INSPIRING our LEADERS of TOMORROW

# IEEE Future Directions: Technology Convergence

Sections Congress - Amsterdam
22-24 August 2014

**Bill Tonti**
**Gilles Betis**
**Victor Larios**
**Guy Vekemans**

IEEE SECTIONS CONGRESS 2014

IEEE Internet of Things

IEEE TRANSPORTATION ELECTRIFICATION

IEEE Smart Cities

Rebooting Computing

Green ICT

IEEE CLOUD COMPUTING

Software Defined Networks

Big DATA

CyberSecurity

# IEEE Future Directions
# New Initiatives

IEEE

# FDC Scope

**Anticipate and Determine the Direction of Existing, New and Emerging Technologies, and Related Issues, and Spearhead their Investigation and Development by IEEE**

**Act as Facilitator in Creating a New TAB Technical Community**

**Technologies:**
- Cloud Computing
- Green ICT
- Internet of Things
- Software Defined Networks
- Rebooting Computing
- Transportation Electrification
- CyberSecurity
- Big Data

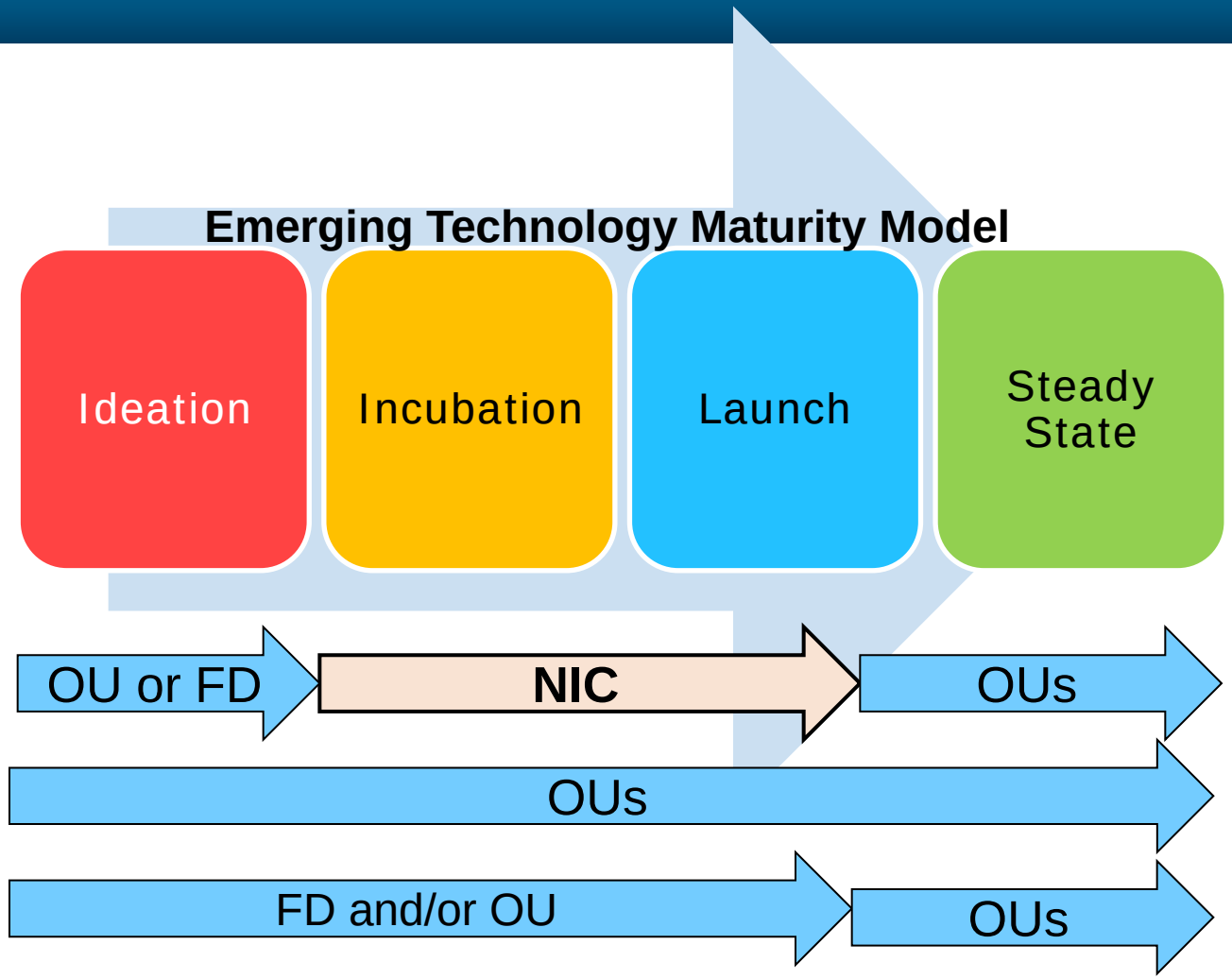
**$LV^4$**

**World Challenge:**
- "Growing Urbanization: Smart Cities"

- Help develop Business Plan for Technical Community and forward to TAB Management Committee

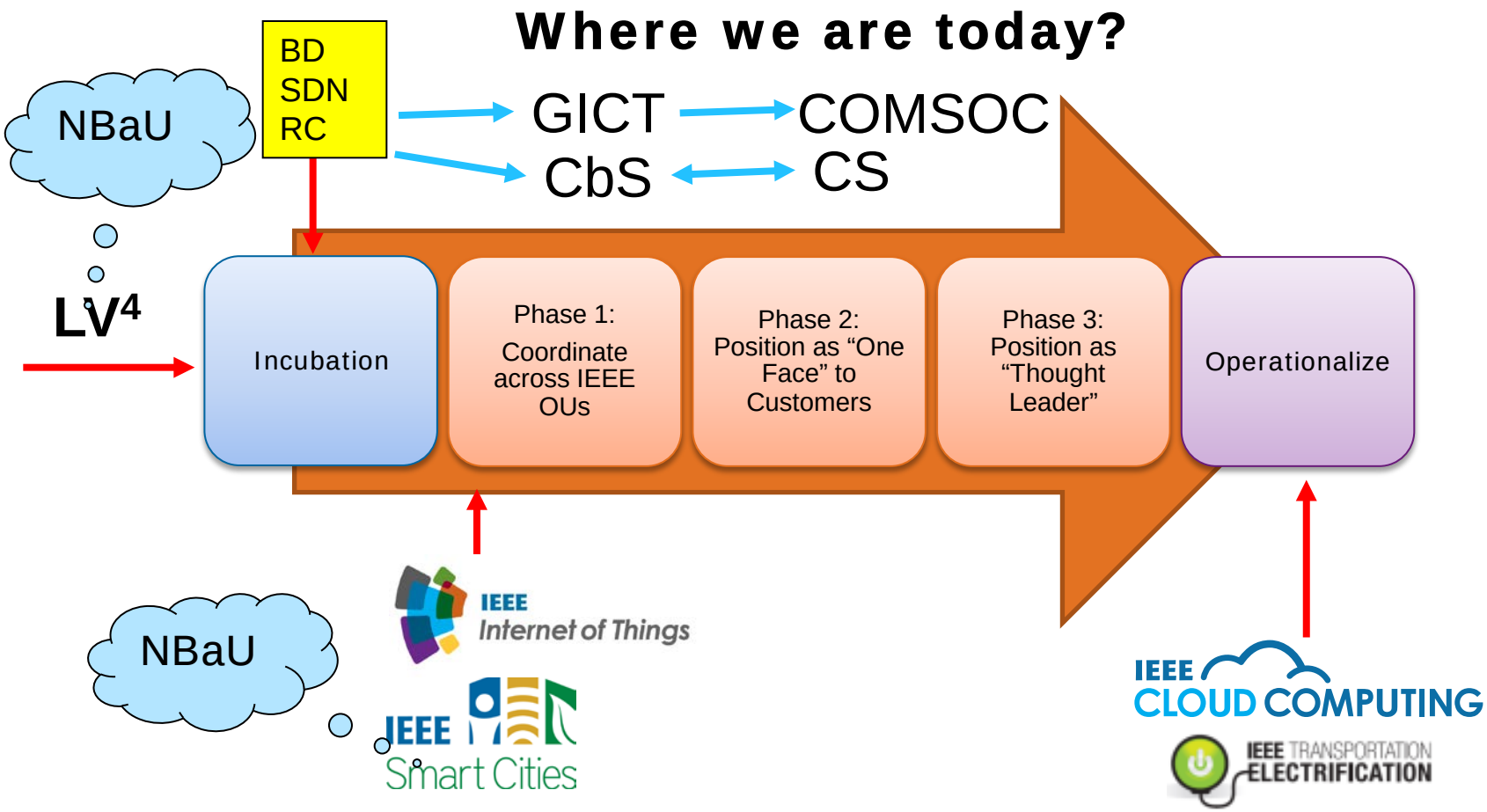
**$LV^4$**: Leveraging Data **Volume**, **Velocity**, **Variety** to create **Value**

# Technology Engine: Enabling LV4




OU: Organizational Unit
FD: Future Directions
NIC: New Initiative Committee

# FDC Maturity Model




NBaU: Not Biz as Usual

# FDC Incubator Project Metrics

| Technology | Web Portal | Tech Community* | SME Lead(s) | New or Existing IEEE Standards Inclusion | IEEE Steering Committee | IEEE Event | 2014 FDC Support |
|---|---|---|---|---|---|---|---|
| RC | **Yes** | **Yes 738 members** | E.Track T.Conte | No | **Yes** | **Yes** | Yes |
| GICT | No | **Yes 2,305 members** | J.Elmirghani | Yes | Yes | No | Yes |
| SDN | **Yes** | **Yes 1,107 members** | A.Manzalini | No | **Identified** | **Yes** | Yes |
| CbS | No | No | G. McGraw C. Landwehr | No | **Yes** | **Yes** | Yes |

