



# The Multi-Faceted Role of ICT in Smart Sustainable Cities



ITU-TRCSL Workshop on Greening the Future: Bridging the Standardization Gap on Environmental Sustainability

*Colombo, Sri Lanka* October 03-04 2013

## Sekhar Kondepudi Ph.D



Associate Professor  
Smart Buildings & Smart Cities



Vice Chair  
Focus Group on Smart Sustainable Cities



# CLIMATE SUMMIT

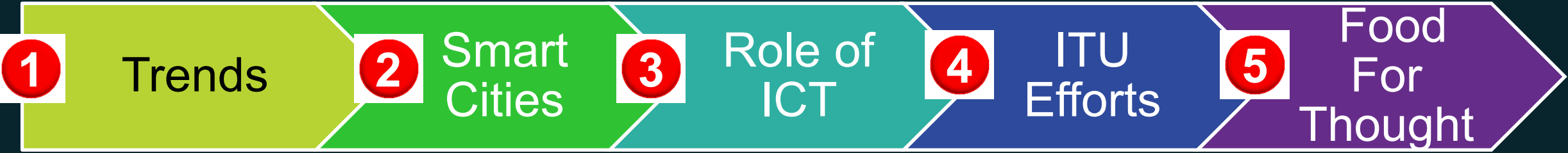
WHAT IF IT'S  
A BIG HOAX AND  
WE CREATE A BETTER  
WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- ETC. ETC.



12/19 USA TODAY  
YOUNG PITT

# Agenda





1

Trends

2

Smart  
Cities

3

Role of  
ICT

4

ITU  
Efforts

5

Food  
For  
Thought

# Landscape



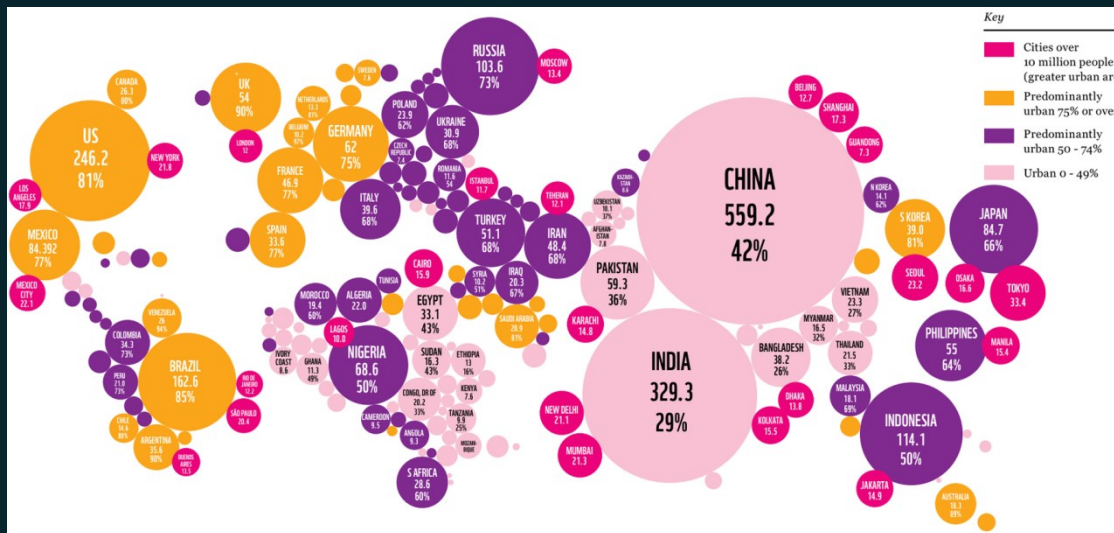
Data Convergence  
Sustainability & Green  
Internet of Things

