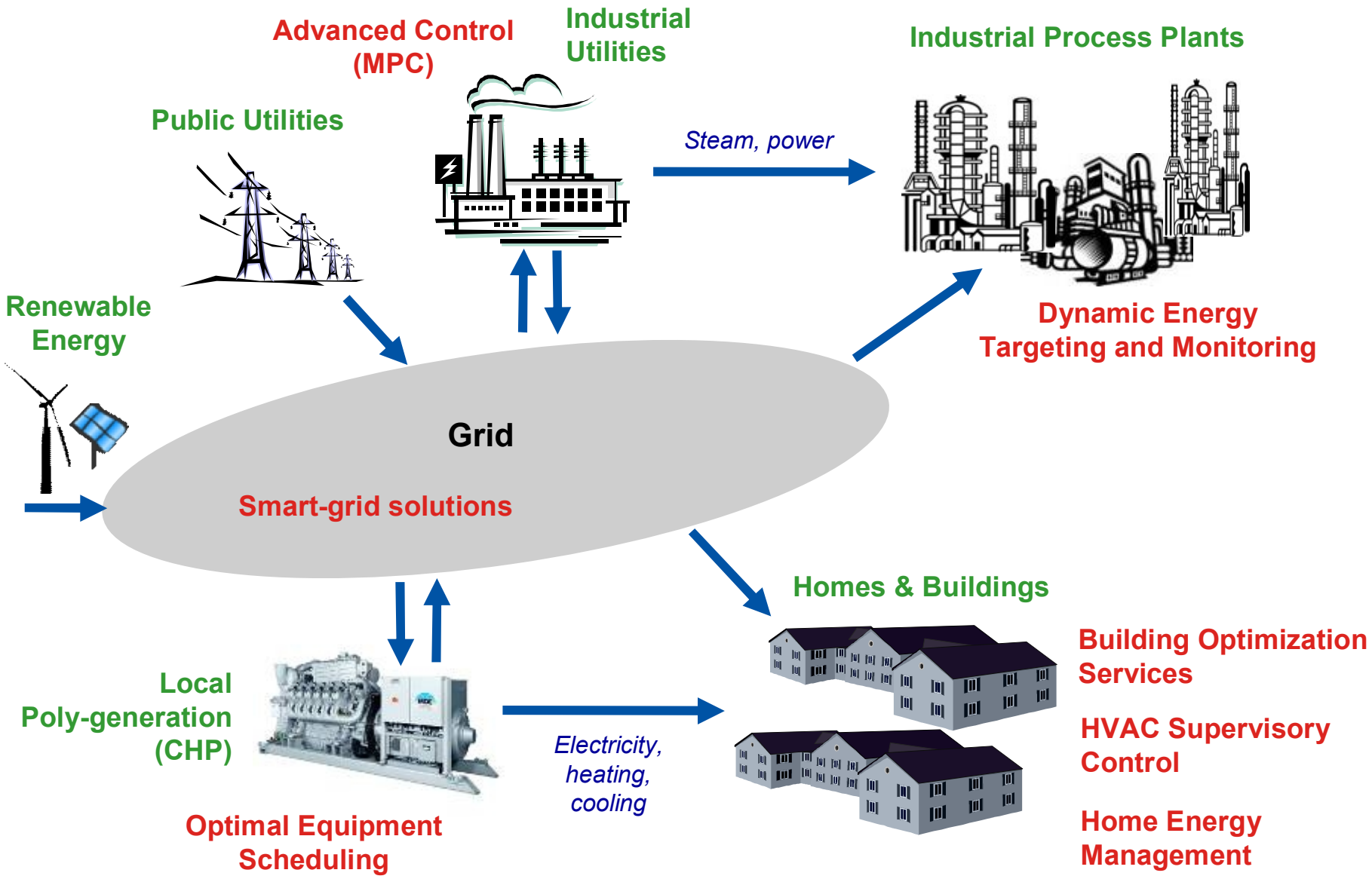

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Integrated Building Management