* As of 19 June 2014

**LV$^4$: Value increase**

# IEEE Technology Time Machine
# TTM 2014
# *ttm.ieee.org*

- A Tool FDC uses to look at New Space
- Symposium Tracks

**A Future of Humans [SSIT]**

**B Future of Health Care [EMBS]**

**C Future of Fabrication [RAS]**

**D Future of Processing [CS]**

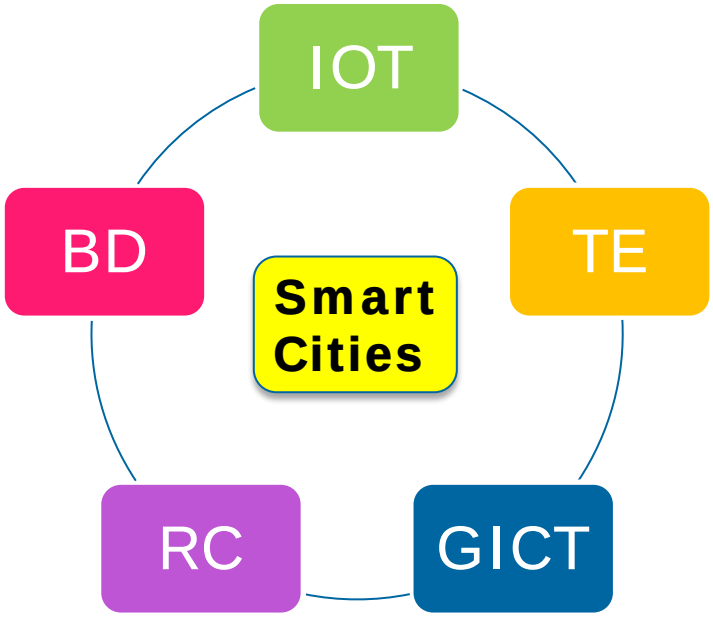
**E Future of Energy [PES]**

**F Future of Networks [ComSoc]**


- Venue:
  - 21-22 October 2014, Dolce Hayes Mansion, San Jose, CA

# Smart Cities Wheelhouse

- Leverage **LV$^4$**
- Smart Cities:
  - Utilizing: Internet of Things, Big Data, Transportation, Green ICT, Rebooting Computing



# Societies Proposals: FDC-TAB Incubator Projects

| Society | Topic | Status |
|---|---|---|
| CES | Safe Advanced Mobile Power | Approved |
| PES | INTELECT Conf and Expo | Approved |
| RS | Tutorial Certificate Program on Sw Reliability | Approved |
| CS | Advanced Best Practices Learning Pack | Approved |
| ComSoc | Two-day continuing education courses | Approved |
| ComSoc | Rapid Reaction Standardization Activity for Internet of Things ( IoT) | Move to IoT Initiative |

# FDC 2015: Top Technology Contenders

- 3D Printing
- Brain Machine Interface
- Smart Materials
- Cross Cutting
  - Environmental
  - Trusted Cyber Space

# Become Involved
# *fdc@ieee.org*

- The IEEE Future Directions Alphabet Soup
  - BD
  - CbS
  - CC
  - GICT
  - IOT
  - RC
  - SC
  - SDN
  - TE


- Needs you to become involved as an Expert to make a difference
  - You: Sections, Chapters, Societies, Councils.➔ Everyone
  - For Smart Cities: Requirement is for a local Section and/or Chapter manage the day to day activities.

# Additional Information

# FDC Maturity Model: Incubation Phase

- Incubator managed and funded by TAB Through FD
- Milestones to move from Incubation to Phase 1
  - Web Portal Launch, Staff and Volunteer content curation
  - IEEE New Technical Community formation: 500 members
  - Minimum of 1 S/C partner
  - Vetted Initiative SME who will lead the technology from Incubation to launch
  - Successful delivery of one unique or collaborative event
  - Formation of an IEEE wide Steering Committee
  - A Checkpoint involving new or emergent IEEE Standards activities
  - Continued support of FDC in this topical area
- Phase 1 to Launch Requirement:
  - IEEE funding through NIC and subsequent BOD approval
  - Initiative grows from TAB to IEEE wide
  - May require STDS, EAB, MGA, M&S, Corporate Comm. Involvement
  - Metrics are a function of the specific project plan, however community growth is a fundamental metric for each initiative

# Things to consider in each Phase

**Incubator**

- Bleeding Edge
- New to IEEE
- New for Coordination
- New Tools

**Phase 1: Coordinate across IEEE OUs**

- Content, scope
- Global Perspective
- Prods: Conf, Stds, Educ, New Oppt, Community Building
- Gap Analysis
- Id lead OU(s)

**Phase 2: Position as "One Face" to Customers**

- One voice
- Customer Impact
- Member Impact
- Portal
- Connections are seamless
- Pipeline from "Contributors" well developed
- Branding
- Social Media

**Phase 3: Position as "Thought Leader"**

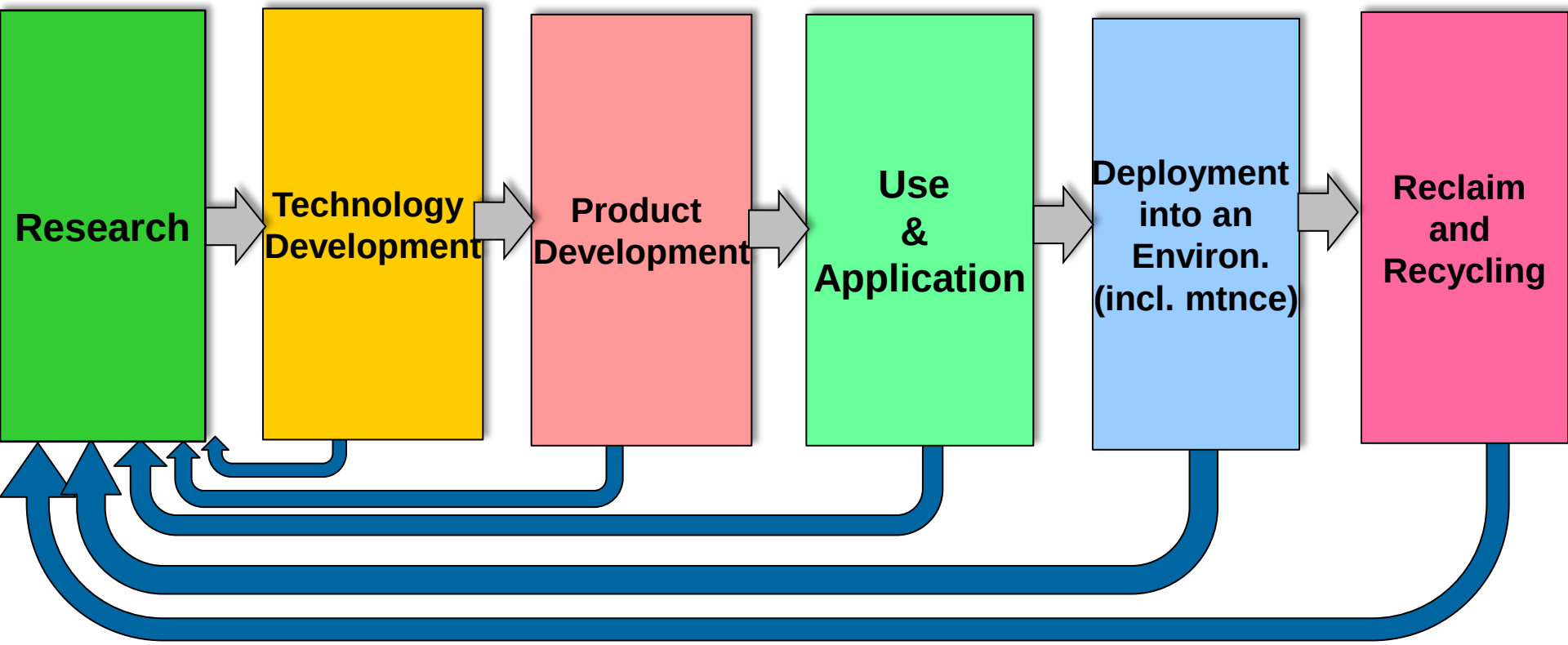
- Drive Leadership
- Right People on the bus
- Public Visibility oppts
- Gov/industry interest
- Positioning of Key Stds
- Metrics: Inc. Paper submissions, usage stats, web hits, Advertising $

**Ongoing Support**

- Operationalize
- Sustained income
- Long term goals
- Final structural option: Lead OU stabilization or new committee development

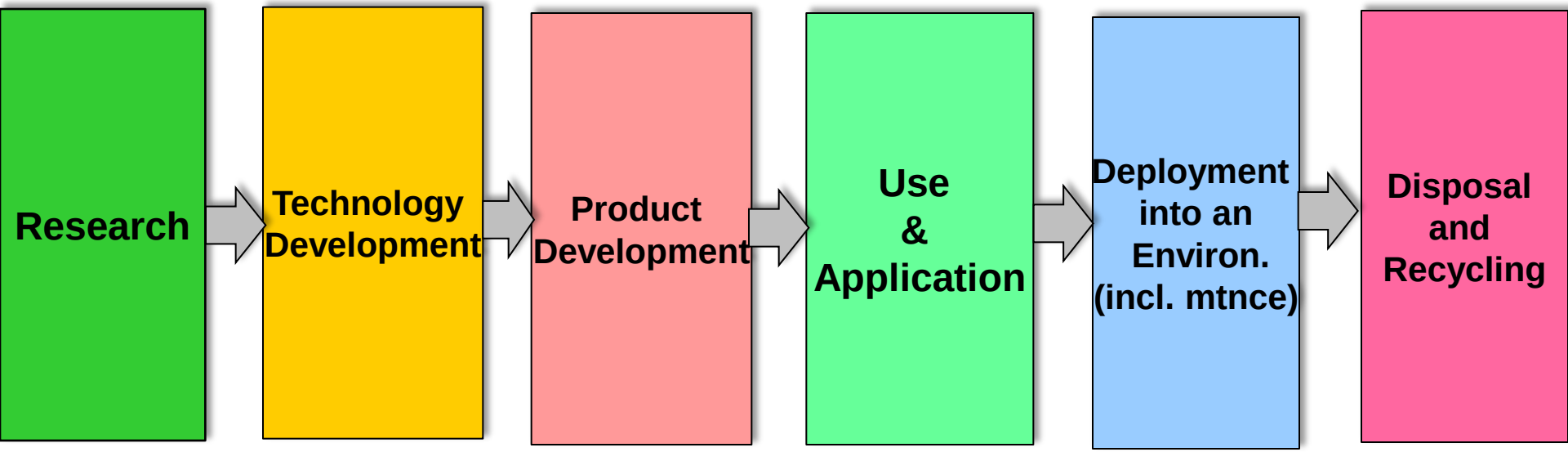
IEEE

# Technology Coverage Model




- Issues are identified at each stage that create the need for more focused research or development.
- Customers are different at each stage

# Technology Coverage Model: Assuring full coverage across lifecycle




- New options
- New technologies

- Optimization Algorithms
- Improved efficiency

- Reliability
- Quality
- Standards

- Reliability
- Quality
- Standards

- Network Mgmt.
- Ops Mgmt.
- Data Mgmt.
- Policy

- Recovery of materials before disposal

# Initiative Ecosystem: Smart Grid Example

- The activities funded by the Initiative fill gaps in coverage, provide a “One IEEE” view and support the efforts of the individual OUs
- They serve as the foundation to help build Thought Leadership -- the “glue” that ties it all together

