Many of the cities around the globe need to accelerate their efforts to limit greenhouse gas emissions
Public policy makers are taking aggressive action to reduce carbon emissions

Climate Change Policies

**Kyoto Protocol**
(2005) An amendment to the United Nations Framework Convention on Climate Change (UNFCCC), countries that have ratified the protocol have committed to reduce their emissions of carbon dioxide and five other greenhouse gases or engage in emissions trading if they maintain or increase emissions of these gases – Europe’s commitment was to cut GHG emissions to 8% below 1990 levels.

Established a scheme for greenhouse gas emission allowance trading within the European Community

**Copenhagen 2009**
The first phase of Kyoto will expire in 2012. The United Nations Climate Change Conference in Copenhagen in December 2009 will be the next global opportunity to discuss and agree a successor to Kyoto that will bring about meaningful carbon cuts

Source: Economist, European Union, Goldman Sachs Report
The global drive towards lower carbon economy coinciding with urbanization growth is creating the need for change.

Over 60% of greenhouse gas emissions are created in and by cities.

Cities are the most suitable platform to start the movement towards a more sustainable future.

Over 50% of the world’s population currently live in cities and this is expected to grow to > 60% by 2030*

Urban population as a % of the total population - 2005

Source: **UN Commission - Population to the UN Economic and Social Council**
Cities are trying to deliver on ambitious environmental targets and trying to ensure an attractive and competitive urban ecosystem

However trying to deliver on ambitious environmental targets impose numerous difficulties for Cities

Environmental targets

Intercity competitiveness

Moving Policy Targets

Infrastructure Constraints

Financial constrictions
Many cities also in ASEAN have begun to develop solutions to these challenges, however progress has been slow.

Progress has begun in Cities …

- **Improve operational efficiency**
  - Real time road pricing
  - Capacity and Capital
  - More efficient public transport

- **Driving Behaviour Change**
  - Encourage efficient energy use
  - Reducing water consumption
  - Reducing car dependence

- **Introducing New Technology**
  - Phasing out of old technology
  - Carbon capture and penalties

However it has been hampered by:

1. **A lack of drive:**
   - Regulatory pressures are too weak
   - Low on Chief Executive and City Leader's agenda
   - Lack of incentives for energy providers

2. **Fragmentation of projects**
   - Difficulty defining scalable solutions
   - Fragmented value chain
   - Lack of access to capital
   - Lack of internal capacity and bandwidth
Smart cities / Eco cities

**Smart Grid Cities:** *Involves the entire energy pathway from the power source to the home and all points in between*

**Eco Cities:** *Involves a holistic sustainability perspective in the design and implementation of new/retrofit cities taking into consideration waste, heating, transport, distributed generation, health and local economy.*

**Smart Buildings:**
- Micro generation
- Highly insulated
- In-house data on energy usage and costs
- Smart thermostats, appliances and in-house energy control devices
- High efficiency appliances
- Plug-in hybrid electric cars

**Smart Grid Substation:**
- Smart sensors:
  - Rapid diagnosis & corrections
  - Power quality measurements
- Automatic fault isolation
- Smart meters
- Embedded renewables
- Grid-based storage

**Conventional energy supply**

**Renewable energy supply**

**Grid-based storage**

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*Image: Renewable Energy Asia | June 7th 2017 | Page 7*
Cities will need to adopt a fully integrated model to develop smarter solution for a sustainable city infrastructure

“A city in which citizens, companies and government sustainably live, work and interact, through delivery of integrated, low carbon products and services”

Our vision of a Smart City

A city will only achieve this vision by adopting an integrated approach to an infrastructure model by:

- The adoption of solutions areas through technology, operational effectiveness and behavioural change
- Through planning and investment across the infrastructure using the silos of integration across water, buildings, waste, energy, heat/cooling, public safety and mobility
- Driving the vision by new communication and data technology support
The adoption of solution through technology, operational effectiveness and behavioural change will drive the integrated Smart City model.

**Mobility**
- Replacement of combustion engines with electric equivalents
- Electrical vehicle recharge network and a purpose-designed payment infrastructure
- Reduce congestion with increased electrified mass transit options

**Buildings**
- Intelligent power and lighting systems
- Building climate control systems
- Micro generation and solar heating

**Heating**
- High-efficiency heating/cooling systems
- Increased use of both micro and community combined heat and power
- Heating/cooling networks and storage

**Safety**
- Increased access to real-time information, enabling a safer, more effective environment and boosting operations efficiency

**Energy**
- Historic and real-time energy data available
- Potential for a range of new energy services and tariffs
- Automatic system response to changing demand patterns

**Water**
- Metered usage, displaying historic and real-time consumption
- Potential for a range of new water service propositions and tariffs
- Smart-pipe networks to reduce leakage and manage pressure

**Waste**
- Increased waste-to-energy power generation
- Waste data availability improves municipal and private waste management
- Incentives for recycling of high percentage of household and commercial waste
Smart solutions need to be linked across the infrastructure areas and supported by communications.