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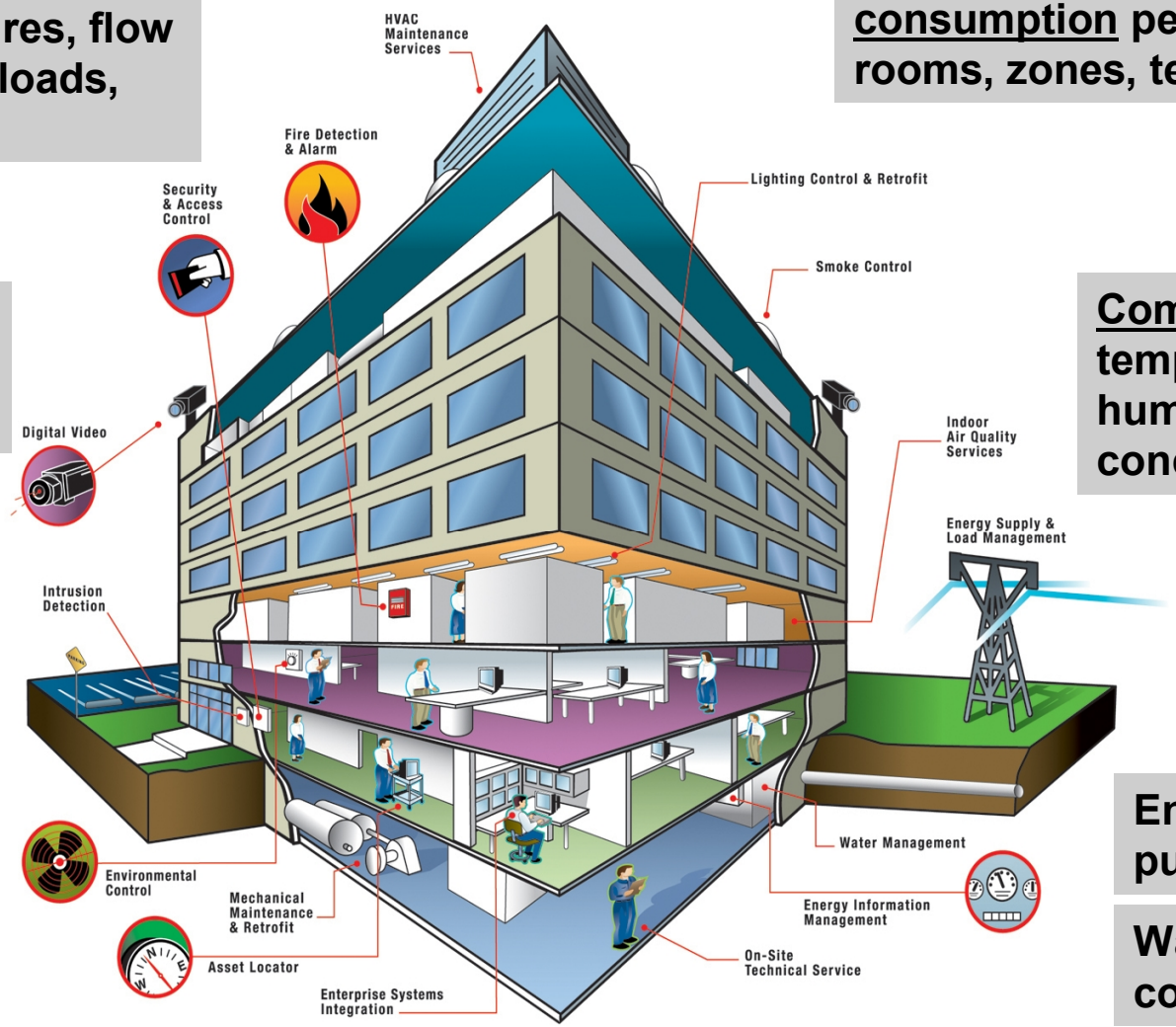
HVAC operation: set points, temperatures, flow rates, equipment loads, on/off schedules

Break-down of electricity consumption per floors, rooms, zones, tenants, etc.

Security: Access logs Video recordings



Comfort: temperature, humidity, CO_2 concentration

Energy purchases

Water consumption

ENTERPRISE Buildings Integrator

Energy Efficiency in Buildings

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- **Terminology**
  - **Efficient energy use** = using less energy to provide the same level of service … *e.g. by using more energy efficient appliances, insulating the home, optimal control of appliances, etc.*
  - **Energy conservation** = using less energy to achieve a lesser energy service … *e.g. through behavioral change*

- **Approaches to Energy Efficiency**
  - **Monitoring and control** of major energy loads (heating, ventilation, air conditioning, lighting, …)
  - **Building optimization services** – systematic performance monitoring aiming at identification of faults and their elimination