## Smart Grid Product/Service Ecosystem

| | | | | | | |
|---|---|---|---|---|---|---|
| **Smart Grid Initiative Activities** | **Web Portal**<br>• Content Update<br>• “Opt-In” Group<br>• Search Engine Optimization | **Newsletter**<br>• Editorial Support<br>• Staff Support<br>• Article Pipeline<br>• Subscriptions | **Conferences**<br>Smart Grid World Forum<br>• 2010 - Brussels<br>• 2011 – China<br>• 2012 – Geneva | **Marketing / Communications/ PR**<br>• *Branding*<br>• *Logo*<br>• *Press Releases*<br>• *Interviews*<br>• *Placed By-lines*<br>• *Supported Media Events* | **SG Technical Community**<br>• Subscriptions<br>• Thought Leader Roundtables<br>• Whitepapers w/surveys<br>• Webinars<br>• Ask Me Anything (AMA) | **Social Media**<br>• IEEE Smart Grid LinkedIn Group<br>• IEEE SG Twitter site<br>• YouTube<br>• Wikipedia |
| **OU Activities** | **Publications**<br>• Transactions on Smart Grid<br>• Transactions On Sustainable Energy<br>• Journal of Photovoltaics | **Articles**<br>• 8,500+ in Xplore | **SG-Specific Conferences**<br>• ISGT<br>• SmartGrid Comm<br>• Smart Measurements for Future Grids | **Conferences with Smart Grid Content**<br>• IEEE PES T&D<br>• IEEE Power Line Communications<br>• Applied Measurements for Power Systems | **Standards**<br>• IEEE 2030<br>• IEEE 1547.4<br>• IEEE 1701, 1702<br>• IEEE 1901<br>• 90+ additional SG-related | **Continuing Education**<br>•Smart Grid Boot Camp |

# Smart Cities Initiative

*A Response to the Urbanization Challenge*

Gilles Betis

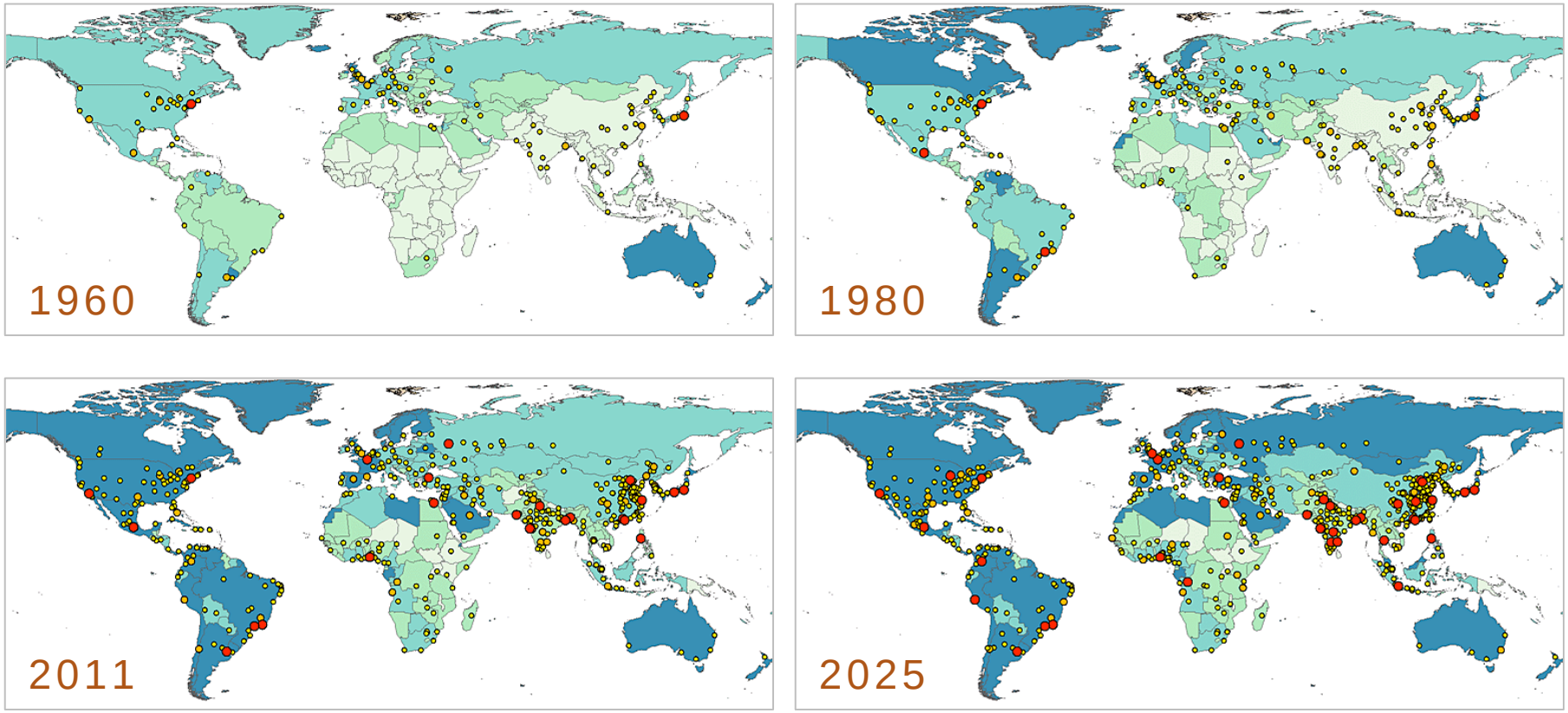
# Trend Toward Smart Cities

- Half of the world population is living in cities in 2013
- Half of the population of  Asia will be living in cities by 2020
- Half of the population of Africa will be living in cities by 2035
- Population in cities is expected to grow from 3.6 Billion to 6.3 Billion by 2050
- Megacities are impressive but represent only 9.9% (13.6% in 2025).
  Over 50% of urbanization involves cities of less that 500K people

# Growing Urbanization


http://esa.un.org/unup/Maps/maps_urban_2025.htm

# Growing Urbanization




**Percentage Urban**

- 0-25%
- 25-50%
- 50-75%
- 75-100%

**City Population**

- 1-5 million
- 5-10 million
- 10 million or more

***Percentage of urban population and agglomerations by size class***

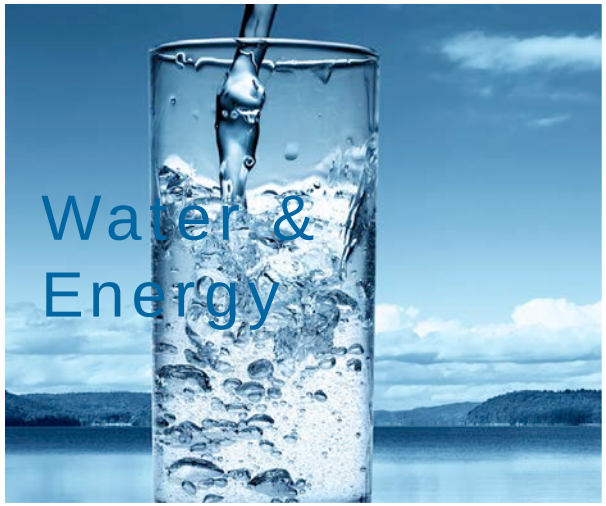
**Source:** United Nations, Department of Economic and Social Affairs, Population Division: *World Urbanization Prospects, the 2011 Revision*. New York 2012

http://esa.un.org/unup/Maps/maps_urban_2025.htm

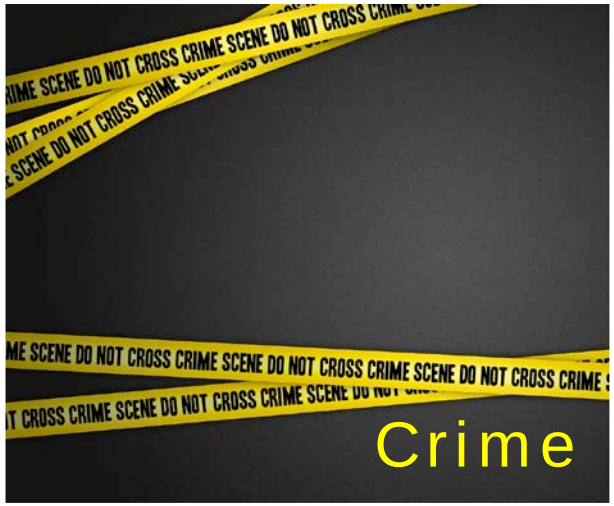
# Urban challenges

*at least some of them…*

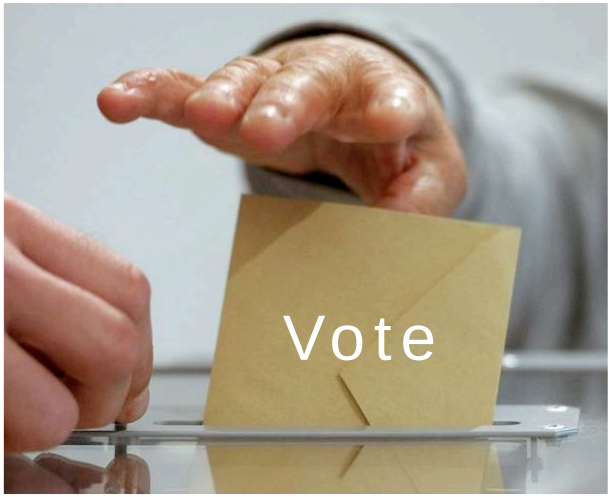






# Citizenship & Democracy



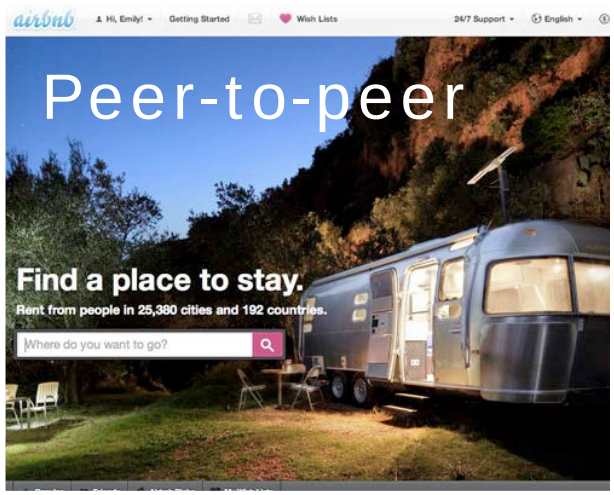





# The Emergent Economy

*collaborative & open*








# A matter of transition

# Cardinal Objectives of Smart Cities

SMART ?