ing Workforce,  
ed for Renewed Infrastructure  
olving Business Models

regulatory Framework  
Global Standards  
Incentivization

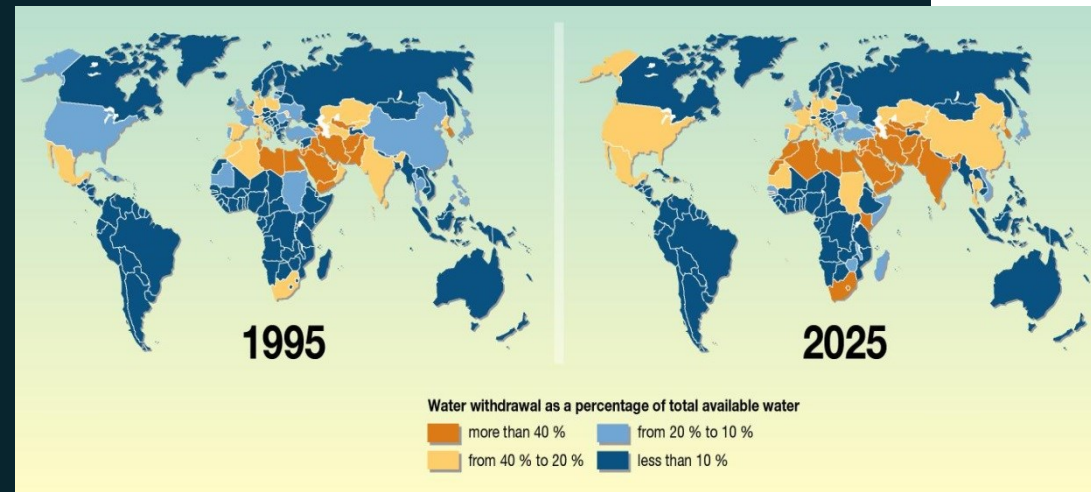
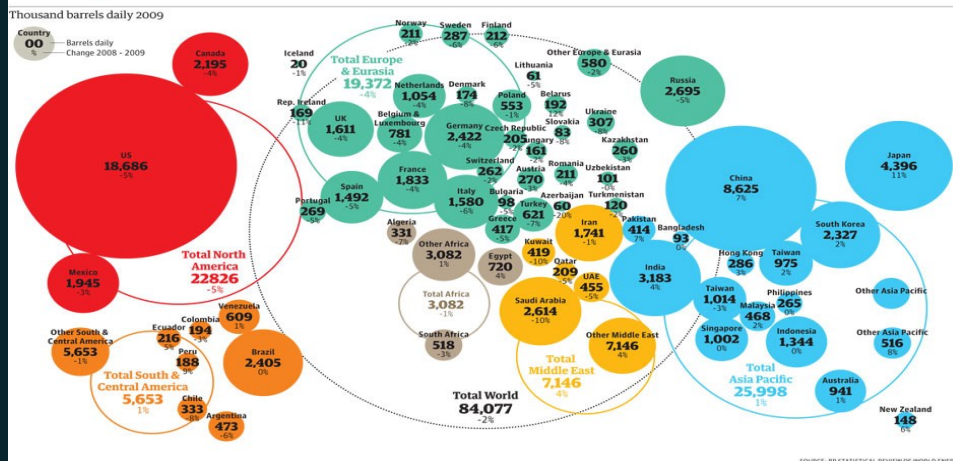


