Smart sustainable campus

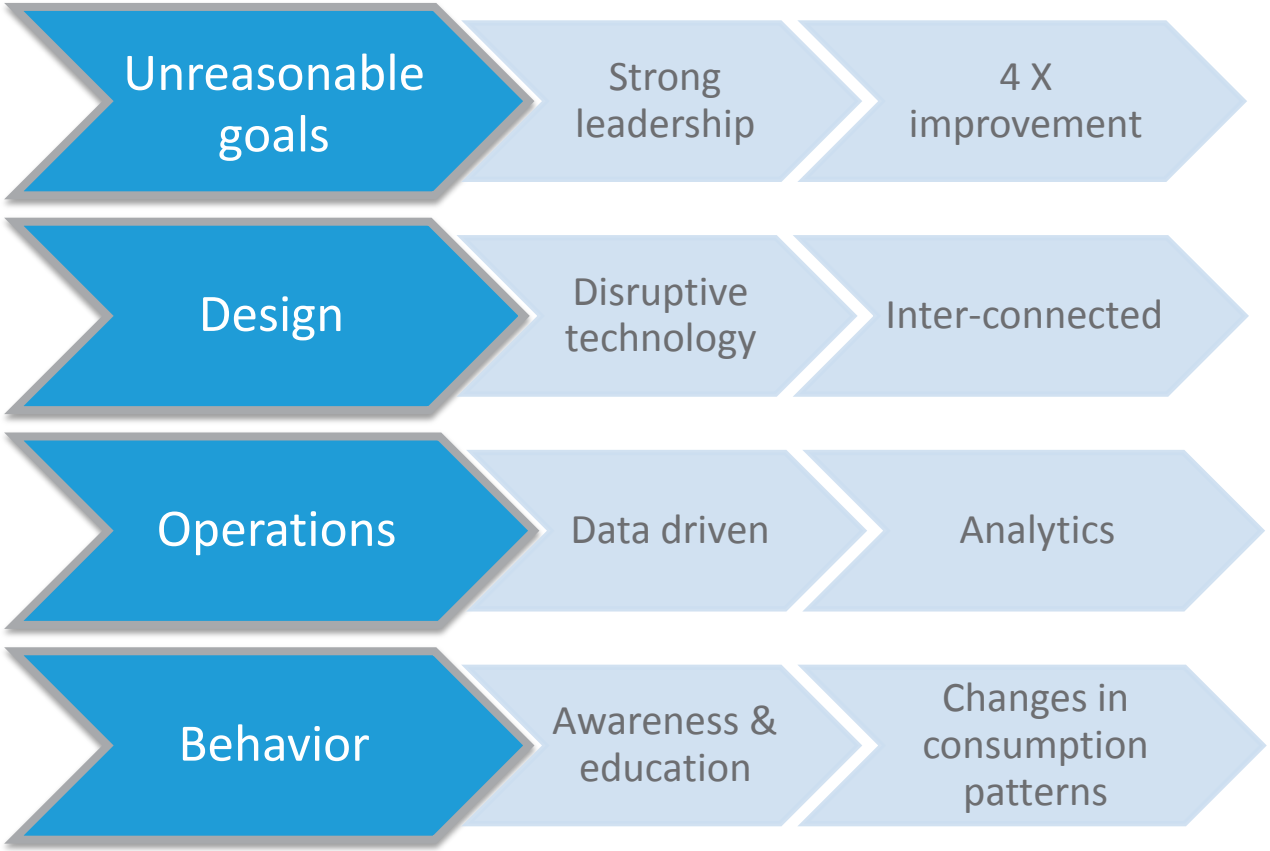
Powered by Data, Driven by Technology, & Sustained by Profits