HVAC Control

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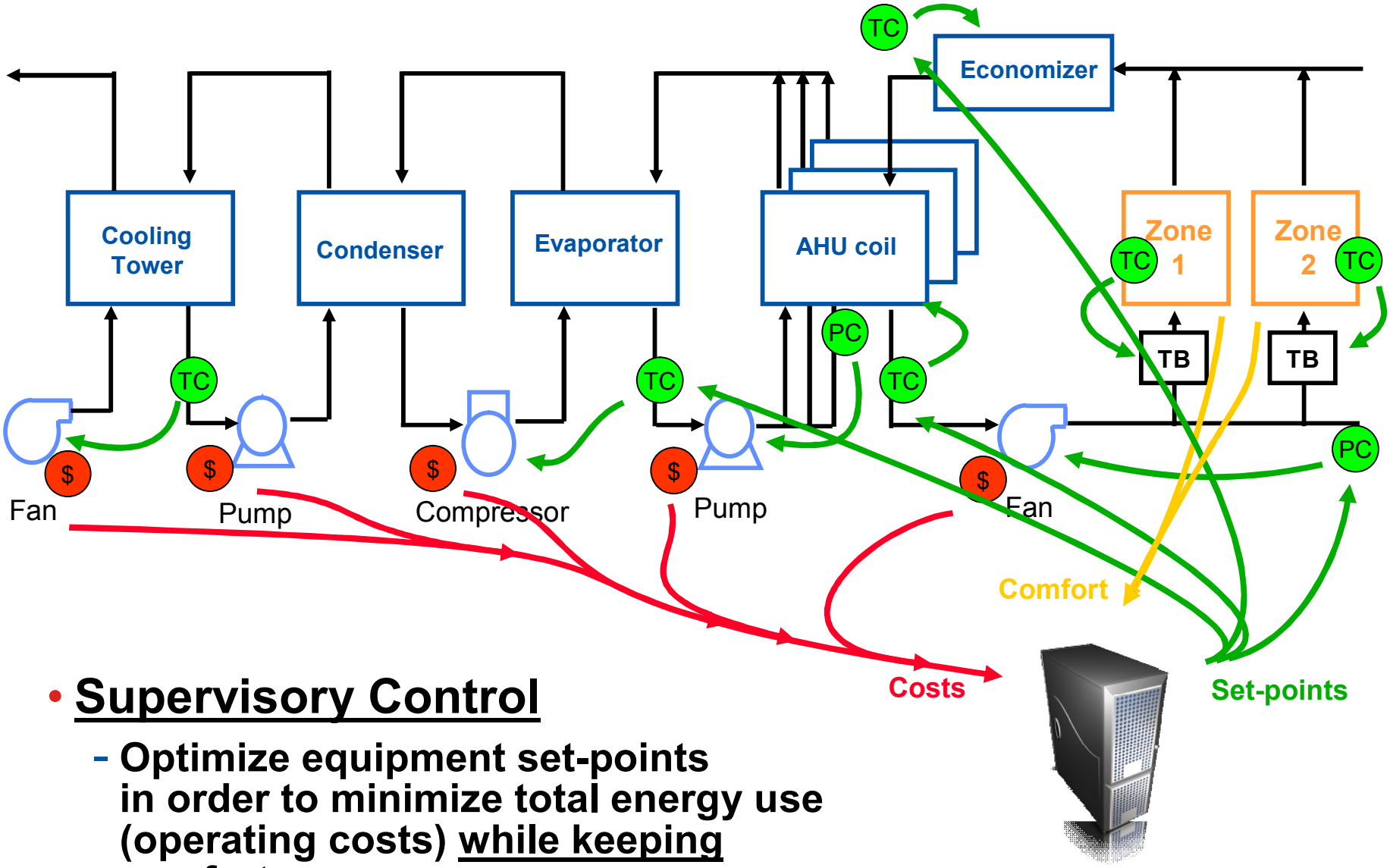

- **Supervisory Control**
  - **Optimize equipment set-points in order to minimize total energy use (operating costs) while keeping comfort**