# Population, Energy & Water



## ENERGY

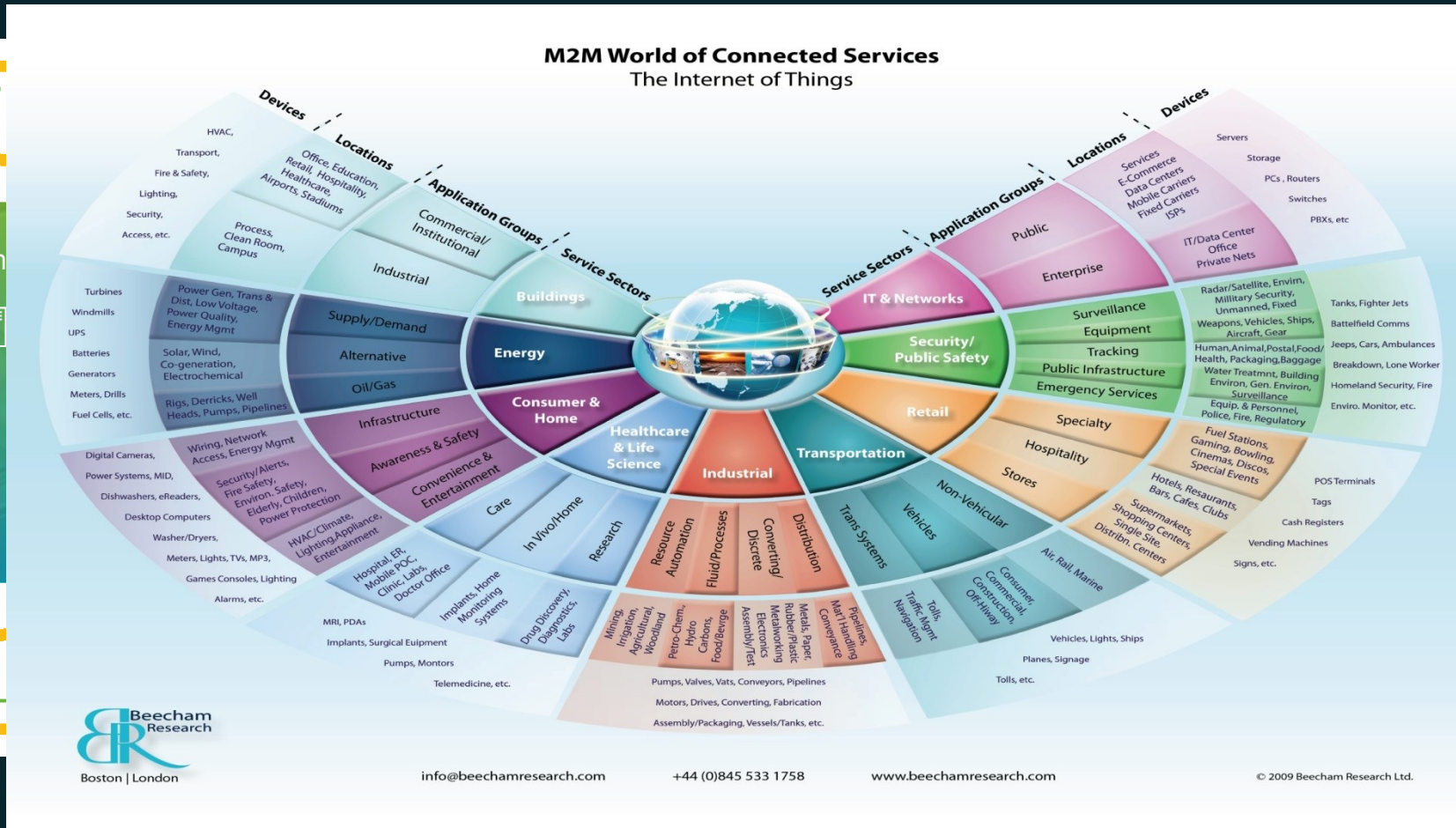
Oil consumption around the world



# Everything Will be Connected – Internet of Things

**Drivers**

Connected consumer electronics



**50 Billion Connected Devices**

**World Population**

7.6

2020

**Evolution of the Internet**

Source - CISCO





# Attributes of a “Smart City”

MOBILITY

SUSTAINABILITY

LONGEVITY

SECURITY

RELIABILITY

TECHNOLOGY

FLEXIBILITY

EFFICIENCY

INTEROPERABILITY

SCALABILITY



# Smart Cities

- Smart Cities are **well managed**, integrated **physical and digital infrastructures** that provide optimal services in a reliable, **cost effective**, and **sustainable** manner while maintaining and improving the **quality of life** for citizens.