Smart Cities: The Opportunity

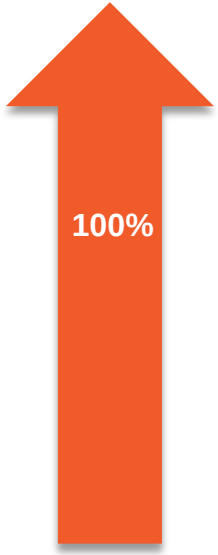
- Over 60% of India of 2030 is not yet built
- Massive urbanization, over 590 million people will live in cities by 2030
- Improve quality of life
- Improve productivity of people
- Improve public safety & security, disaster management
- Reduce wastage and improve resource consumption efficiency

Source: McKinsey report on India

Key attributes of smart Campuses/ Future cities



Impact of efficient design at Infosys - Growth from 2008 to 2014



Increase in no. of employees in India

Absolute Increase in energy

663 Million units (kWh) avoided

0.56 Million Tons of CO_2 emissions avoided

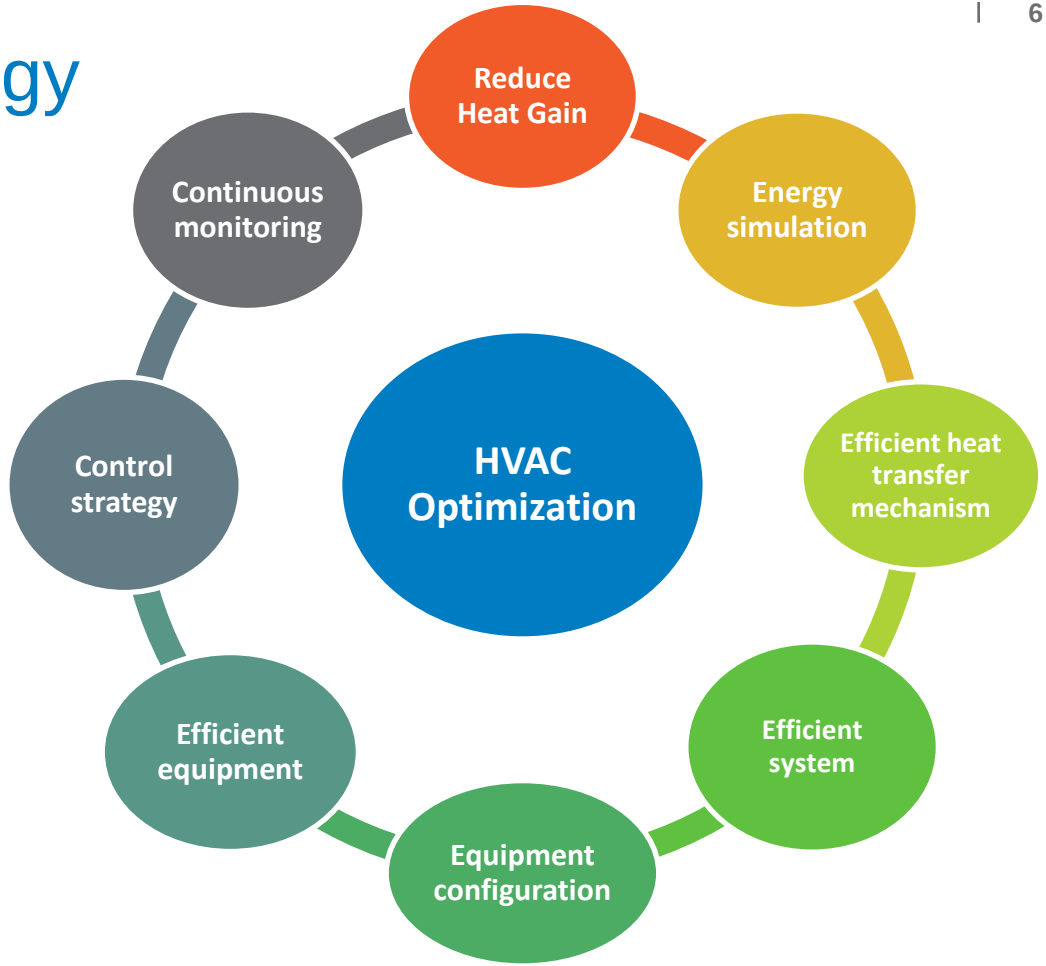
80 Million USD spend on electricity avoided