Attractive for People & Business

Inclusive

**Is it just a matter of TECHNOLOGY ?**

Sustainable

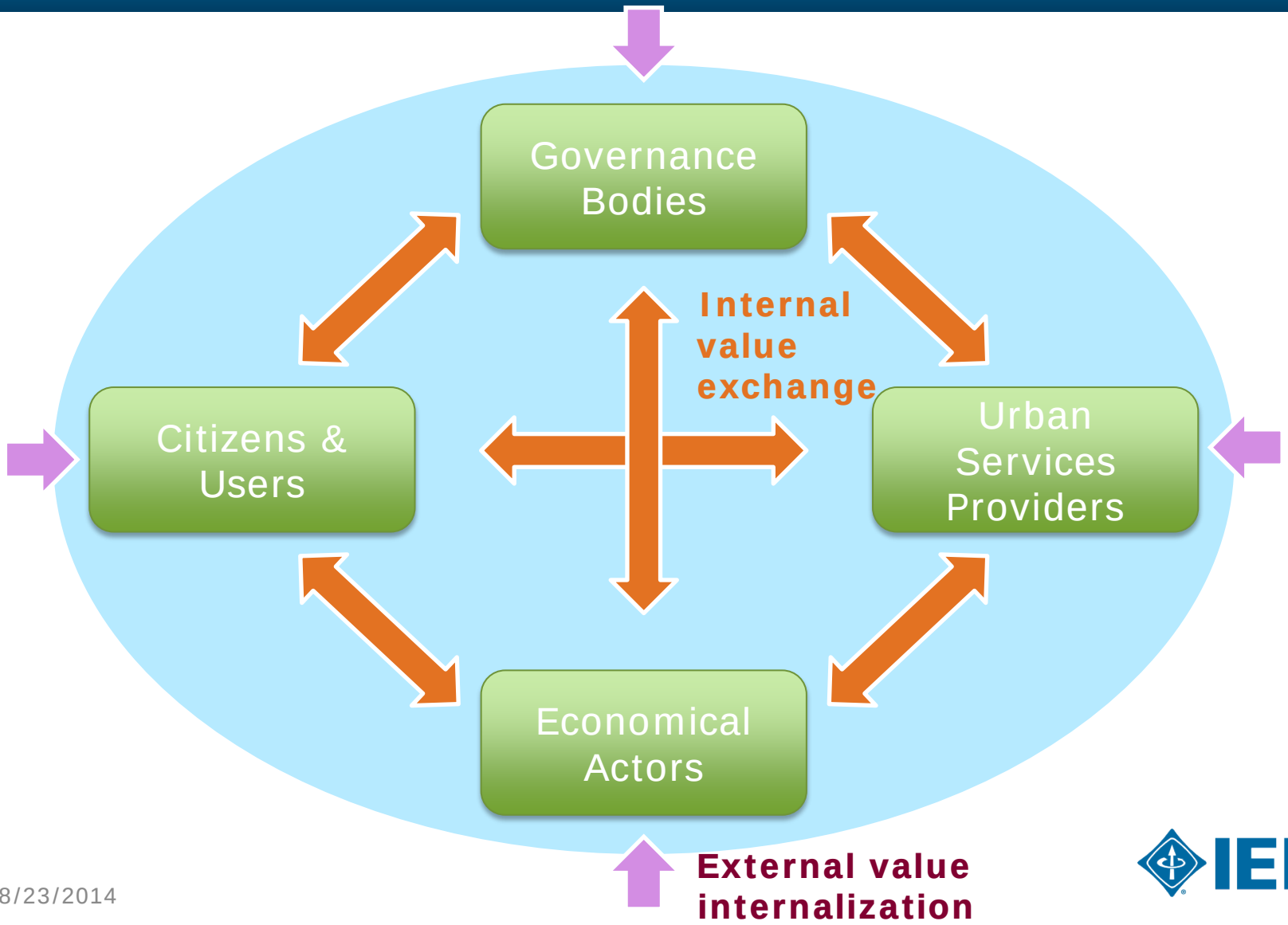
Resilient

Agile & Adaptive

Support Stable & Robust Process

**Creating societal value for the urban ecosystem**

# Value chains in the ecosystem

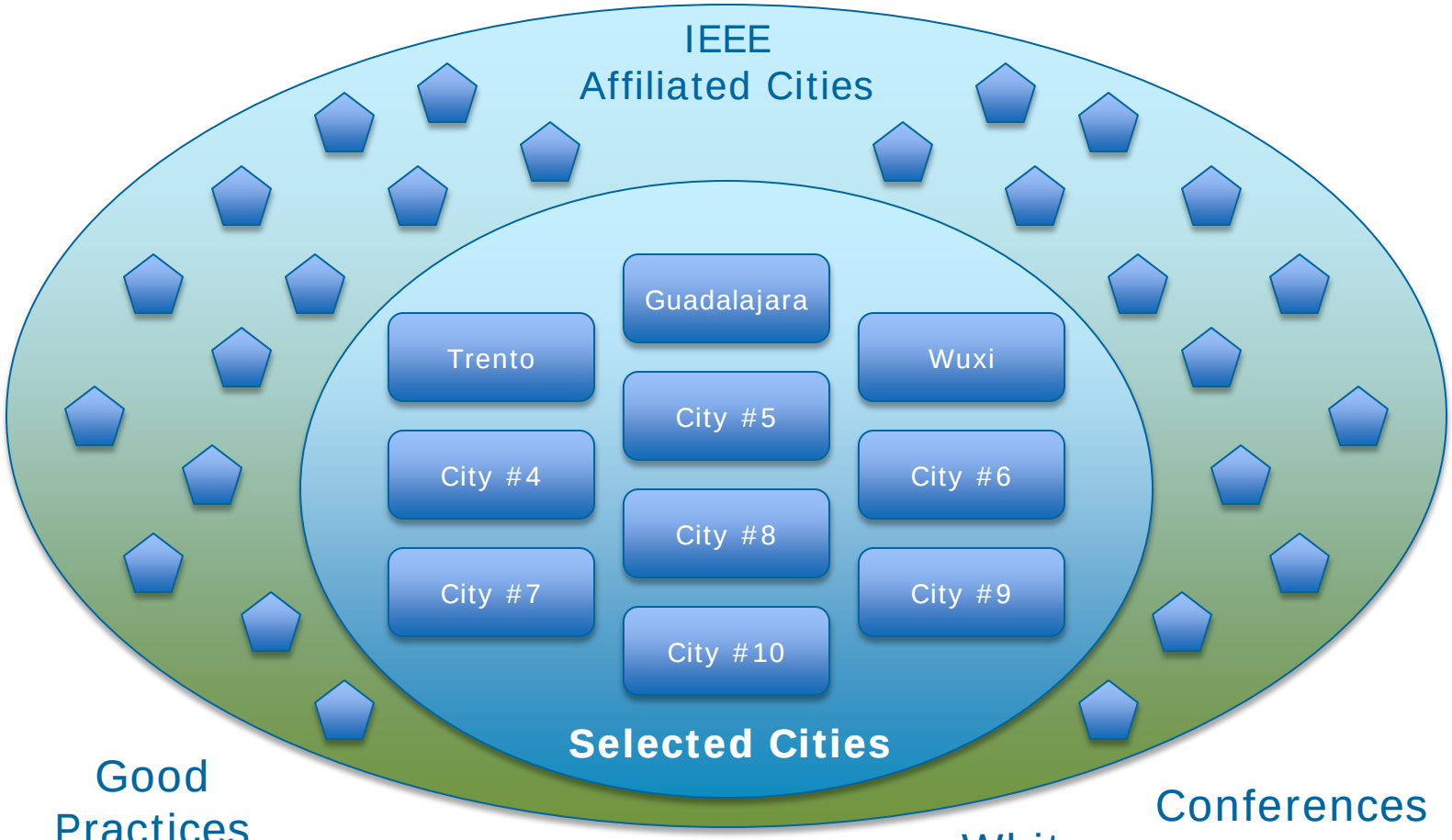


# Objectives

- The IEEE Smart Cities Initiative is a global, multi-disciplinary, cross-OU effort to:
  - Create a **vibrant and world wide network of cities**, providing education, insights and expertise
  - Collaborate to share knowledge, experience and good practices
  - Involve local **governance**, **universities**, **industries** and local **IEEE volunteers**
  - Assist municipalities in **managing the transition** to urbanization
  - **Raise awareness** of the benefits and downsides of technology and help guide the appropriate uses of technology
  - Establish IEEE as a **thought leader** and trusted source for information on technology related to Smart Cities
  - Associate with **ITU** and **Marshal McLuhan Foundation**

# The Initiative Galaxy

*The Smart Cities Initiative Network & Forum*




Good Practices

Knowledge

MOOCs

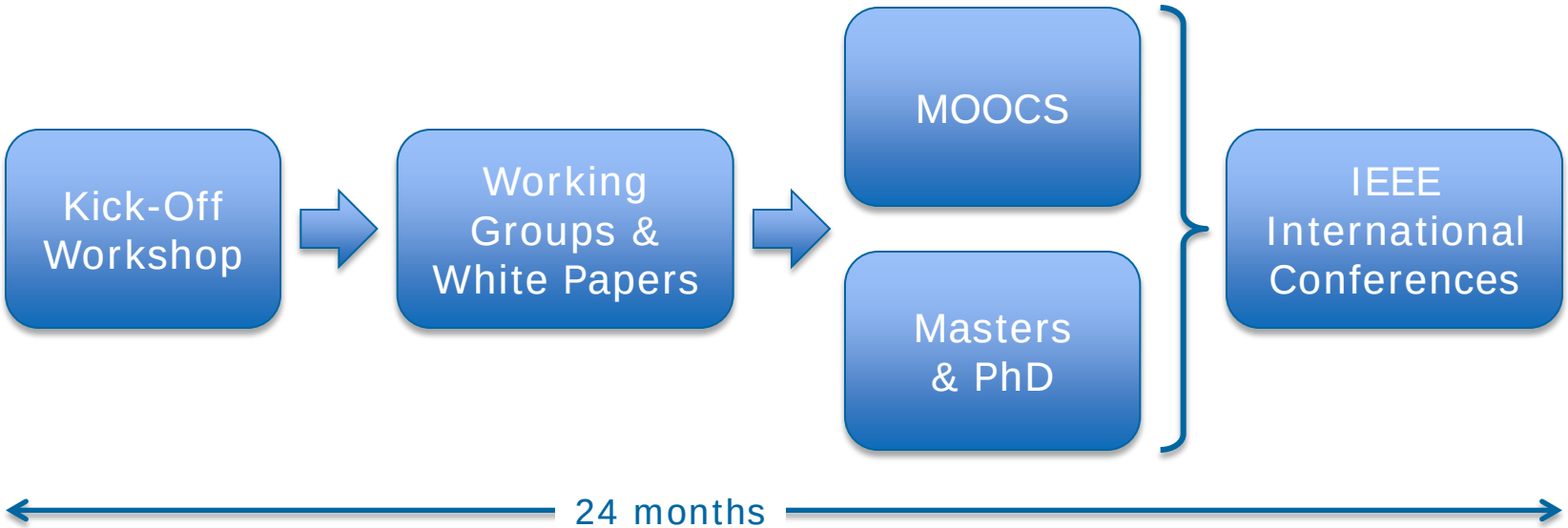
White Papers

Conferences

# Deliverables

- As a framework for the initiative
  - Web Portal
  - Knowledge Database : Whitepapers, applications, metrics, use cases, etc.
  - On-Line Technical Community
  - Dissemination through press releases, newsletter, conferences, Twitter feed…
- For each of the selected cities
  - Completion of one **quick-off workshop** per city
  - **Working groups** and **whitepapers**
  - **Metrics** to measure effectiveness of municipality efforts to evolve to Smart City
  - Published **theses** and doctoral **dissertations** from university students in each city
  - Four **MOOCs** per city developed by the selected universities
  - **Courses** developed by the universities on jointly agreed upon topics
  - Follow-on **conferences**
  - IEEE have rights to use courses and publications outside the country where developed