- **Well Managed** – Governance
- **Cost Effective** – Economy
- **Sustainable** – Environment
- **Quality of Life** – Society

- **Physical & Digital Infrastructure** form “Collective Intelligence” across both private and public domains including

- Real Estate
- Industrial
- Utilities
- Water, Waste & Air
- Public Safety
- Healthcare
- Education
- Mobility

# Foundational Aspects

## Economy

- Employment
- GDP
- Market – GLocal
- Viability
- Investment
- PPP
- Value Chain
- Risk
- Productivity
- Innovation
- Compensation

## Governance

- Regulatory
- Compliance
- Processes
- Structure
- Authority
- Transparency
- Communication
- Dialog
- Policies
- Standards
- Citizen Services

## Environment

- Sustainable
- Renewable
- Land Use
- Bio-Diversity
- Water / Air
- Waste
- Workplace

## Society

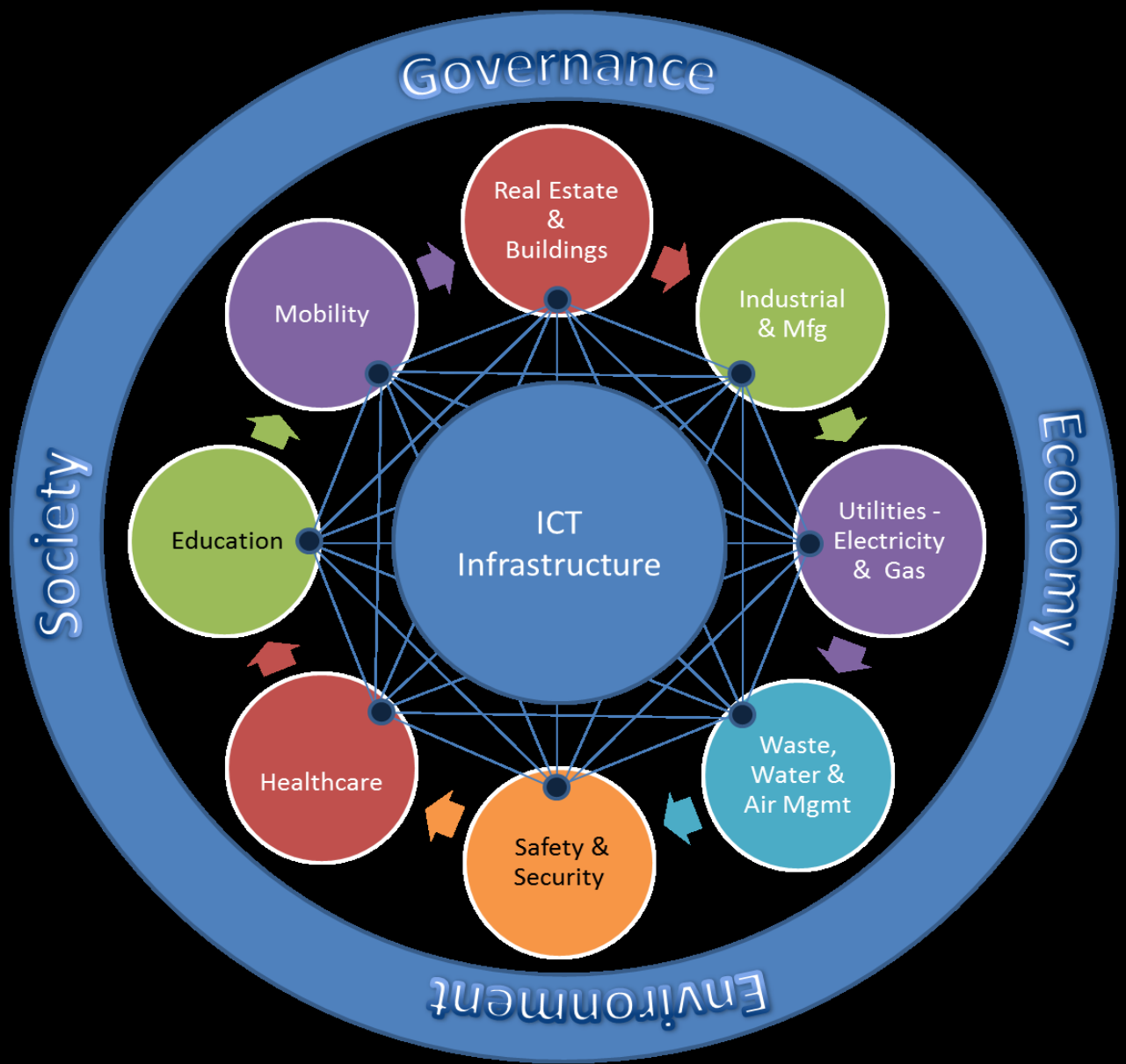
- People
- Culture
- Social Networks
- Tech Savvy
- Demographics
- Quality of Life
- User Experiences
- Equal Access
- End Consumers
- Community Needs
- The City as a Database



