“ICT Roadmap for the Arab Region to Transform to Smart Sustainable Cites”

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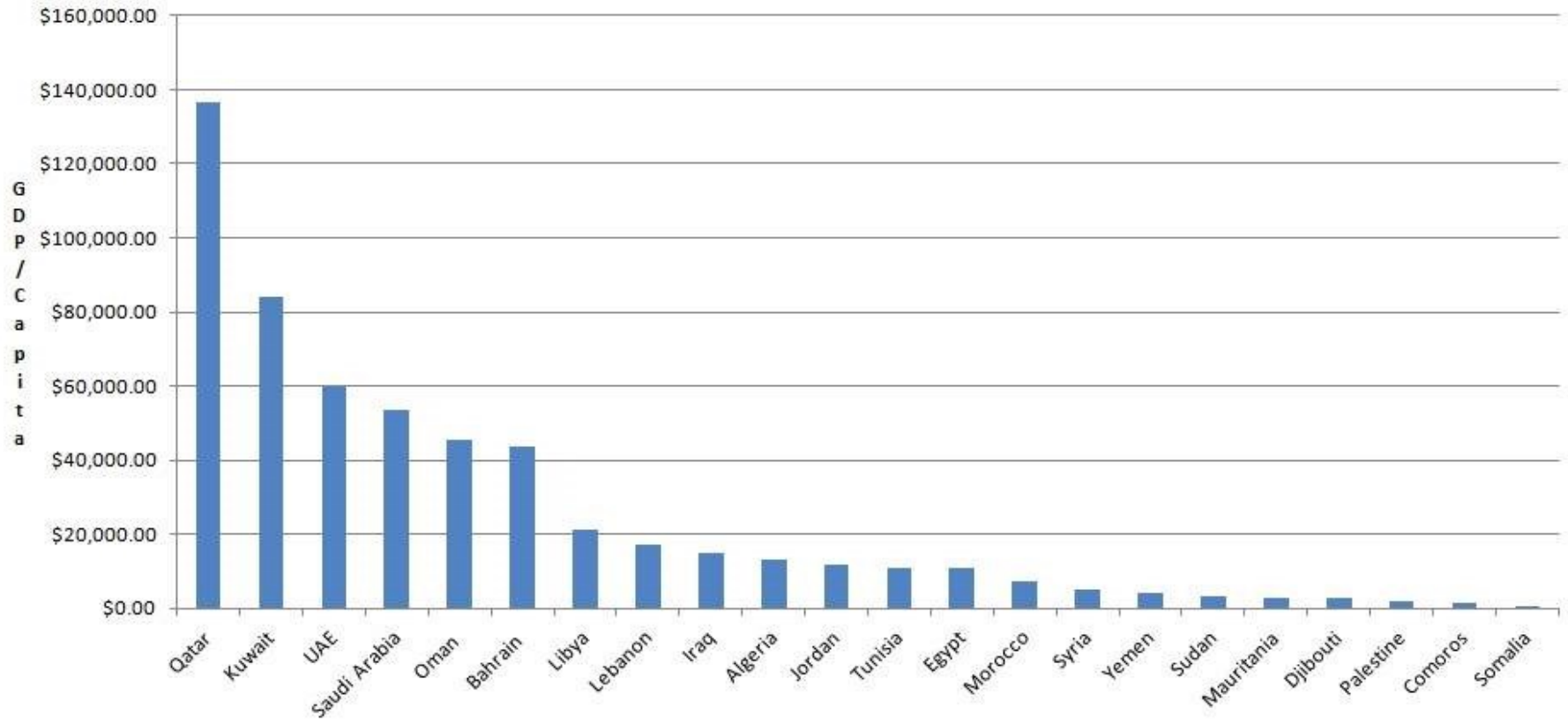
Objective

- This document focuses on answering the question, “Which ICTs are required for SSCs in the Arab Region and what is the technology roadmap?"
  - The approach taken assumes that the reader is familiar with the deliverables produced by the ITU FG-SSC