Value of Building Optimization Services

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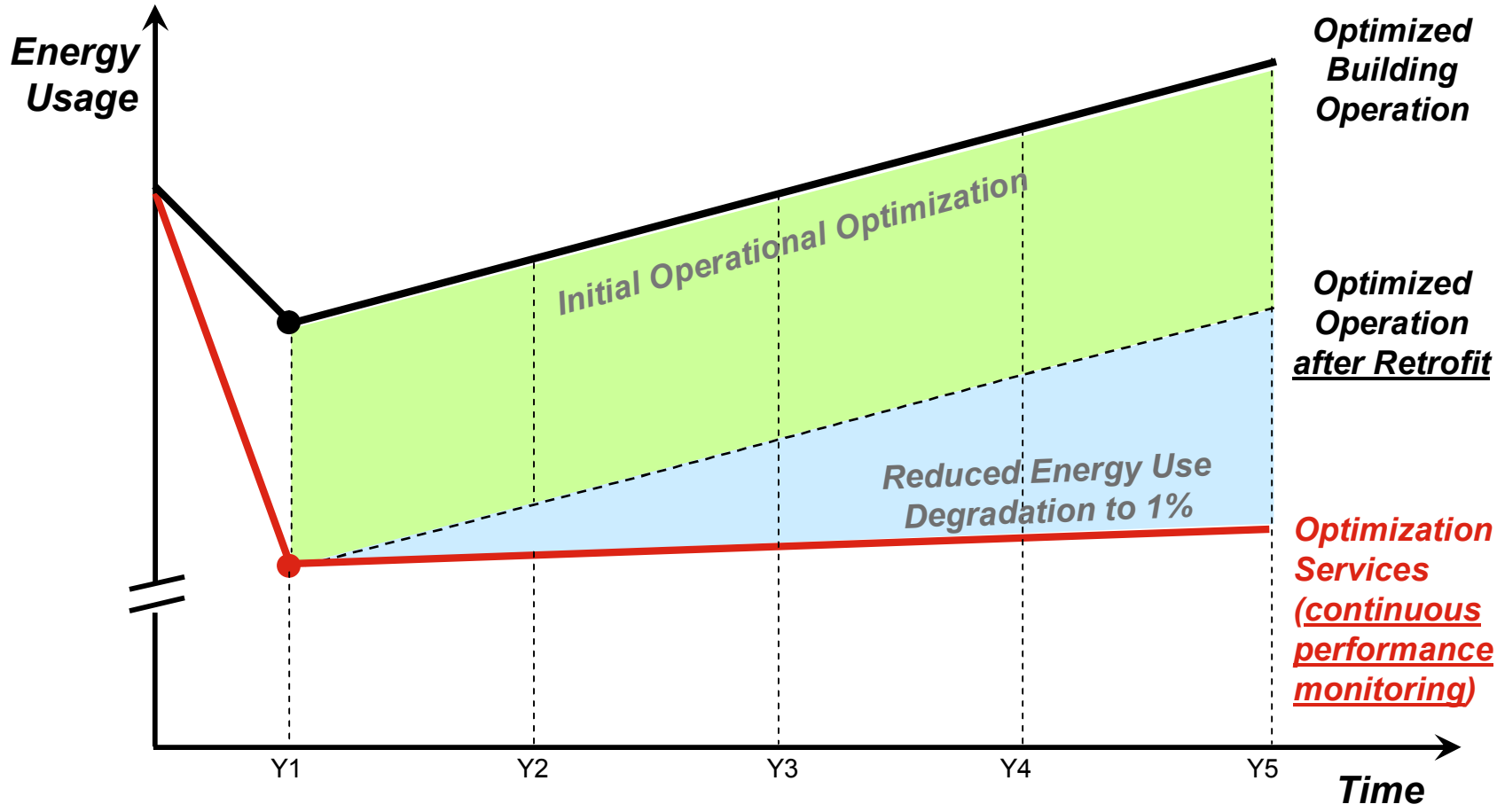

Building Performance Monitoring

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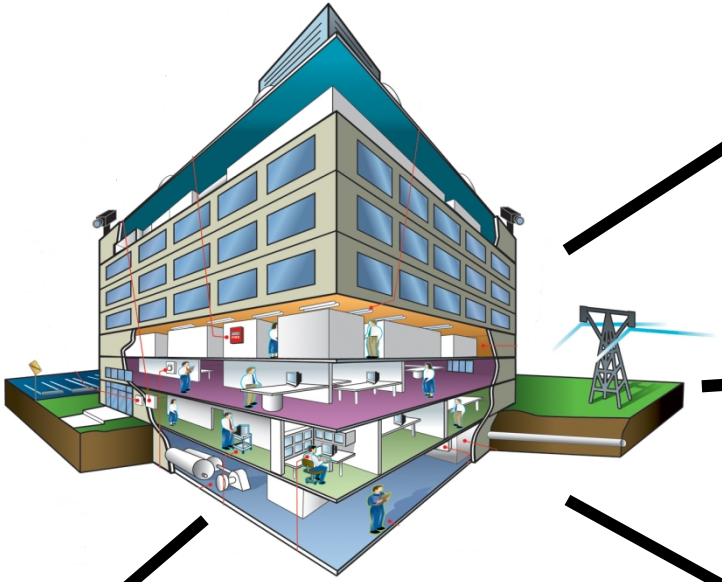
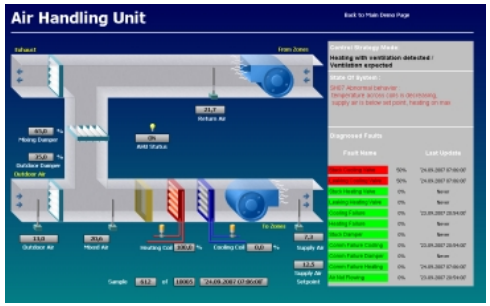
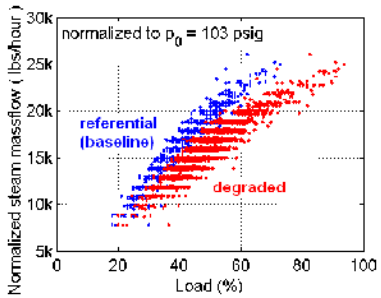