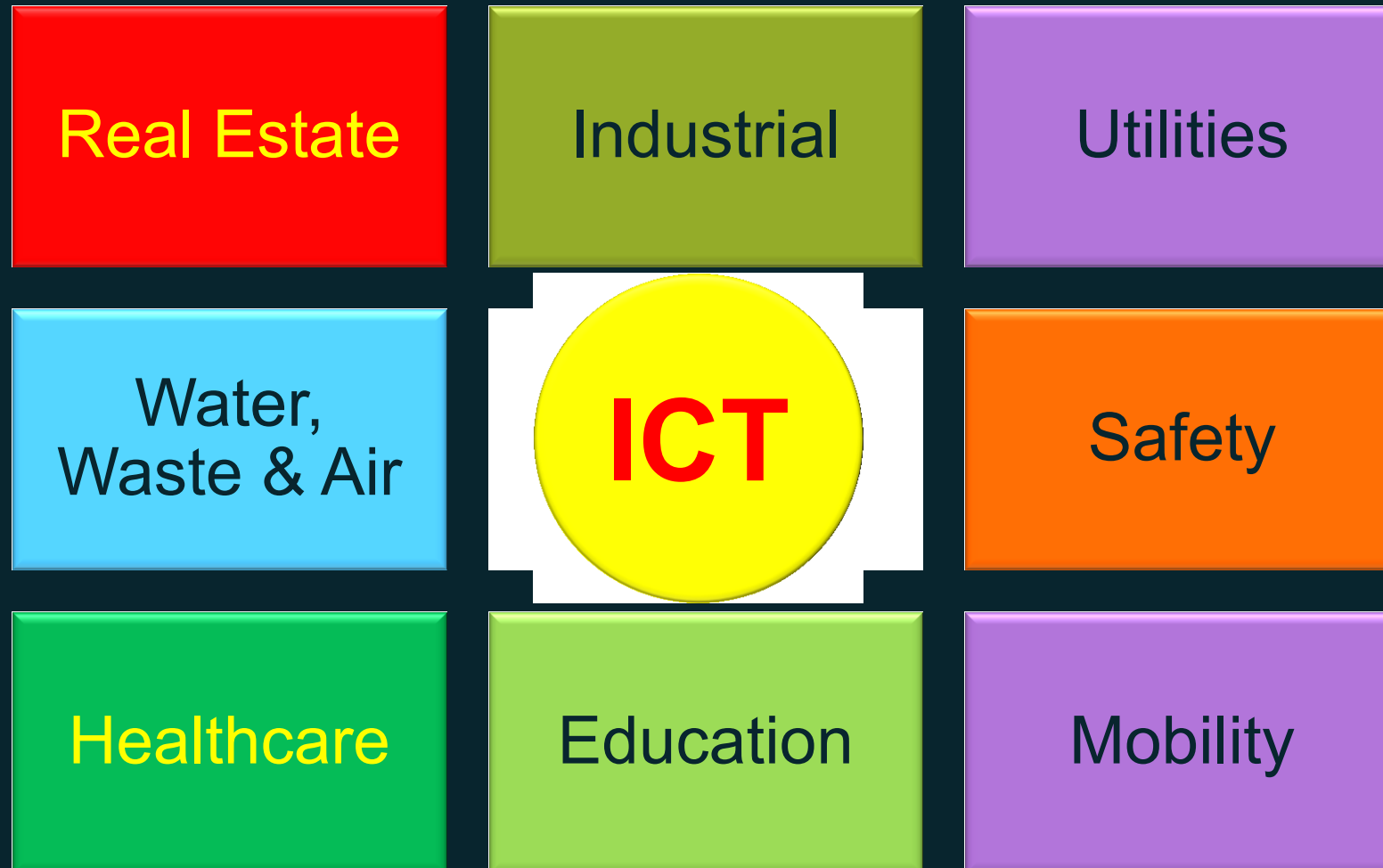
# Scope of ICT Today - Pervasive



# ICT is the “Glue”



# Smart City Infrastructure Verticals



# Cross-Vertical Coordination

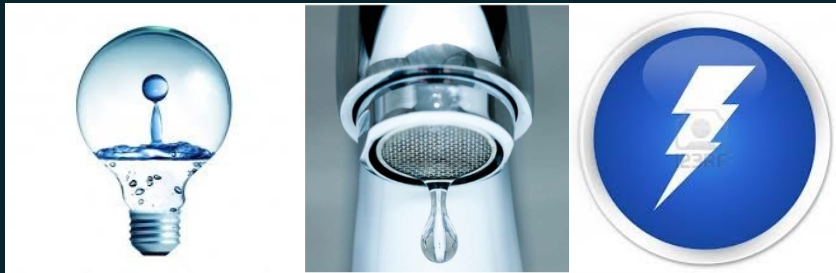
- A smart sustainable city will be constantly **tuning itself**, **honing the individual efficiencies of the different vertical infrastructure** operations such as real estate, industry, utilities (energy), water, waste and mobility.
- However to achieve a higher order of optimization, these very seemingly **“independent “ vertical infrastructure silos will need to coordinate with each other** in order to making living **more convenient and comfortable** while at the same time balancing the fragile **environment**.



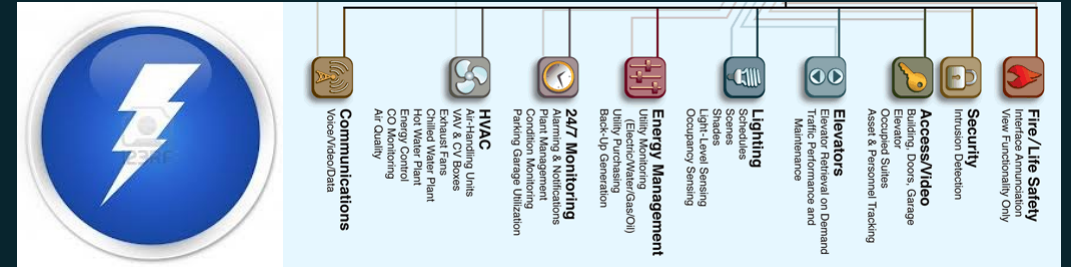


# Example Smart Water - Energy

- A smart system which coordinates water availability and price with the use of energy and power
- For example, when actual fresh water is in low supply, making real time decisions to use recycled water OR water from a desalination plant (all of which use power).
- Such optimization / smart decisions can reduce water treatment costs, make power consumption more efficient, and realize a variety of other synergistic effects



# Example Smart Energy - Buildings



- A Smart System which knows how to “arbitrate” and dispense power to critical areas in the building in the case of a power outage or at high electricity prices
- The ability to intelligently arbitrate according to a preset (or dynamic) priority needs these seeming disparate sub-systems to communicate with another.
- For example, a building has many siloed sub-systems – HVAC, Lighting, Elevators etc and during a power outage, critical areas need to be given higher priority. A Data Center may need to have higher priority within a building compared to a cafeteria and within the cafeteria, refrigerated space for food may have a high priority.