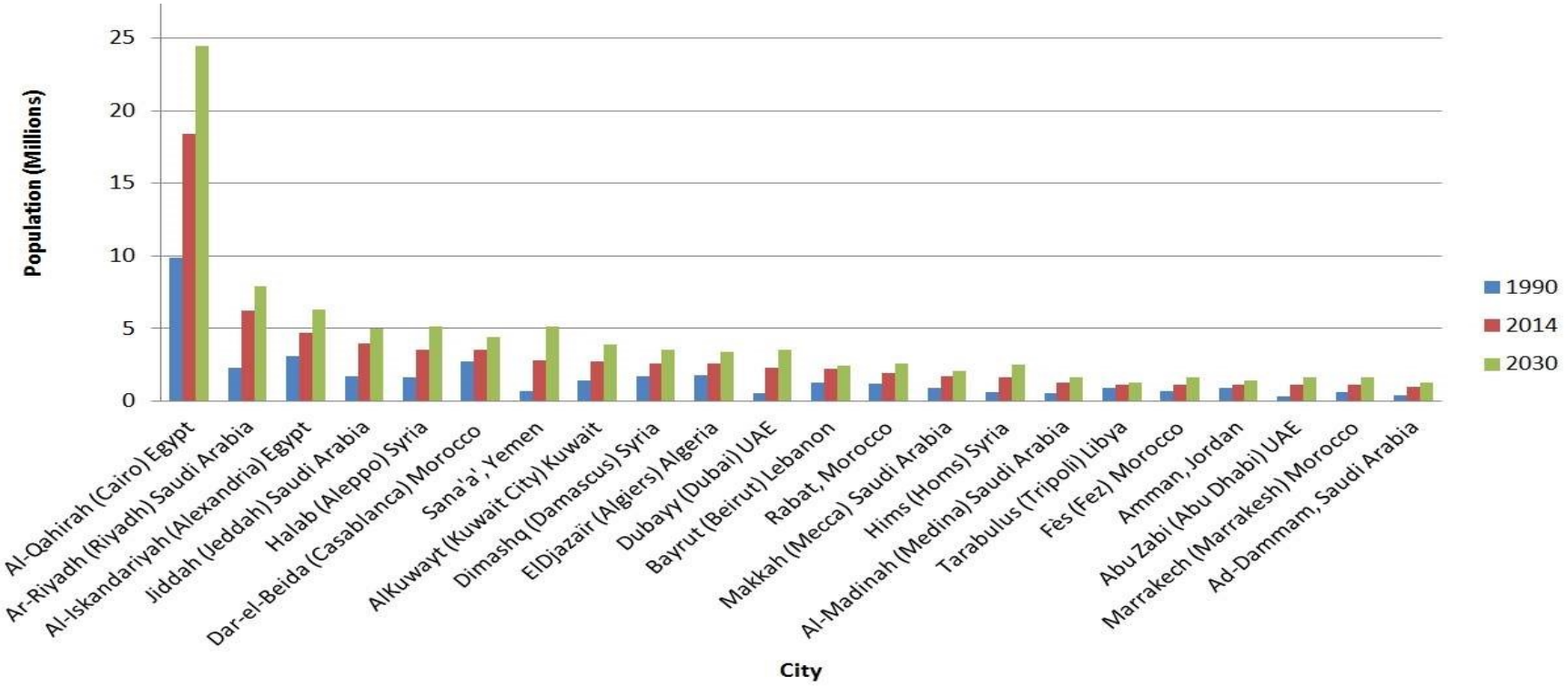
Comparison of GDP of the Arab States



- The average GDP is $17k compared with Europe at $34k
- The distribution of GDP among Arab States has a very wide range
  - The ratio between richest and poorest is 230000
  - This compares with the 28 countries in the European Union where the ratio is 8.9

Sources: World Bank 2013
http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?order=wbapi_data_value_2013+wbapi_data_value+wbapi_data_value-last&sort=desc
European Union, Eurostat 2013
http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tec00114

Trends in Urban Population in the Arab States



- The average urban growth rate of approximately 2.2% per annum
- The next decade is likely to see a growth in urban population of 55 million or 15%
- There could be more than 55 cities of 1 Million more inhabitants across the region by 2025

Sources: Katja Schäfer "Urbanization and Urban Risks in the Arab Region" 1st Arab Region Conference for Disaster Risk Reduction, 19 – 21 March 2013 at Aqaba – Jordan
http://www.preventionweb.net/files/31093_habitataqabaurbanresillience.pdf
[United Nations, Department of Economic and Social Affairs, Population Division, Urban Agglomerations Wallchart 2014. http://esa.un.org/unpd/wup/wallcharts/WUP_2014%20Urban%20Agglomerations%20Wallchart.pdf