Smart by design - What is possible? Standard Vs. efficient design

	Performance metric	Standard design*	Efficient design*	% Reduction
1	Building energy consumption	250 kWh/m2/year	75 kWh/m2/year	70%
2	Lighting design	1.2 W/sqft	0.48 W/sqft	60%
3	Air-conditioning design (Reduction in heat load)	300 sqft per TR	750 sqft per TR	60%
4	Total building electrical design**	8 W/sqft	3.5 W/sqft	56%

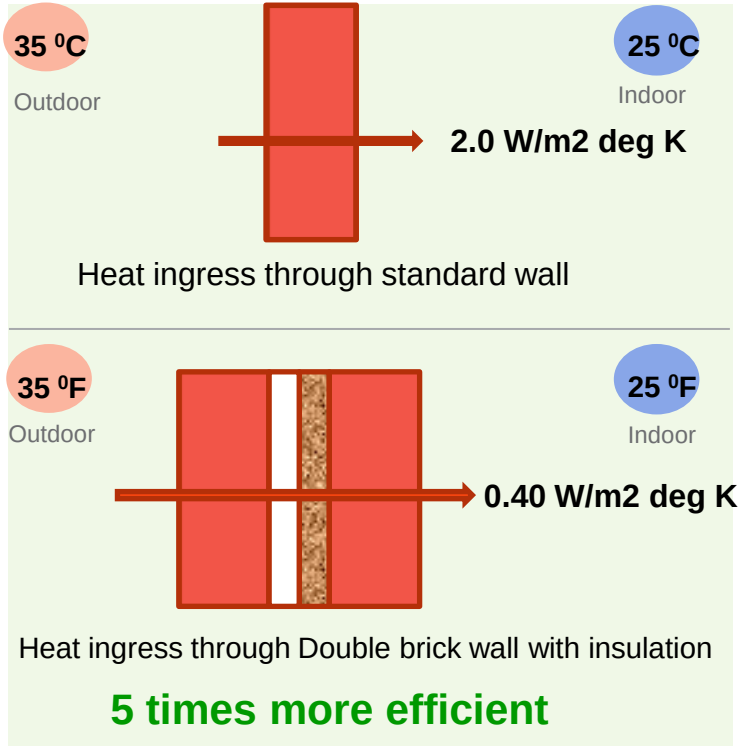
* Average for commercial office buildings (incl. lights, AC, computers, miscellaneous)
** Total electrical load for commercial office buildings including chiller plant