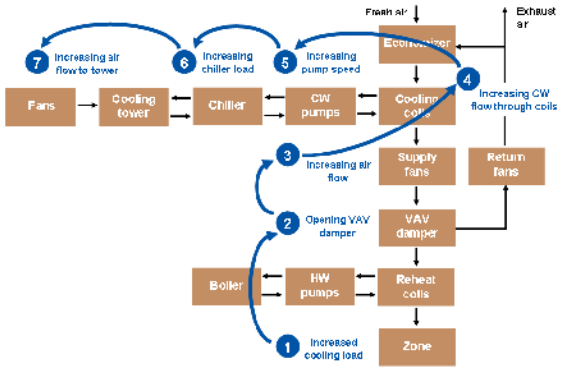
1 **Fault Detection and Diagnostics**



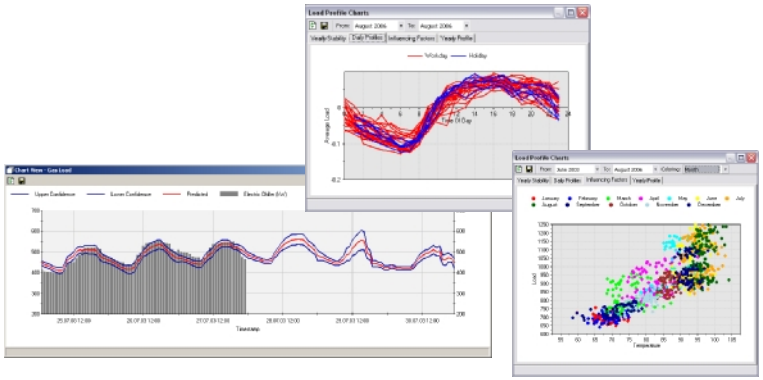
2 **Equipment Performance Monitoring**



3 **Control System Optimization**



4 **Energy Management**



Remote Analytics

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Boilers, chillers, air handlers, fans, pumps, heat exchangers, etc.

HVAC equipment

HVAC control system

Sensor readings

Control signals

Sampling period depends on dynamics of operation; from 1 minute to 1 hour

Remote Server

Historical Database

Analytics

Automated service 24/7

Automated fault detection and diagnosis (AFDD)

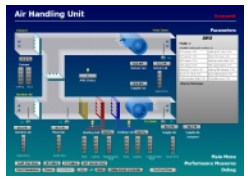
Assessment of degraded performance

Technician

Fast loop

Actions

- Equipment inspection
- Repair / cleaning



Summary of the worst performing pieces of equipment, detected faults and inefficiencies + corresponding costs

Slower loop

Building owner

Actions

- Investment decisions
- Replacement / retrofits

Performance measures

- Energy efficiency ratio (EER)
- Fouling rate of HEX
- Efficiency of fans, etc.

Faults

- Leaking valve
- Stuck damper
- Sensor out of calibration, etc.