Urbanisation Challenges in the Arab Region 1/2

- Urbanization is driven by economic development, migration to oil-rich countries, drought and conflict (importance varying by sub-region).
  - In 2010 there were 7.4 million refugees, 9.8 million internally displaced people , and 15 million international (economic) migrants
- Several primary cities have become extended metropolitan regions, some are actual or emerging mega-urban regions with complex issues of regional-wide urban governance, authority conflicts and governance voids
- Highly-centralized government modalities weaken relationships between citizens and local government

Source: Katja Schäfer "Urbanization and Urban Risks in the Arab Region" 1st Arab Region Conference for Disaster Risk Reduction, 19 – 21 March 2013 at Aqaba – Jordan

http://www.preventionweb.net/files/31093_habitataqabaurbanresillience.pdf

Urbanisation Challenges in the Arab Region 2/2

- Wide disparities across regions and urban poverty
- Affordable housing shortage (speculatively escalating land prices, cumbersome and expensive property registration and limited access to housing finance)
- Urban informal settlements in some part of the Arab Region
- Security of urban water and food insecurity are key defining social problems
- Youth bulge (60% of population below 25 years) and unemployment rates
- Marginalisation and poverty induced by lack of mobility have fuelled recent political polarisation in the region
- Internal trade is underutilized - need for greater intra-Arab cooperation.

Source: Katja Schäfer "Urbanization and Urban Risks in the Arab Region" 1st Arab Region Conference for Disaster Risk Reduction, 19 – 21 March 2013 at Aqaba – Jordan

http://www.preventionweb.net/files/31093_habitataqabaurbanresillience.pdf

Trends in telecommunication services in the Arab States - *ITU 2014*

- Fixed line peaked in 2008 with 10.3 subscriptions per 100 inhabitants.
  - (Europe peaked in 2005 when there were 45.5 subscriptions per 100 inhabitants. There has been a steady decline since).
- Mobile cellular subscriptions reached 109.9/100 inhabitants in year 2014.
  - (Europe was 124.7).
- Mobile broadband subscriptions reached 24.6% population by 2014.
  - (Europe was 63.8%).
- Fixed line Broadband has reached 3.1/100 inhabitants
  - (Europe was 27.7/100)
- Individuals using internet 40.6%
  - (Europe was 74.8%)27.7/100)