4X optimization strategy

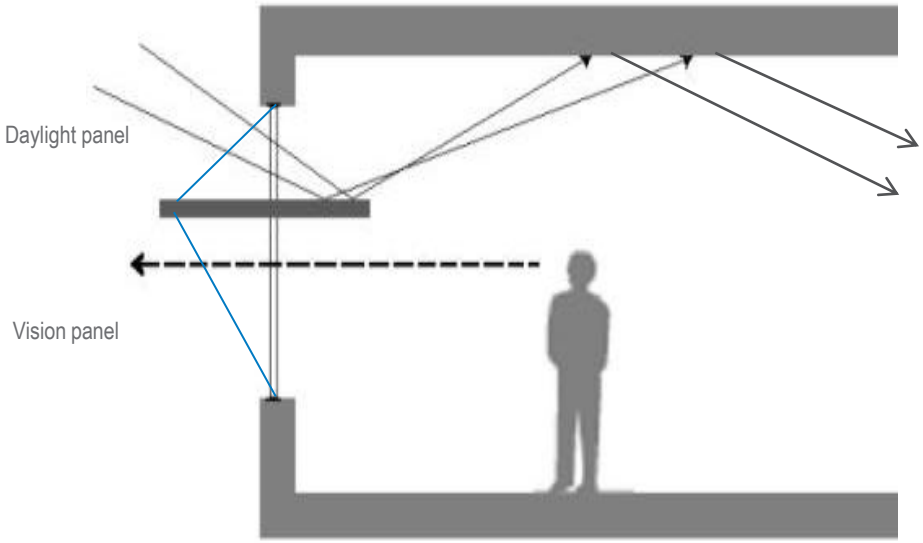


Envelope: insulation + Smart windows

- **Restricted external heat gain in building to less than 30 W/m2**
- Wall insulation with R value of 15
- Roof insulation with R value of 16
- Double glazed unit with argon gas to achieve R value of 5.5
- Low SHGC of 0.2 with low e glass
- Window-wall ratio < 30%



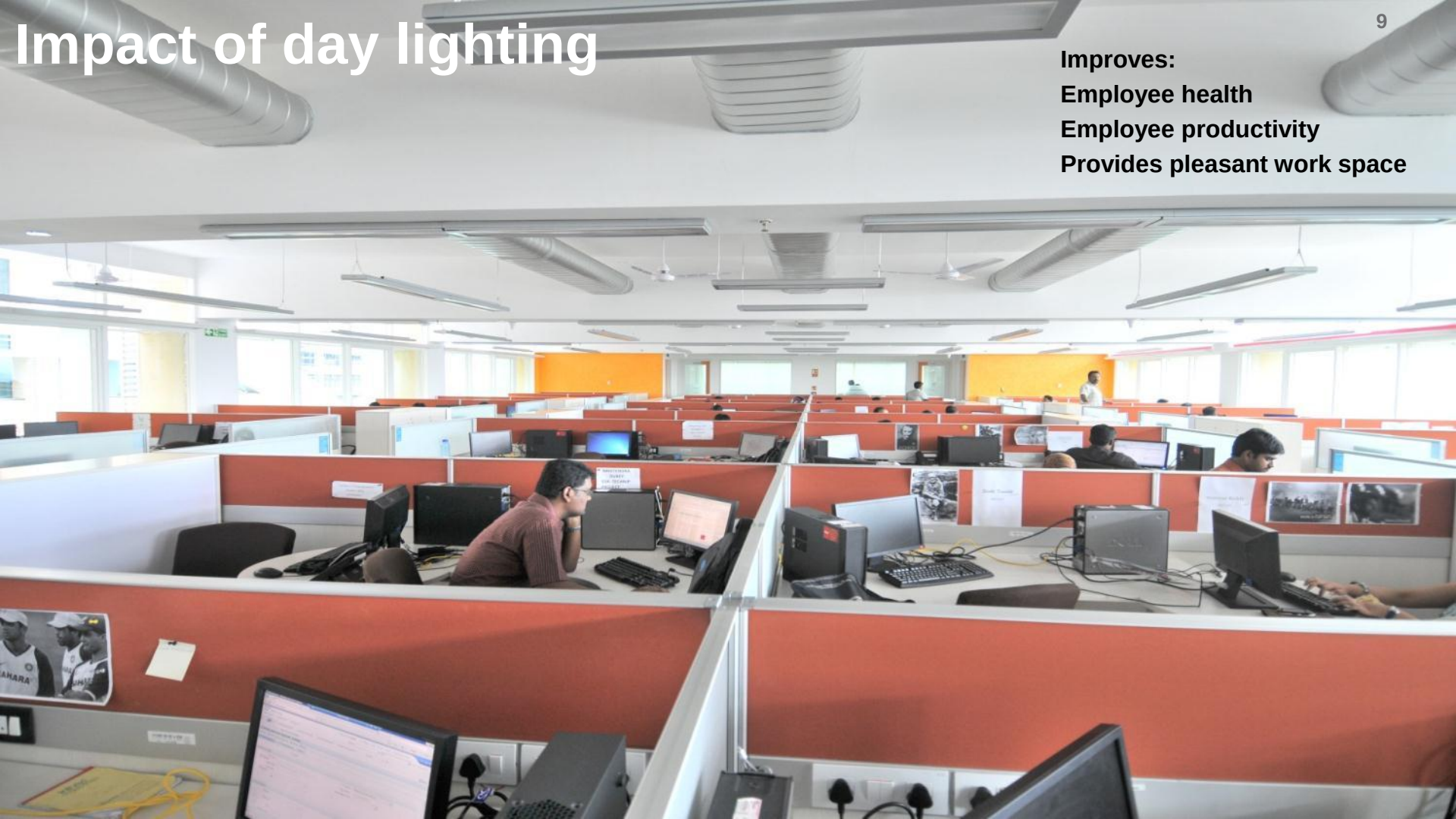
Infosys : 90% of occupied space should be naturally lit