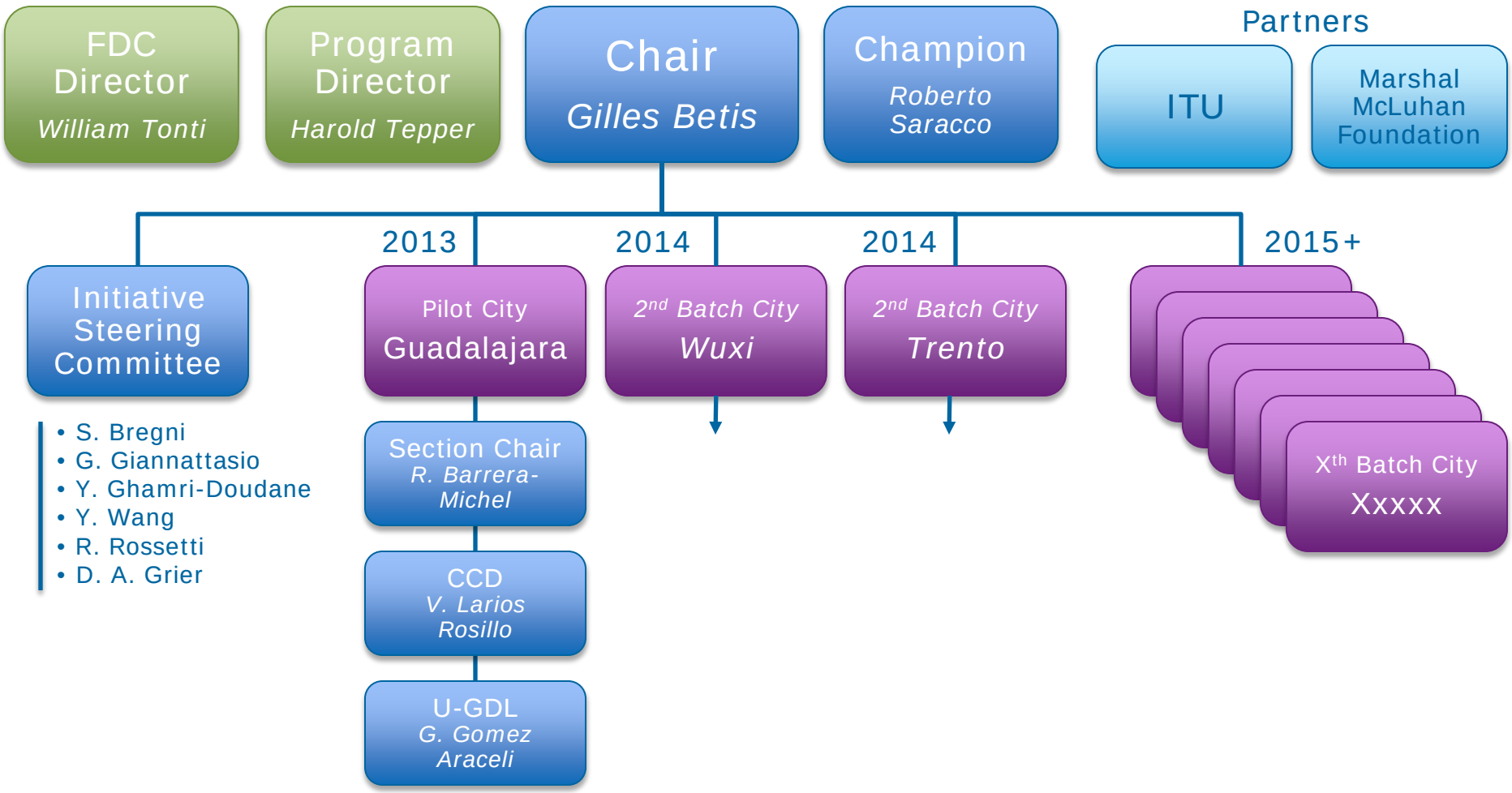
# Activity Flow and Deliverables




Web Portal – Data Repository - Metrics

Press Release – Newsletter – Twitter Feed - Conferences

# Organization



# Smart Cities Initiative

*The Guadalajara Experience – A local perspective*

Victor M. LARIOS

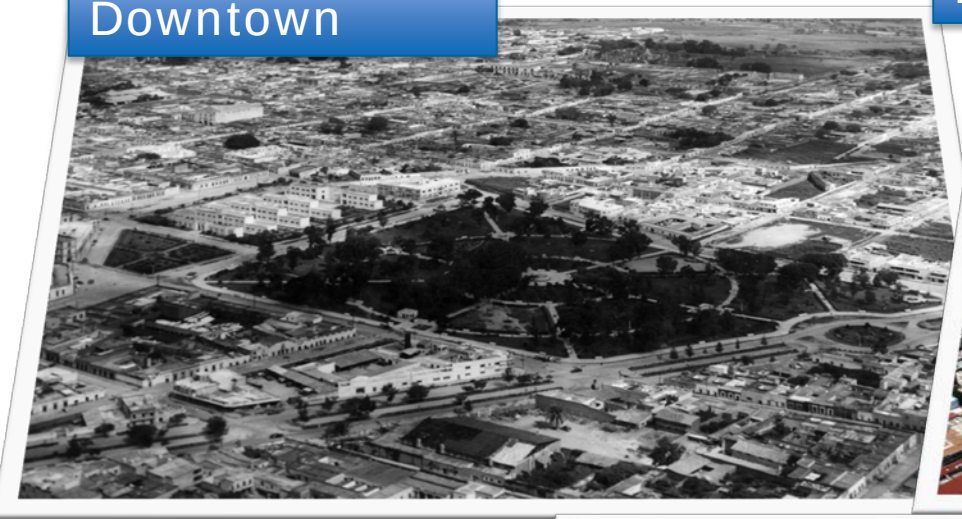
# Context of GDL City


## Facts

- Founded in 1539
- 4.2 Millions People
- x4 growth in past 30 years
- 6 interconnected municipalities
- 17Km from north to south
- 1/4 of Mexico City Size

# GDL City evolution

Morelos Park in Downtown



1920

Downtown social tissue reconstruction

2014

City renewal keeping traditions, architecture and talent designed by MIT Carlo Ratti

2018

Selected city from a national contest to be the smart city model for Mexico

# The renewal project

CIUDAD CREATIVA DIGITAL GUADALAJARA

IEEE Smart Cities

- 40 hectares @ digital hub + 380 hectares of sustainable impact
- Capacity for talent production & attraction
- IEEE Volunteers with compromise
- High tech industry ecosystem supporting

Government

Academy

Volunteers

Industry

http://ccdguadalajara.com

IEEE

# GDL CCD Project Video

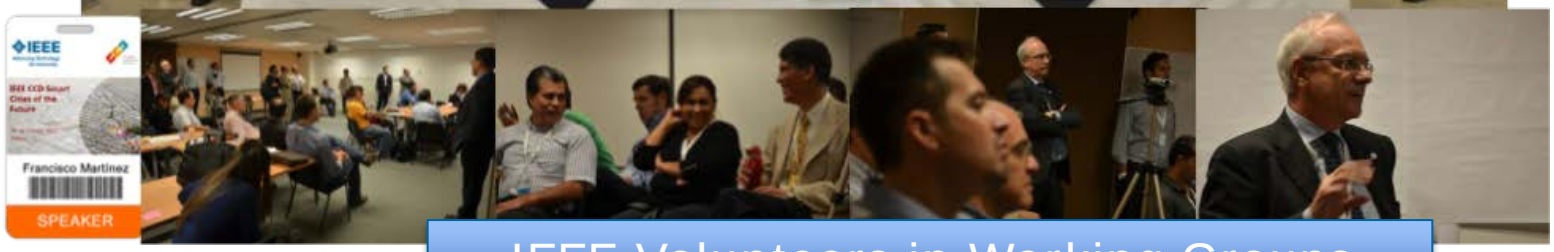
https://www.youtube.com/watch?v=5UDWfU_wDq0