Source: ITU statistics and indicators 2014 http://www.itu.int/pub/D-IND

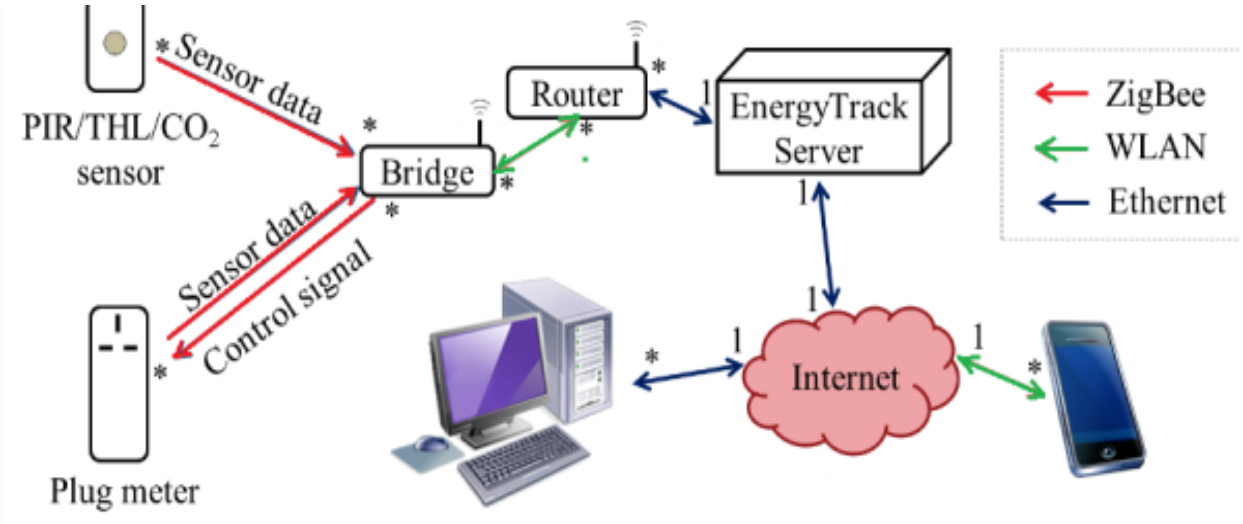
Analysis of Indicators from ITU

- Telephony services are mainly via mobiles
  - Subscriptions are approaching saturation with some inhabitants having more than one subscription
- Internet access is mainly through mobile subscriptions
  - Only 40.6% have internet access compared with Europe at 74.8%
  - Fixed line connections appear to be quite low and declining
- Wireless broadband services generally suffer from low data throughput even though the maximum speed is high.
  - For example, if the base station has a maximum data rate of 50 Mbit/s and there are 50 users connected the average throughput is only 1 Mbit/s
  - With a fixed line the speed can be up to the maximum rate of the line which may be 50 Mbit/s or more with optical fibre capable of 1Gbit/s and beyond

What basic telecommunications capability is recommended for SSCs in the Arab Region?

- The coverage, speed and take up of broadband services should be targeted at 100% of the population with a target of at least 30 Mbit/s download speeds
- It is recommended that for new buildings, fixed lines should be provided, including at least one optical fibre plus at least one twisted pair.
  - The provision of two of each should be considered as a low-cost way of enabling future growth or upgrade without disrupting existing services
  - Additional considerations are needed to accommodate the sensor layer network and IoT…

The Sensor Layer Network and Internet of Things



- IoT trends show that we will have 25 billion connected devices by the year 2020*
- Devices like smart phones and machine to machine (M2M) (or thing to thing -ToT) communications will be the main drivers for further IoT development
- Sensors may be used for: security, lighting, presence, weather, transportation, movement or position installed on the physical infrastructure of the SSC. These devices make it possible to monitor: climate, road congestion, air pollution, and criminal misbehaviour.

Sources: ITU-T FG-SSC deliverable "Technical Report on Smart Sustainable Cities Infrastructure", 2014
*Gartner "4.9 Billion Connected 'Things' Will Be in Use in 2015"
http://www.gartner.com/newsroom/id/2905717

Sensor powering at city scale

- Powering the sensor layer network is an important lifecycle consideration
- Whilst batteries may be suitable for the home or personal environment a visit to a remote location in a in a city to replace batteries in wireless sensors is a costly service maintenance consideration
- A battery life of less than 10 years can destroy a remote sensor business proposition
- Wireline options should therefore be considered as a more sustainable alternative to wireless devices for the urban environment.

Sensor powering at city scale: batteries

- Example: a current of 15.7 µA is required to power a Zigbee device operating at a low duty cycle
- A small a pair of alkaline primary cells of size AA may typically have current capacity of 3000mAh.
  - This current drain would give fully charged cells a life of 21.7 years.
- However this is more than the expected life of the battery which is up to 10 years.
  - In the Arab region high temperatures can be expected which will reduce the life of the battery.
  - At 40 degrees a battery will have only 70% capacity after 4 years
- It is recommended that further studies should be made on the expected lifecycle if batteries are to be used to power remote devices in the sensor layer network especially at elevated temperatures

Sources: Dementyev, A. et al. "Power consumption analysis of Bluetooth Low Energy, ZigBee and ANT sensor nodes in a cyclic sleep scenario", Wireless Symposium (IWS), 2013 IEEE International Conference, 14-18 April 2013, IEEE Xplore