Big Decision: Embedded / Local / Remote

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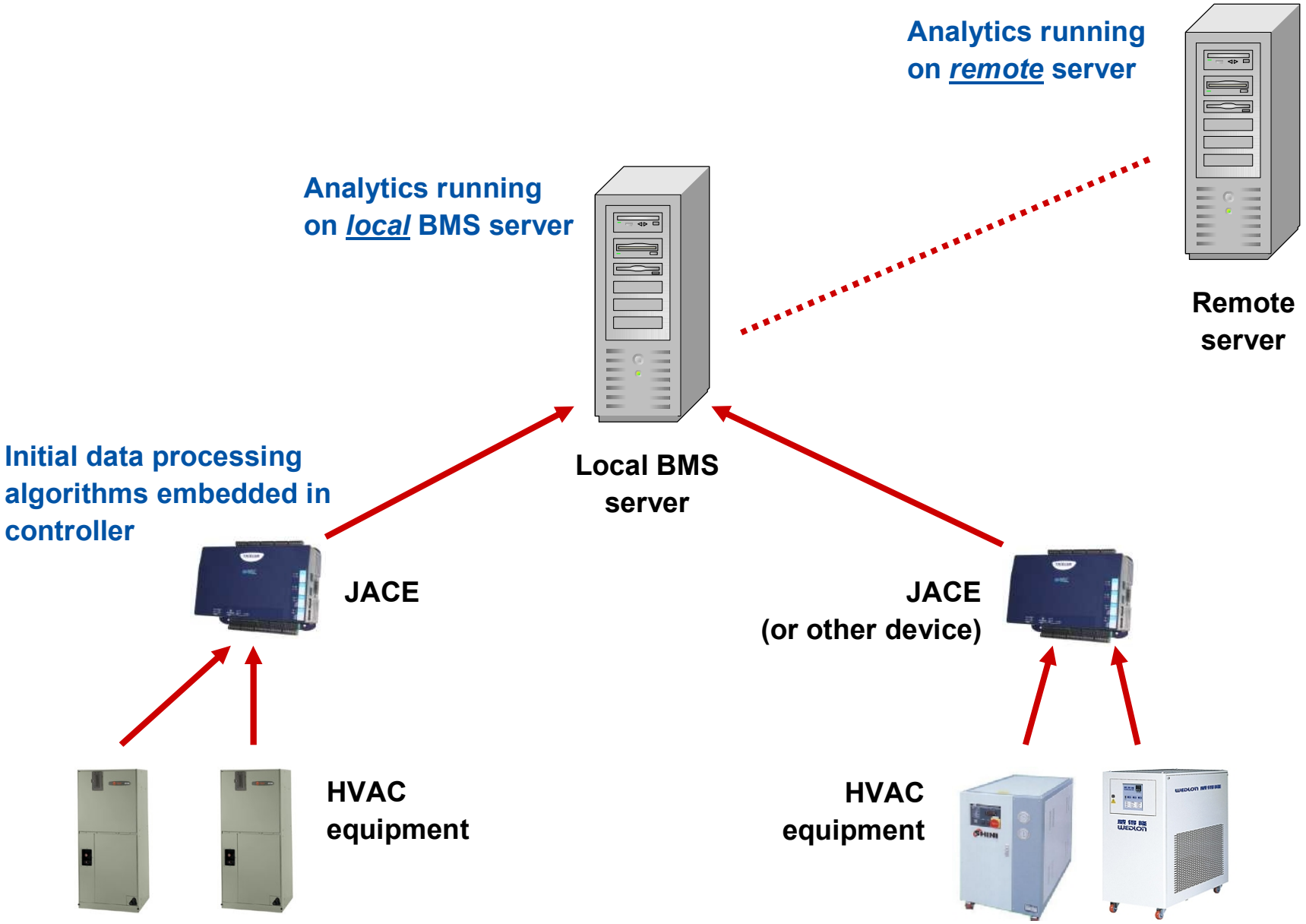