Light shelves for deeper penetration of day light

Glare free design without blinds

Impact of day lighting



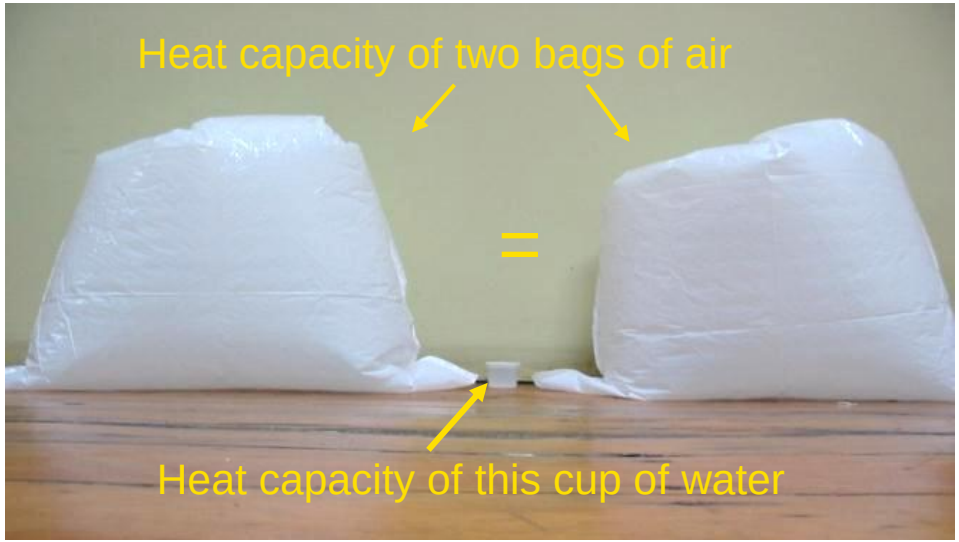
Improves:

Employee health

Employee productivity

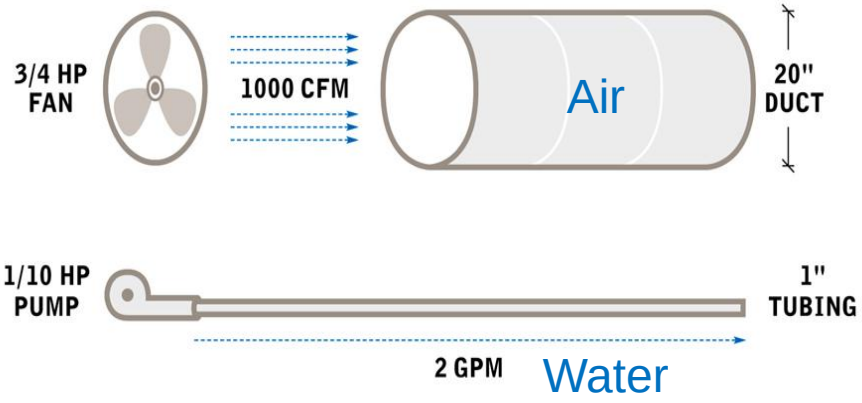
Provides pleasant work space

Efficient heat transfer mode and medium



Water has 3400 times higher heat carrying capacity than air for the same volume

Pumping Air Vs. Water for same cooling capacity

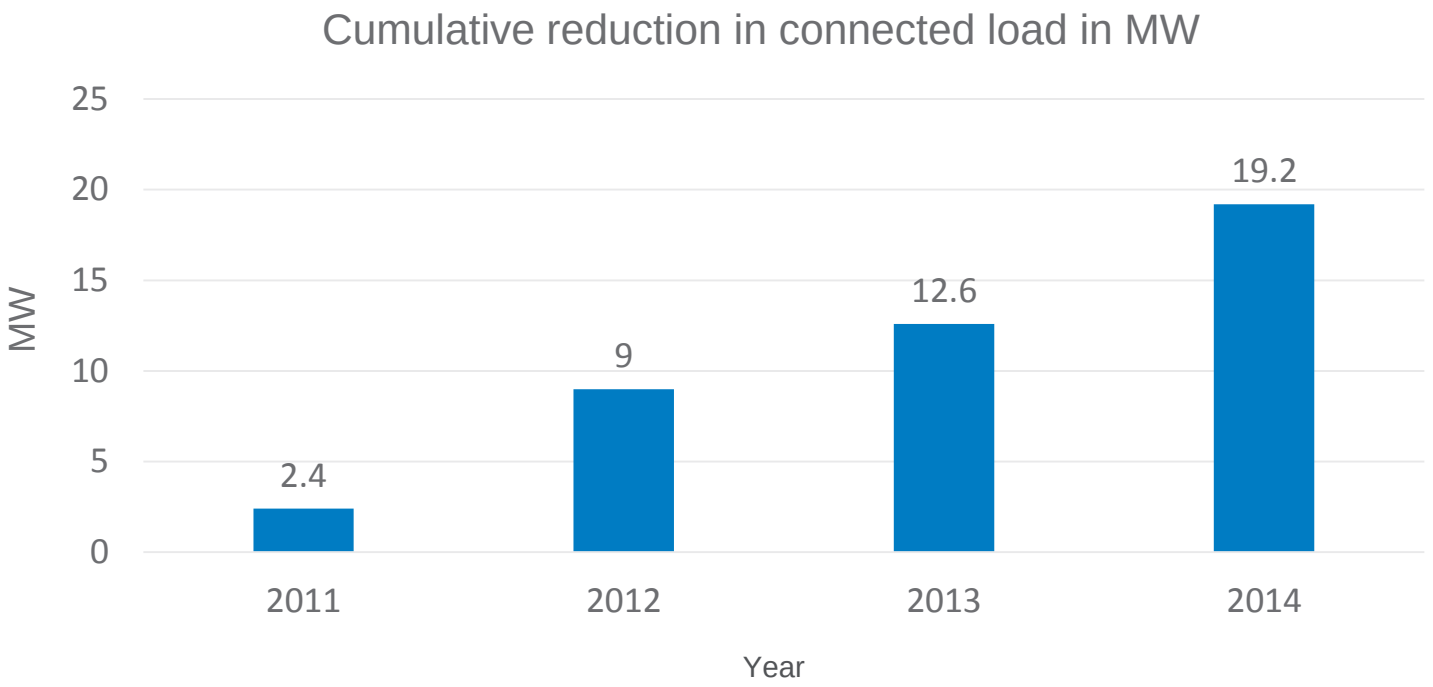


Pumping cost is 7.5 times lower with water as a medium of heat transfer

Radiant cooling retrofit

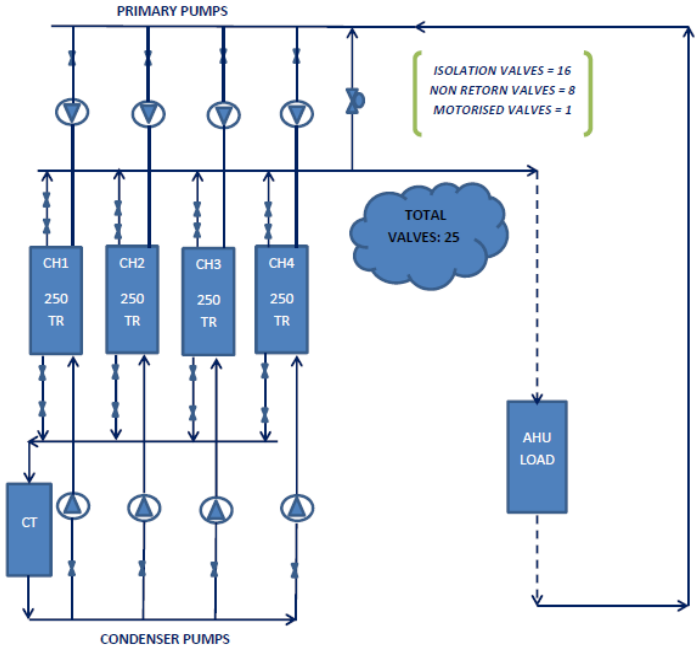
Retrofit of Mechanical systems

Retrofits: 30% IRR on retrofit projects



Re-engineering of chiller plants

- Reduction in energy 30%
- Reduction in no. of equipment 45%
- Reduction in space 25%

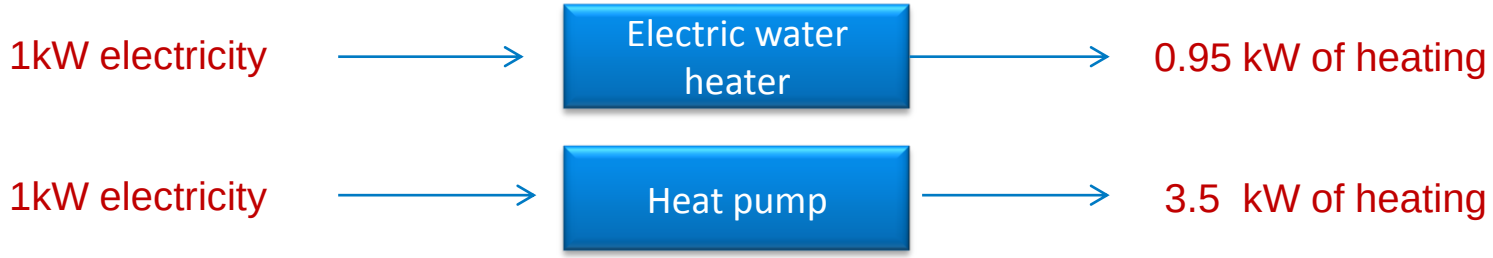


Conversion of chilled water pumping system from primary-secondary to variable primary

Replacement of electric heaters with heat pumps

Air source heat pump, draws heat from atmosphere

- 3.5 times more efficient than electric heating
- 4 MW of connected load reduced across Infosys campuses



White roofs for existing buildings

Google earth view of Infosys bangalore campus

- Reduces building heat gain and urban heat island effect
- 26 lac sqft area covered with white roof across Infosys campuses
- Reduces heat ingress and hence cooling load

Lighting Retrofits – Smart street lights

- Over 2000 street light retrofits at Infosys
- High pressure sodium vapor luminaire of 250 W replaced with 90 W LED.
- Migrated from yellow light to white light for improved night vision
- Dimmable, schedulable, motion based activation

UPS system retrofits – 30% IRR

- Reduced installed UPS capacity from 13.5 MW to 7.8 MW (Reduction of 5.7 MW)
- Replaced standalone UPS systems with modular type high efficiency UPS
- 15% improvement in UPS efficiency. Reduction in no. of UPS and UPS AMC costs.