# IEEE Smart Cities Pilot in GDL

Twitter: @IEEESmartCities
http://smartcities.ieee.org

- MOU IEEE- GDL City July 2013

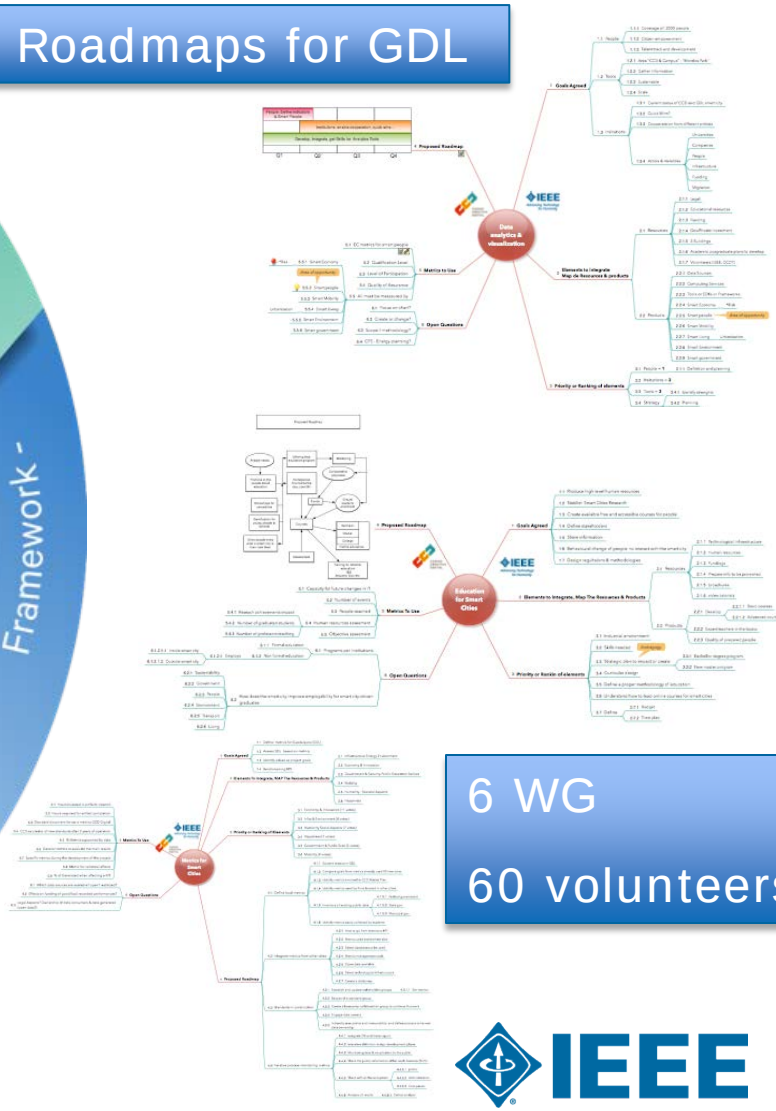
- Kickoff workshop in GDL October 2013


- IEEE Volunteers in Working Groups

# GDL volunteers organization


WG Roadmaps for GDL



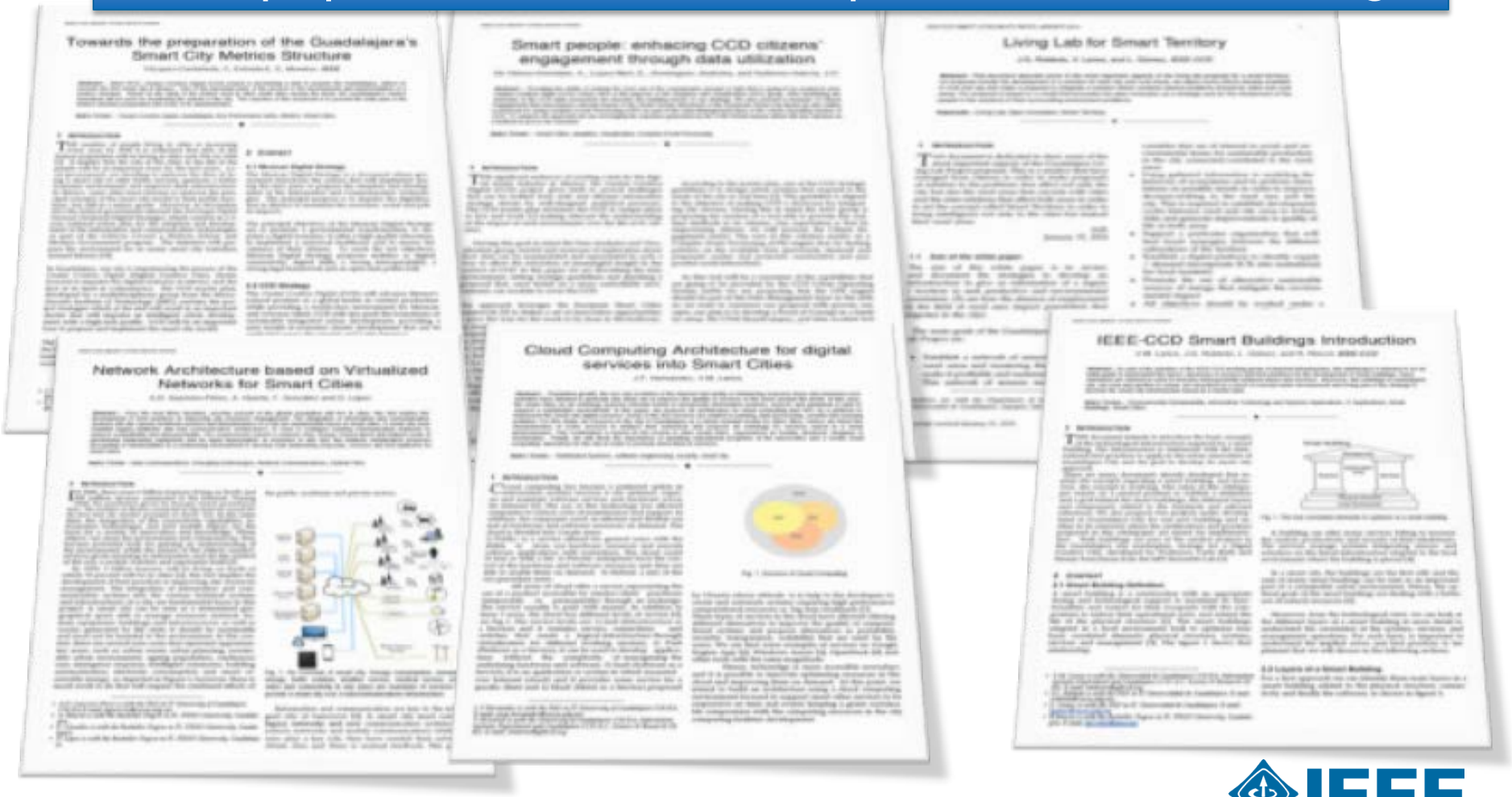
6 WG

60 volunteers

# GDL 1st Results & Opportunities

IEEE Smart Cities

## Whitepapers to share the experience & Knowledge




IEEE

# GDL 1st Results & Opportunities

**New** Smart Cities MOOCs Development in process


**New** Living Labs Projects for the City and a Smart Territory

**New** Smart Cities Innovation Center at Universidad de Guadalajara

**New** IEEE Smart Cities workshop in WCIT 2014 @ GDL

# Lessons learned at GDL Pilot

- Working groups
  - **Commitment** of volunteers takes time (Stamina addicted kernel supporting)
  - IEEE **Kickoff** necessary to create out of the box initiatives & create confidence
  - **Neutrality** of IEEE important for the ecosystem (academy, government, industry)
- City Impact with IEEE
  - Not to **reinvent the wheel** and share with other cities -> Opportunity
  - IEEE as facilitator towards an **inclusive & collaborative Smart City**

# Smart cities
# Engaging technologies and communities

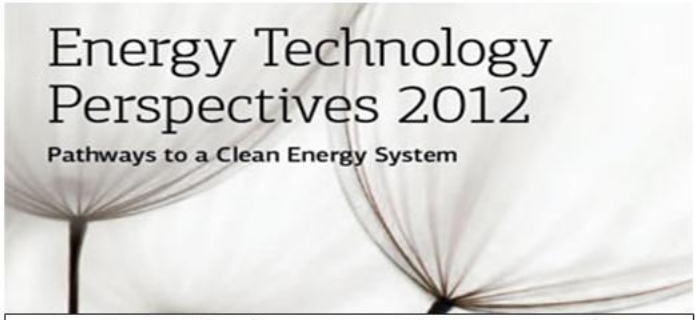
Ir. Guy Vekemans

# Content

- Smart cities in Europe, what's happening?
- Some examples of large scale pilot projects
- Bringing smart cities technologies and concepts to the market – KIC InnoEnergy

# The energy “revolution”

## Flexibiliy as “key feature” of the future energy system



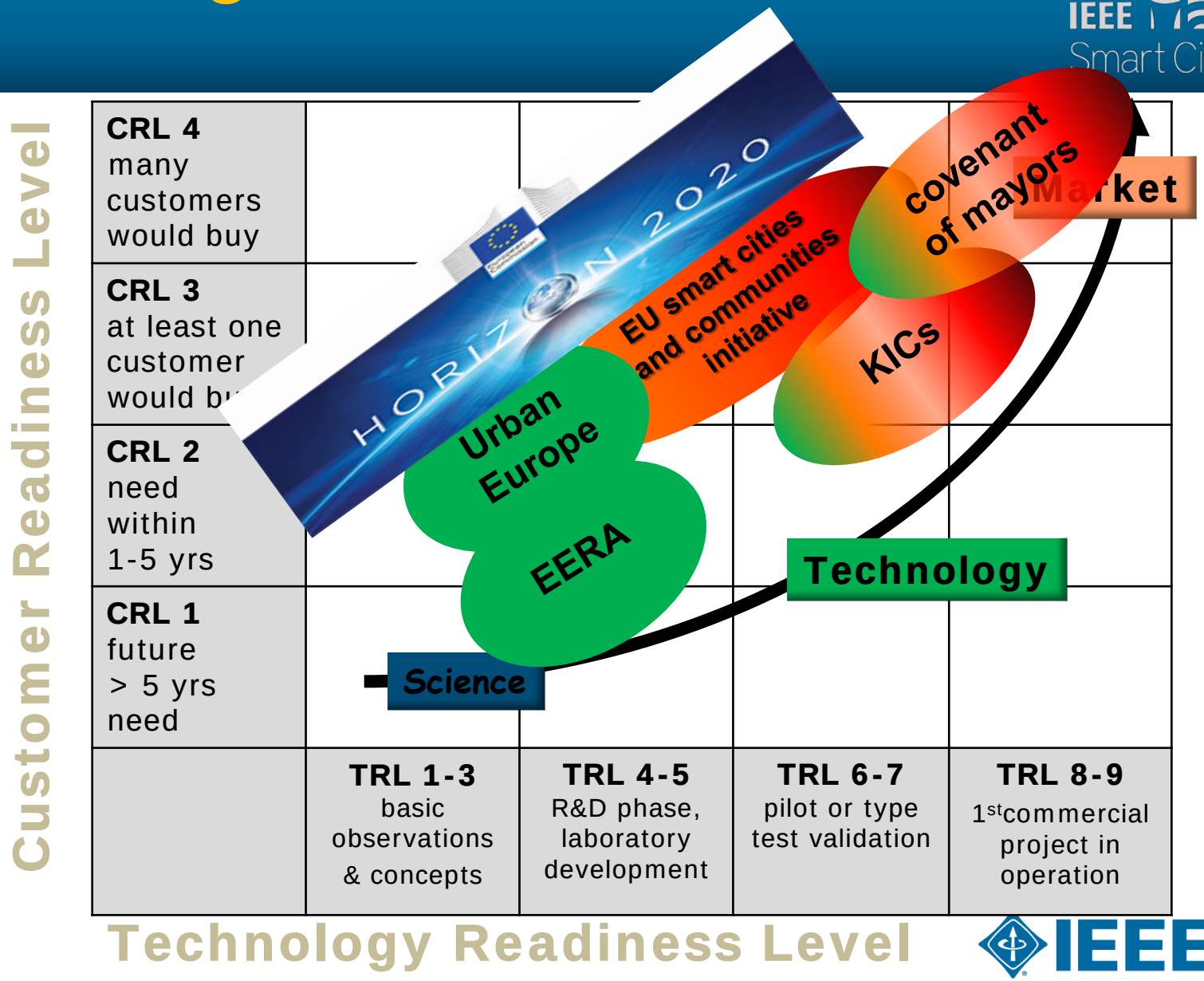

Report IEA (International Energy Agency)