Information Exchange Losses

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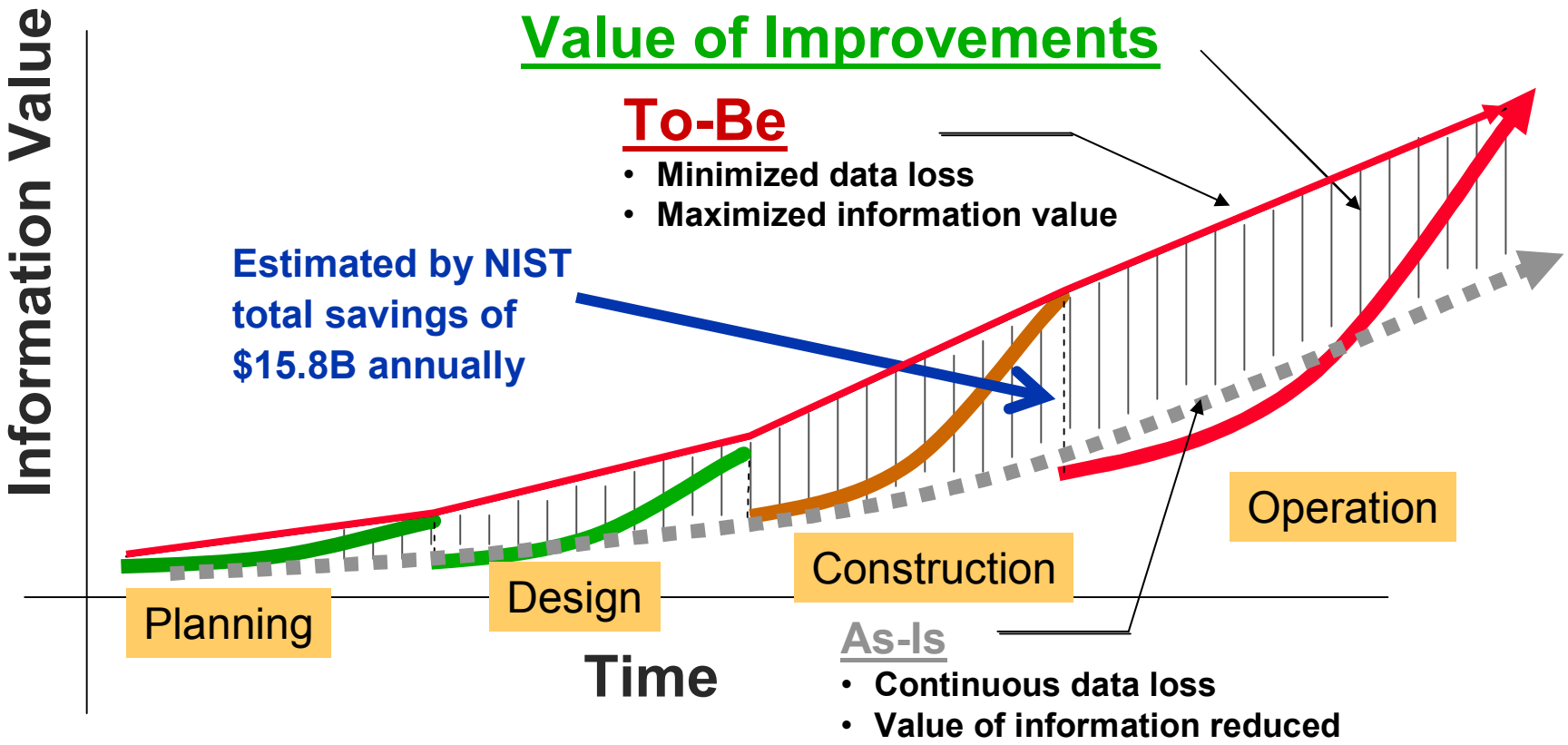

Why do we need a common language?

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- **Building Information Model (BIM) is the digital expression of a building**

- **BIM enables to get answers to questions like…**
  - *Where are all the Variable Air Volume (VAV) devices in the building?*
  - *Where is the VAV device that controls the space I'm in?*
  - *What Roof Top Unit (RTU) is it connected to?*
  - *What are the damper settings on each of the RTU's?*
  - *What zones have a drift of more than 2 degrees from set point?*
  - *Across the 500 sites in my enterprise, which of them have the I/O points required to support this diagnostic routine?*