# Focus Group on Smart Sustainable Cities (FGSSC)

Established at SG5 meeting in Geneva, 29 January to 7 February 2013

As an open platform for smart-city stakeholders

Welcome Contributions & Participation



# FG SSC Membership / Team

- Chairman: Silvia Guzman, Telefonica
- Vice-Chairmen:
  - Flavio Cucchietti, Telecom Italia
  - Pablo Bilbao, Federation Argentina de Municipios, Argentina
  - Franz Zichy, USA
  - Nasser Saleh Al Marzouqi, UAE
  - Ziqin Sang, Fiberhome Technologies Group
  - Sekhar Kondepudi, National University of Singapore.
- Senior Advisor (ITU) : Cristina Bueti
- TSB Secretariat (ITU) : Erica Campilongo : [tsbfgssc@itu.int](mailto:tsbfgssc@itu.int)



# FGSSC Tasks & Deliverables

- Defining the role of ICTs in environmentally sustainable smart cities, and identifying the ICT systems necessary to the development of a Smart Sustainable City;
- Collecting and documenting information on existing smart city initiatives and technical specifications, focusing in particular on the identification of standardization gaps;
- Identifying or developing a set of Key Performance Indicators (KPIs) to gauge the success of smart-city ICT deployments;
- Establishing relationships and liaison mechanisms with other bodies engaged in smart-city studies and development;
- Identifying future smart-city standardization projects to be undertaken by its parent group, ITU-T S5 5;
- Developing a roadmap for the ICT sector's contribution to Smart Sustainable Cities, providing cohesion to the development and application of technologies and standards.



# First Meeting @ Turin : May 08 2013

- Establishment of FG-SSC structure and deliverables:
  - 4 working groups
  - work plan
  - future meetings
- Presentation of contributions received;
- Liaison statements sent to other bodies engaged in smart-city studies and development (e.g. ETSI);
- **2nd meeting: Madrid, Spain, on 17 September 2013**



# 4 Working Groups

Working Group	Description	Leader
ICT Role & Roadmap	<ul style="list-style-type: none"> <li>• Success Stories</li> <li>• Key Attributes – City Infrastructure &amp; Services</li> <li>• Definition</li> <li>• Environmental Challenges</li> <li>• Key Stakeholders</li> <li>• Barriers &amp; Challenges</li> <li>• Factors &amp; Recommendations for Successful Implementation</li> </ul>	Sekhar Kondepudi
ICT Infrastructure	<ul style="list-style-type: none"> <li>• ICT Infrastructure needs</li> <li>• Existing ICT Infrastructure</li> <li>• New Infrastructure Needs for SSC</li> <li>• Special Requirements (Resilience, QoS)</li> <li>• Examples of ICT infrastructure in SSC</li> <li>• Opportunities for coordinating development</li> </ul>	Flavio Cucchetti
Standardization Gaps, KPIs and Metrics	<ul style="list-style-type: none"> <li>• Characteristics and minimum requirements for the classification of a SSC</li> <li>• Smart City Labels – Minimum Requirements</li> </ul>	Ziqin Sang
Positioning	<ul style="list-style-type: none"> <li>• Organizations active in the area of SSC</li> <li>• Communication and promotion plans</li> <li>• Charter (engagement with cities)</li> </ul>	Daniela Torres





# Software Applications for Smart Cities

## Smart City Applications

- City Dashboard
- Smart Air & Smart Water
- Smart Waste
- Smart Parking & Traffic
- Smart Utilities
- Smart Lighting
- Smart Noise
- Smart HealthCare
- .....



## Smart City “Social” Applications

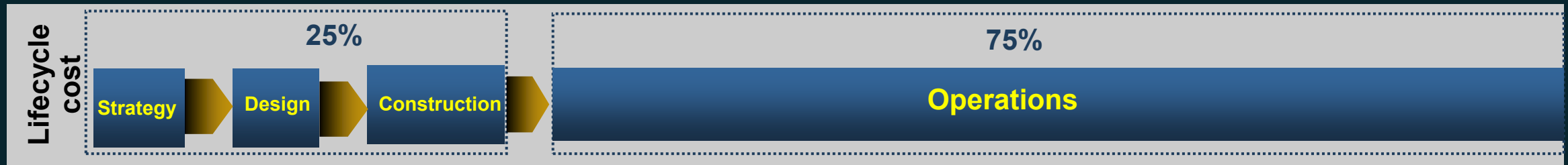
Marry “Facebook” type Social Applications to the City Infrastructure