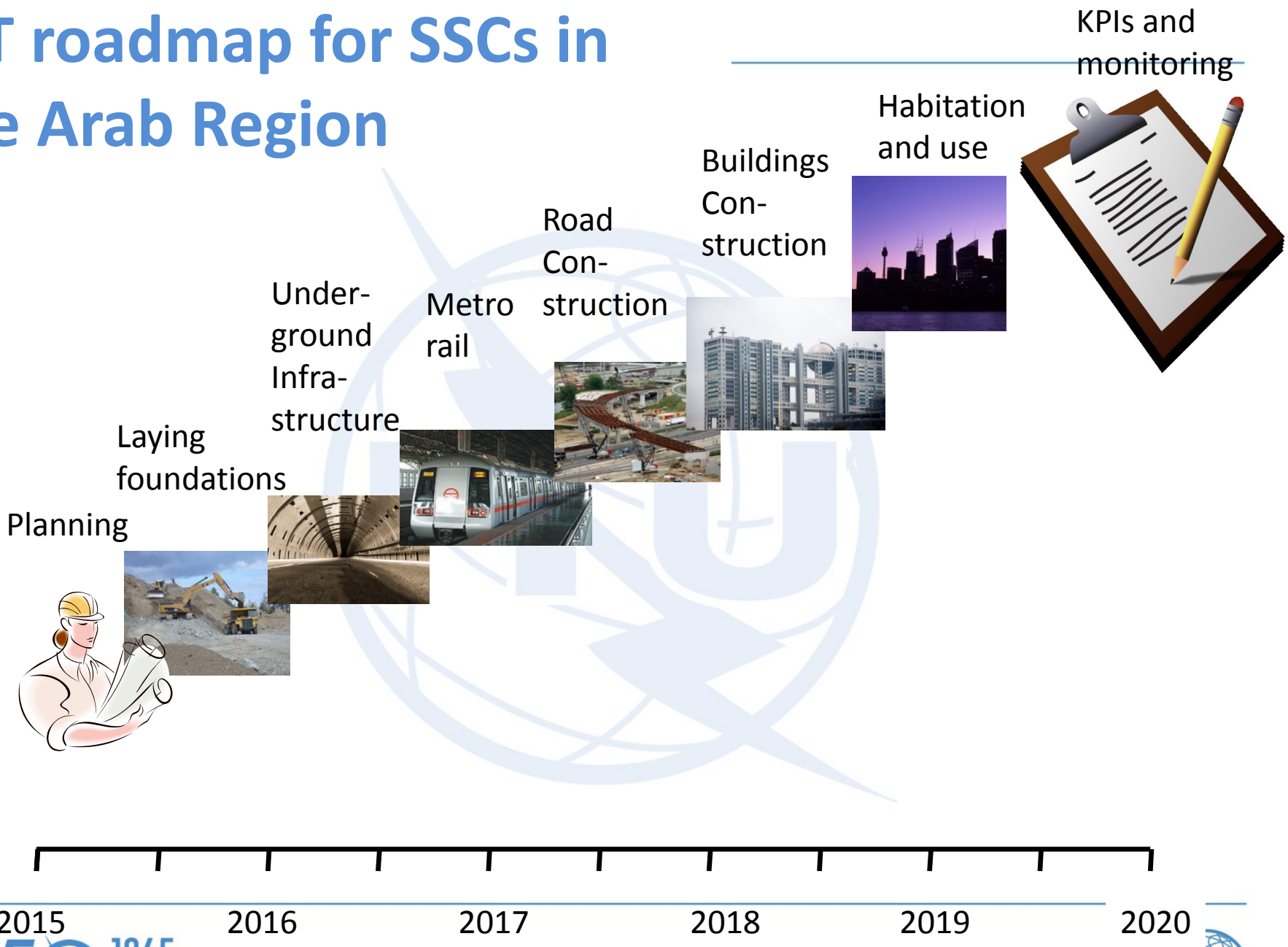
Energizer "Typical Temperature Effects" http://data.energizer.com/PDFs/temperat.pdf

Sensor powering at city scale: wireline

- Telephony cable (twisted pair) may be used to provide both backhauling (e.g. A/VDSL) and powering
- This is a typical case of use of the telecommunication company's access network with power (e.g. power for a telephone or ADSL loop extender is provided along the line together with DSL signals for internet access). Powering via the telephone line is also used for ISDN and alarm services
- Power is normally backed up by a battery and generator at the telephone exchange which would not be the case for sensors relying on grid electricity
- Telephone wires may be used in a number of different ways to connect sensors or actuators to a central office whilst transmitting data
  - A recent patent filed by British Telecommunications
  - According to this invention more than one piece of equipment may be connected (e.g. hundreds of sensors), whilst basic telephony and broadband access are also assured if needed
- It is recommended that the technical feasibility and business case for providing twisted pair for sensor-layer networks is studied further both for existing cities and for new build

Source: United States Patent Application 20150071098 "Delivery of electrical power", 27 Feb. 2013
http://www.freepatentsonline.com/20150071098.pdf