*Future decarbonised energy system needs all flexibility solutions:*

- Energy storage
- Energy cluster management incl. flexible demand response
- “Dispatchable” power plants
- Interconnection with adjacent markets

# It’s all about efficient integration

# Integration on EU level



# Smart cities communities initiative (EU)

Smart Cities and Communities


http://www.eu-smartcities.eu/

# European energy research alliance


EERA smart cities joint programme
European Energy Research Alliance

http://www.eera-sc.eu/

# Urban Europe

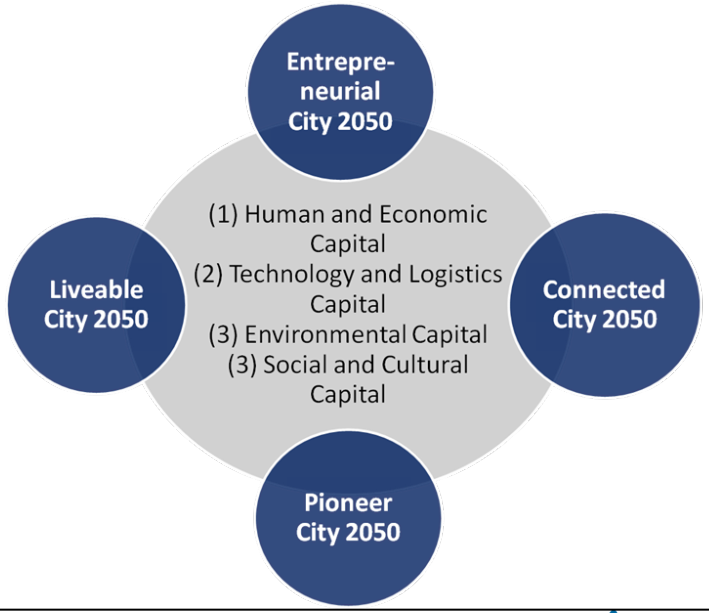
URBAN EUROPE
Joint Programming Initiative

## Strategic Research Agenda - Process

**4 pillars**
representing challenges

**4 integrated city images**
representing research demands

| Society | Economy |
|---|---|
| Ageing<br>Segregation | Brain drain<br>Stagnation |
| **Mobility** | **Ecology** |
| Congestion<br>Emission | Climate change<br>Degradation |