Before (1W+1S)

After (Modular)

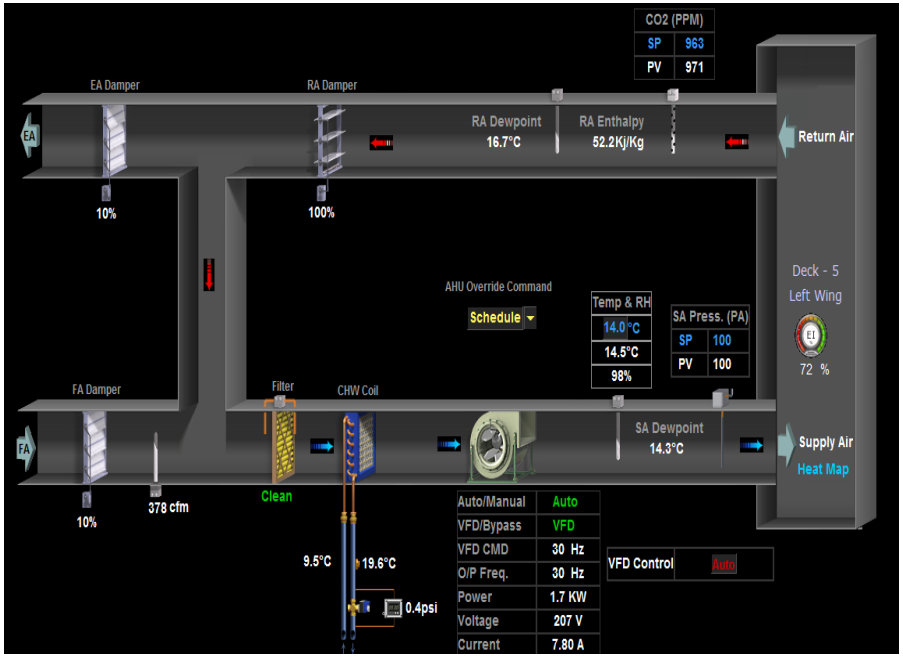
Smart Operations

Central command center

Command center at Infosys Bangalore to monitor, manage and optimize resources usage

Data driven building operations

- Energy saving algorithms optimize operation
- Continuous measurement and verification
- Improves indoor air quality, employee comfort and productivity
- 15% reduction in energy as compared to standard buildings



Example of demand controlled ventilation.
Building only uses as much fresh air as required based on CO2 sensing

Provides data to optimize future building designs

Equipments	Inst. watt / Sqft	Current Year Peak Value	Current Year Peak Time
HVAC - High Side	0.03	1.16	7:39 AM 4/9/2012
HVAC - Low Side	0.04	0.30	8:05 AM 3/10/2012
HVAC - CRITICAL	0.07	0.22	6:10 PM28/10/2012
Lighting	0.13	0.20	6:37 PM 6/11/2012
Fans	0.03	0.05	10:13 AM 7/8/2012
Raw Power	0.04	0.12	6:06 PM 27/10/2012
UPS - Work Station	0.56	0.70	3:16 PM 25/9/2012
UPS - Server	0.03	0.04	9:49 AM 16/11/2012
Misc.	0.00	0.85	1:45 PM11/10/2012
Total	0.95	2.32	12:32 PM27/11/2012

- Standard building designed at 8 W/sqft
- Efficient building designed at 3.5 W/sqft
- Efficient building operating at less than 2.5 W/sqft

Renewable energy and smart grids in smart campuses (cities)

Infosys: Solar Goals: 200 MW by 2017

- Karnataka has excellent policy to promote solar
- Utility scale and rooftop solar
- Solar is profitable
  - Cost INR 6 Cr/MW
  - ROI in 7 years
- Demystifying solar by publishing live data
- Access to solar parks and evacuation infrastructure
- National Labs for testing solar
- Ground level weather data

Electricity generation: Unleash the power of corporate funds

- Increase demand: Utility scale
  - Have a 2020 goal for corporates
  - SPO for all corporates who consume more than 100,000 units a month.
  - SPO for all SEZ developers as their unit holders are getting tax breaks
  - Make RPO implementation more effective and more ambitious
  - Increase the RPO on solar, as many states have achieved their wind targets
- Increase demand: Roof Top Solar
  - Allow net metering
  - Allow Solar funding as part of home loan

Thank You