# Operations Form 75 % of Energy Use in Buildings

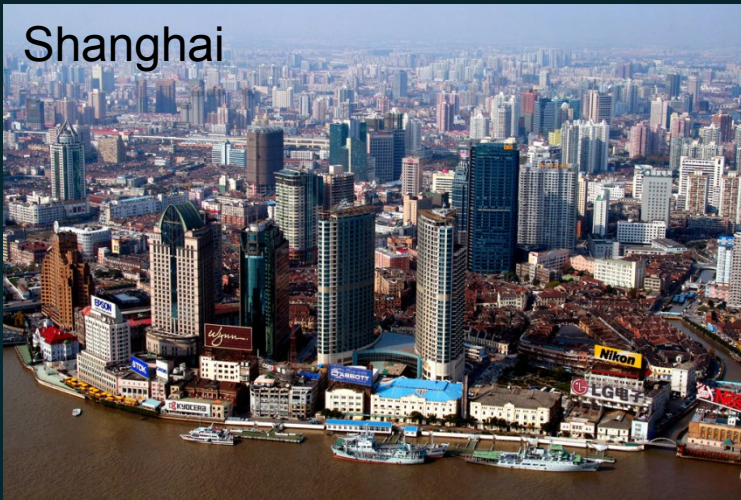
- Most energy usage of buildings throughout their lifecycle is during its operation ( ~ 75 % compared to during construction or commissioning).



- The impact of user behavior and real time control is estimated to be in the range of 20 %
- **Information Communications & Technology (ICT)** is a credible means to help design, optimize and control energy use in existing and future “smart” buildings.

# Construction EUPHORIA

## China – Constructing 1 Japan EVERY 3 YEARS



CHINA

Adding 18-20 Billion sq. feet of construction every year

6000 Empire States EVERY YEAR



Year	# Japans
2012	1
2015	2
2018	3
2021	4
2024	5

# Cities of the Future



*Recognizes you and customizes itself based on your preferences*

**Intelligent**



**Collaborative**

*Ensures that you stay connected to the right people & the right information in real time*

**Efficient**

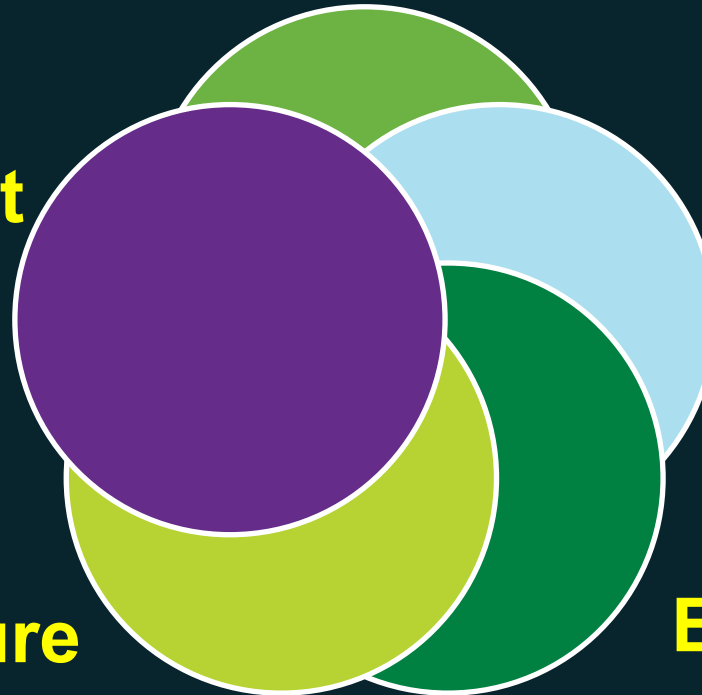
*Uses hard & soft resources optimally while increasing productivity*

**Secure**

*Assures both information & physical security at all times*

**Experiential**

*Delivers goodness in the way you work & live*



THANK YOU

Sekhar Kondepudi Ph.D.  
Smart Buildings & Smart Cities  
National University of Singapore  
[Sekhar.Kondepudi@nus.edu.sg](mailto:Sekhar.Kondepudi@nus.edu.sg)  
+65 9856 6472