- **Procurement**
- **Logistics**
- **Disposal / Collection**
- **Re-Use / Recycle**

- **Electric charging station & billing**
- **Sell back electricity for load levelling**
- **Micro-generation of energy Smart meters**
- **Point of Use**
- **Collection of waste using eVehicles**
- **Solar waste to energy**
- **Water usage & analysis**

*Renewable Energy Asia | June 7th 2017 | Page 10*
... but these solutions require collaboration, coordination, solid integration and strong leadership from the cities

Challenges to solutions at scale

Public Sector
- Lack of alignment
- Lack of dissemination of power
- Intercity disconnect

Private Sector
- Coordination of private sector parties
- Fragmented risk and value
- Uncertain business case

A structured approach is fundamental to overcome these challenges

A clear strategy

Strong coordination across all parties

Initiatives prioritisation in line with the impact on targets

Cities must be the catalyst for bringing together the public and private sectors and help developing new business models
It's not a ‘one size fits all’: A sequential approach is needed to shape a clear and relevant Intelligent City Vision
The current conditions of the city eco system will be an important determinant of the Intelligent City strategy.

Performing an overall readiness diagnostic of the city will provide insights on the ideal starting point and define the base line for the city’s sustainability objectives.

### Indicators

<table>
<thead>
<tr>
<th>Sustainable Strategy (CO2 / Tech Push)</th>
<th>Municipality impact on citizen behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambiguous ———— Rigid</td>
<td>Low ———— High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure Maturity (Renewable / Comms / Data)</th>
<th>Alignment of Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incipient ———— Developed</td>
<td>Fragmented ———— Aligned</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure Investment Cycle</th>
<th>Governance model / distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current ———— 20 years horizon</td>
<td>Constrained ———— Uncontrolled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure Elasticity</th>
<th>Organizational adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid ———— Elastic</td>
<td>Loose ———— Uncontrolled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Citizens willingness to adapt</th>
<th>Planning / Lessons learnt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low ———— High</td>
<td>Static ———— Dynamic</td>
</tr>
</tbody>
</table>

- Current Position

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Each city will have a unique set of drivers steering their strategy:

- Regulation: 20 20 20 targets, and DEFRA’s Indicators 185, 186
- Covenant of Mayors (EU)
- Ageing infrastructure / competitiveness
- Economic stimulus (jobs and green growth)
- Smart technology uptake drivers
- Pull from other stakeholders (utilities / cities / builders)
- Pull from integrated infrastructure initiatives
- Urbanisation, population growth
- Global mobility and competition for investment and jobs
- New private city business models

**Environmental Targets**

- Illustrative
- Understand legacy
- Identify Drivers
- Set Long Term Outcomes

**Intercity Competitiveness**
With both the legacy and the primary drivers in hand, realistic and achievable goals can be set.

**Goals and long term outcomes**

- **Environmental Goals**
  - CO₂ neutral municipality by 2015
  - 20% renewable energy in 2025
  - 40% reduction in CO₂ emission in 2025 (1990 baseline)

- **Infrastructure / Technology Goals**
  - Adapt infrastructure to for micro-generation
  - Electric Vehicle adoption
  - 20% renewable energy in 2025
  - Enable energy storage

- **Overall Ambition Goals**
  - Become the first sustainable city in Europe
  - Create competitive environment to host event (e.g. Olympics)
It’s not a ‘one size fits all’:
Here are some examples of different Intelligent city visions

<table>
<thead>
<tr>
<th>Type</th>
<th>Drivers</th>
<th>Sample of Concepts Applied</th>
<th>Investment</th>
<th>CO₂ Push</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrofit</td>
<td>Sustainable City</td>
<td>• Smart meters / displays&lt;br&gt;• New logistics/waste models&lt;br&gt;• Smart street lighting&lt;br&gt;• Electric vehicles&lt;br&gt;• Charging terminals&lt;br&gt;• …</td>
<td>€1.1 billion</td>
<td>Very Low</td>
</tr>
<tr>
<td></td>
<td>• Reduction of CO₂ emissions&lt;br&gt;• Reduction of energy consumption&lt;br&gt;• Incorporation of renewable in the energy production mix</td>
<td></td>
<td>(£3.2m 1st P.)</td>
<td></td>
</tr>
<tr>
<td>Retrofit</td>
<td>Smart Technology City</td>
<td>• Full Smart Grid&lt;br&gt;• Distributed Generation&lt;br&gt;• Sensors and controls&lt;br&gt;• Energy displays&lt;br&gt;• Smart Sub-stations&lt;br&gt;• …</td>
<td>€100 million</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>• Infrastructure reliability&lt;br&gt;• 1st mover for energy new technologies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Build</td>
<td>Living Laboratory Smart City</td>
<td>• Smart traffic management&lt;br&gt;• Automated transportation&lt;br&gt;• Distributed Generation&lt;br&gt;• Mobility on Demand&lt;br&gt;• Waste to Energy&lt;br&gt;• …</td>
<td>~ €15 billion</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>• Knowledge Economy&lt;br&gt;• Job Creation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Very High: 🔧 High: 🔧 Medium: 🔧 Low: 🔧 Very Low: 🔧
Thank You