Operational Drivers for BIM

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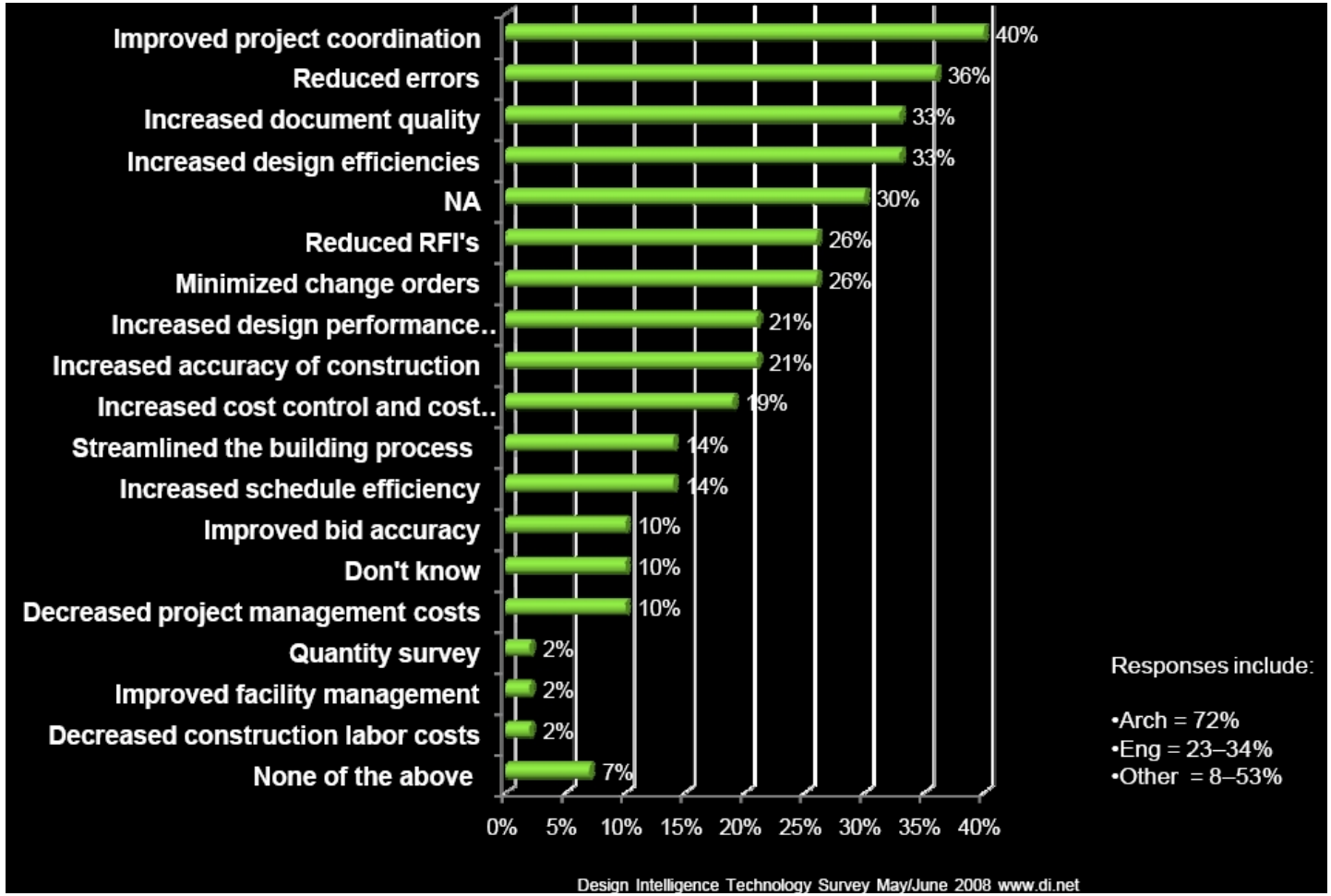
BIM is promoted by architects, designers, consultants, engineers …



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Smart Grid & Energy Positive Buildings

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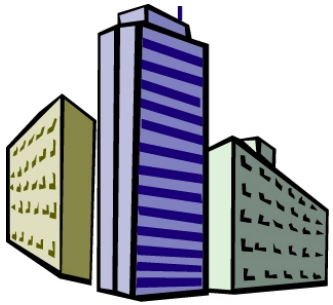
1 Residential or non-residential buildings

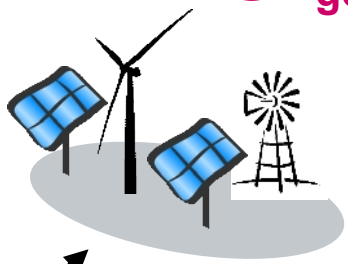


Load management:
- domestic networks
- interoperability of electric appliances
- user interfaces to influence people's behavior
- intelligent gateways for remote access

"Prosumer" = Producer + Consumer of electricity

Micro-storage
Vehicle-to-grid

2 Distributed renewable generation

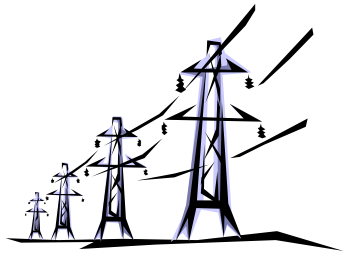


Different forms of ownership:
- single owner
- shared in a district
- leased by ESCO
- owned by the utility

4 Real-Time Data & Decision Support

New business models:
- energy brokers
- virtual power plants
- aggregators (representing multiple consumers)

Needs:
- stability of the network
- optimal resource scheduling
- coping with uncertainty



3 Smart Grid Electricity distribution

Future trends:
- coalescence of communication networks and energy grids
- homes and businesses actively participate in the control of the network

Thank you for your attention!

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