http://www.jpi-urbaneurope.eu/

# KIC InnoEnergy

## Bringing research to the market


eit Knowledge & Innovation Community

KIC InnoEnergy

# Examples of large scale pilot projects

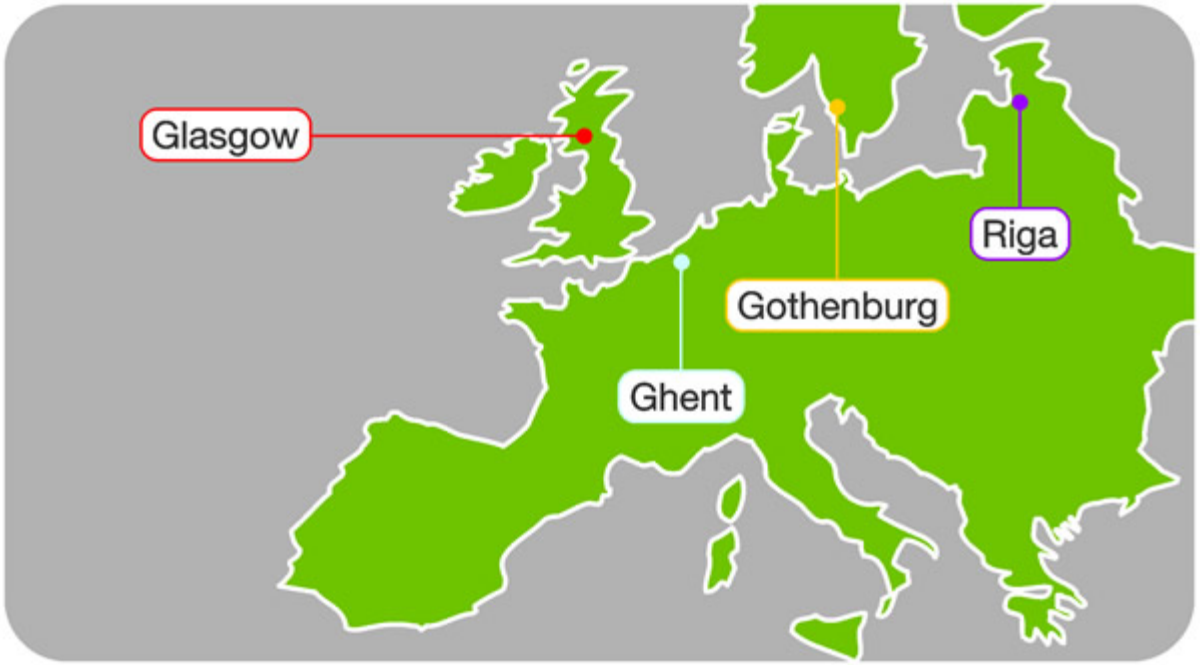
Glasgow
Göteborg
Riga
Ghent

Leuven
Bergamo
Freiburg
Houthaven

Aberdeen
Malmö
Hamburg
Zaanstad – A'dam
Antwerp

Amsterdam
Grenoble

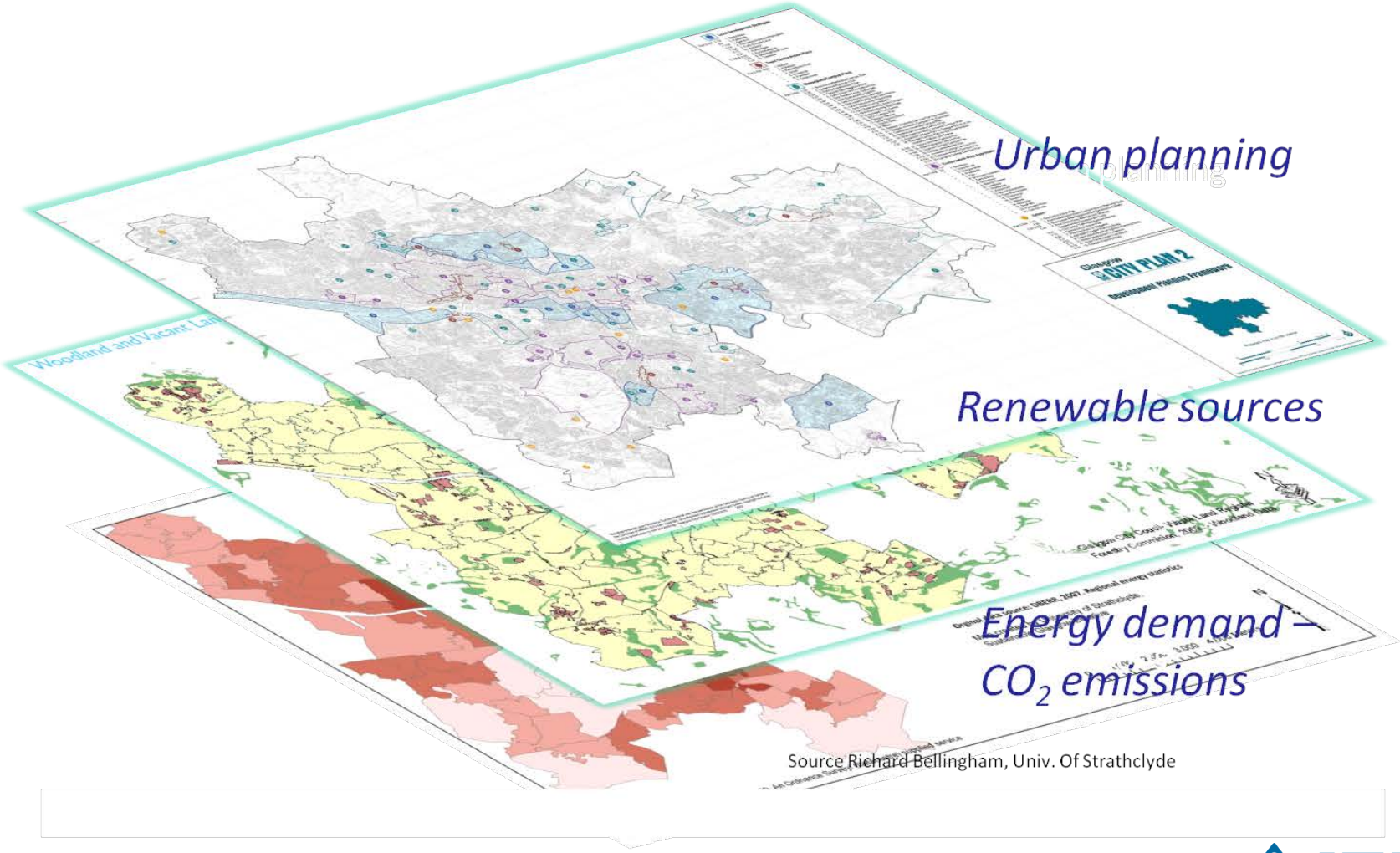
# STEP-UP city energy planning




From Sustainable energy action plans to district projects

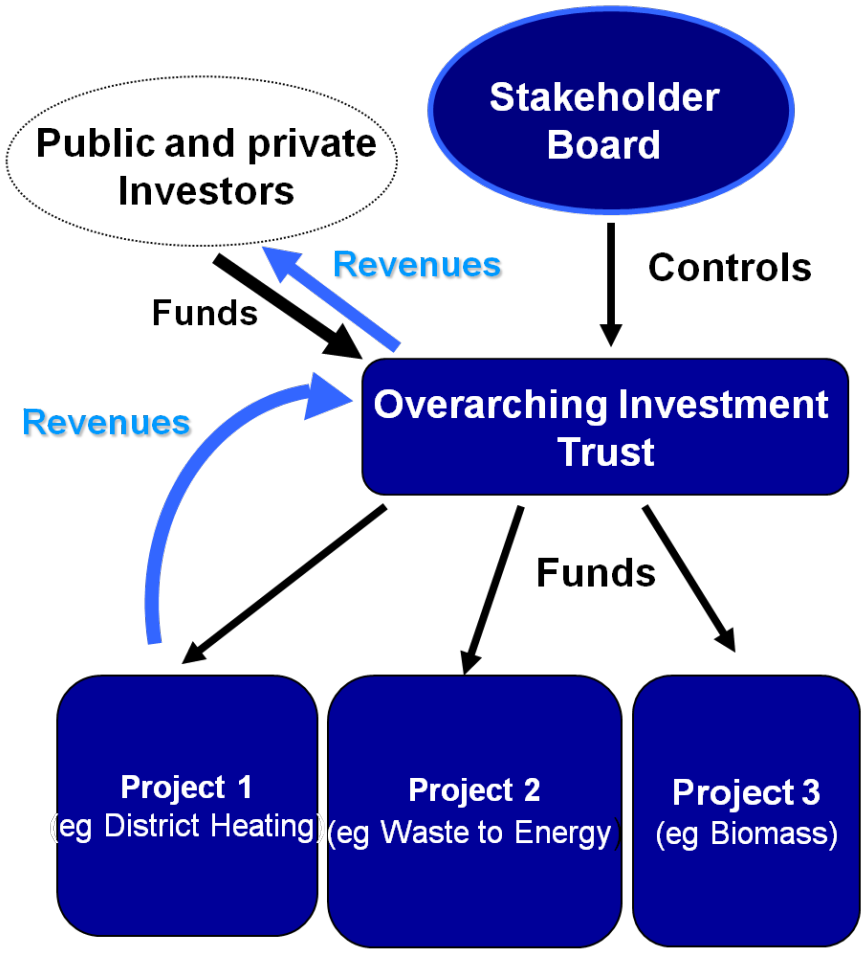
http://www.stepupsmartcities.eu

# Linking competences




Source Richard Bellingham, Univ. Of Strathclyde

# Linking money




Controls wider strategy; Plans; Monitors impacts and opportunities; Revises strategy; develops relationships; builds support; ensures projects match public policy objectives; maintains joined up approach; integrates strategy into public policy and wider plans

Raises funding; develops relationships with potential investors; assesses projects for investment by:
- assessing match to public policy goals and overall framework
- financial viability
- matching projects with investor priorities

Implements and operates new low carbon energy systems and infrastructure to deliver carbon reductions and economic regeneration. Range of potential business models – public private partnerships; publicly owned; commercial or community ownership

Source Richard Bellingham, Univ. Of Strathclyde

# Linking partners

IEEE Smart Cities

## Creating a Partnership

Scottish and Southern Energy

Scottish Water
Always serving Scotland

IBM

newcampus glasgow

CLYDE GATEWAY

Glasgow CITY COUNCIL

NHS SCOTLAND

Honeywell

GHA

Scottish Enterprise

BT

SCOTTISHPOWER

Scotland Gas Networks
A Scotia Gas Networks Company

University of Strathclyde Glasgow

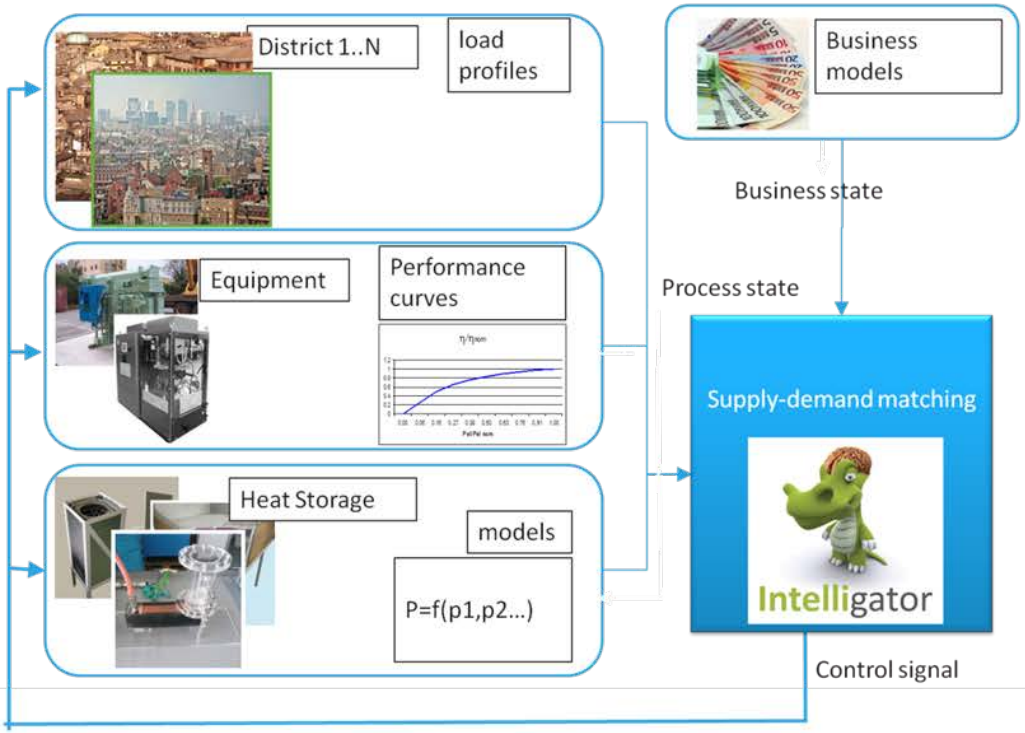
SPT

Source Richard Bellingham, Univ. Of Strathclyde

IEEE

# Energy Hub






- Multi commodity control
- Combined heat/electricity storage
- Innovative thermal storage:
  - State of charge
  - Thermochemical storage
  - Combination short/long term

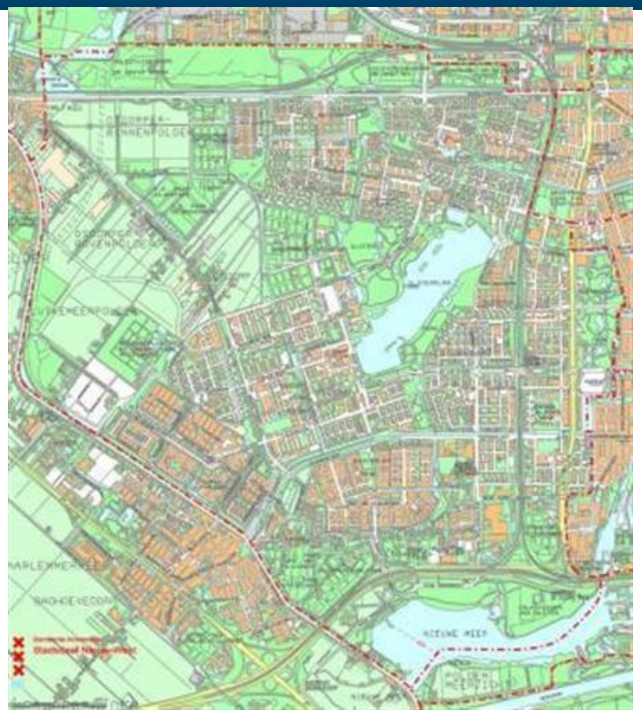
**http://www.e-hub.org/**

# E-harbours


e-harbours
electric
The Interreg IVB
North Sea Region
Programme
Investing in the future by working together
for a sustainable and competitive region


MAERSK

# City-Zen



District Nieuw
West Amsterdam

District Ecocité
Grenoble

http://amsterdamsmartcity.com/projects/detail/id/78/slug/city-zen?lang=en

# KIC InnoEnergy bringing research to the market

## Owned by 27 leading industries, research centers and universities of the European energy market; 6 operating centers

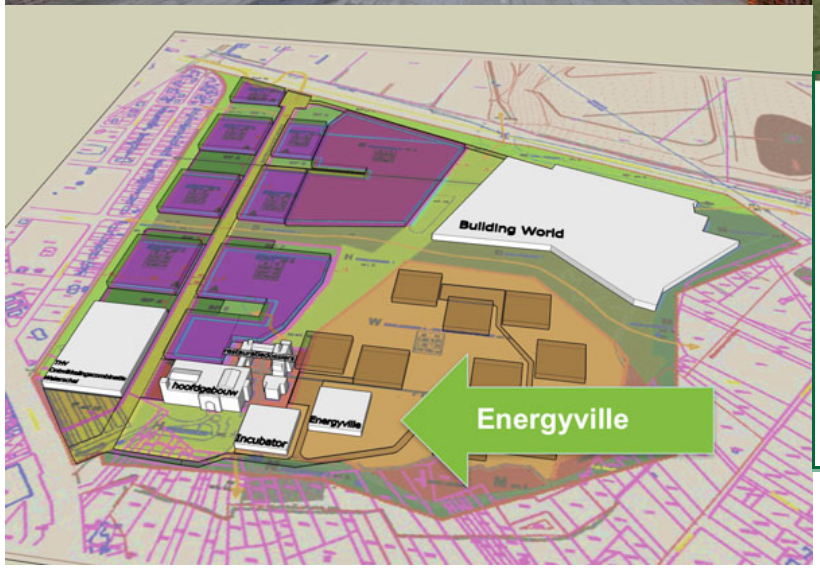

## About KIC InnoEnergy

- The European company for innovation, business creation and education in sustainable energy,
- Provides integrated solutions for finalizing and commercialization of technologically innovations, leading to new products and services at lower costs and higher market success
- Core expertise in supplying know-how, infrastructure, proven processes and market access through its partner network, in managing and funding of collaboration in international consortia, in educating technological competent, entrepreneurial talents (the “game changers”) and in nurturing of start-ups, small enterprises and spin-offs
- European wide risk-sharing partner, acting as investor, utilizing financial resources from EIT and owners

## Facts & Figures (2013)

- Over 150 active Partners in KIC InnoEnergy, thereof 111 from Industry
- Business volume over 200 Mio €, over 40 Mio € for new investments

# EnergyVille – a key player




Energy Ville

IEEE

# Conclusion

**Engineers have a key role in smart cities projects**

- as part of the designer teams
- to adapt technologies from TRL 6 to 7-8 taking into account:
  - Customer behaviour – participation
  - Scale effects
  - Interoperability issues
  - Cross disciplinarity
- as entrepreneurs e.g. ESCO's on DSR, retrofit,…

# QUESTIONS