ICT roadmap for SSCs in the Arab Region



ICT roadmap for SSCs in the Arab Region

KPIs and monitoring

Habitation and use

Buildings Con-struction

Applications, Control, Monitoring and Communications systems

Road Con-struction

Control, Monitoring and Communications systems

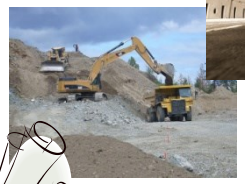
Metro rail

Mapping, Design and Monit-oring systems

Under-ground Infra-structure

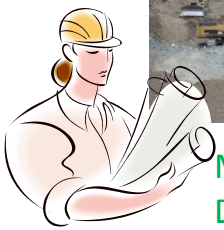
Control systems

Laying foundations



Monitoring systems

Planning

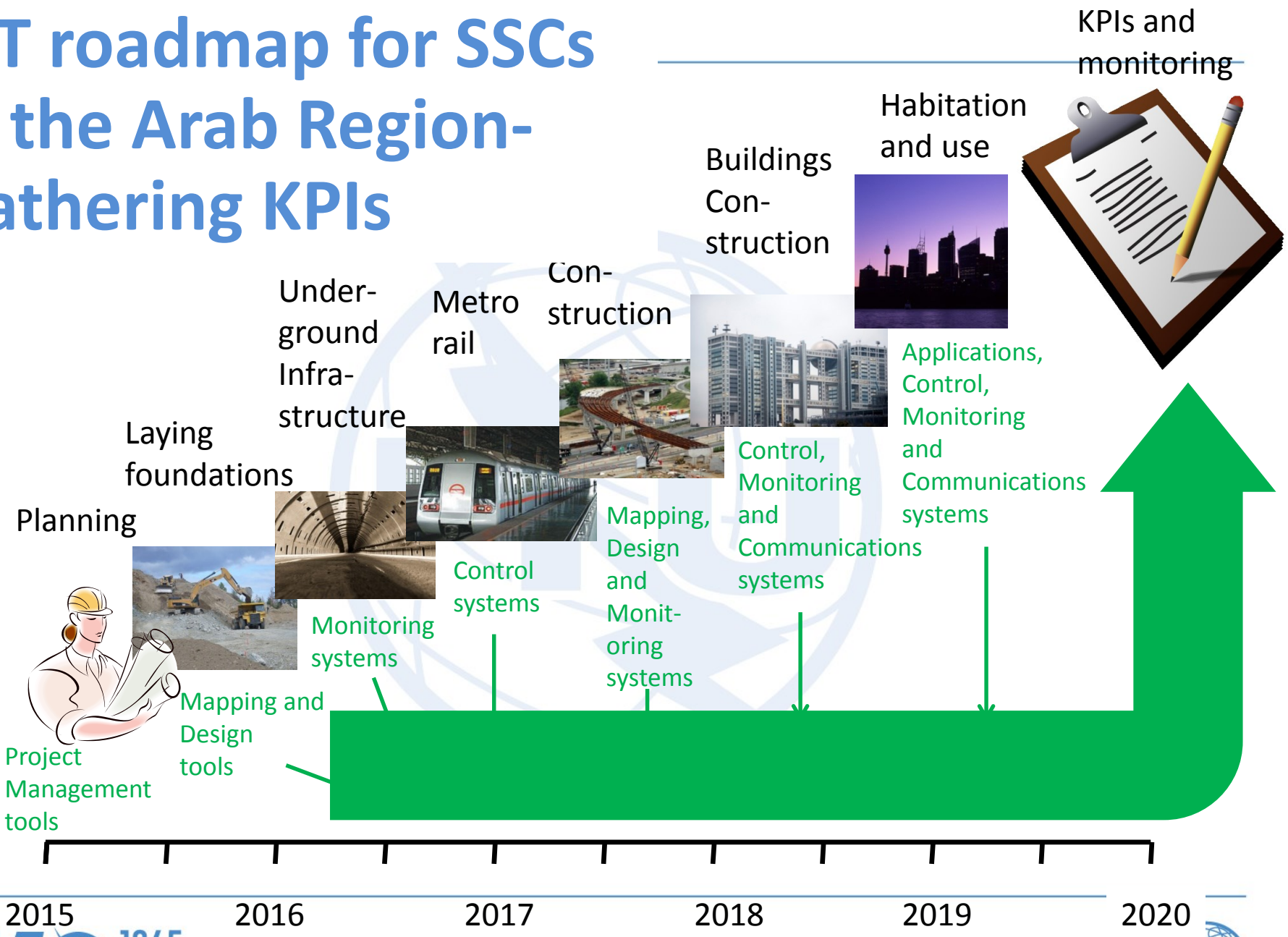


Mapping and Design tools

Project Management tools

2015 2016 2017 2018 2019 2020

ICT roadmap for SSCs in the Arab Region- Gathering KPIs



ICT and Sustainability in Cities

- Why consider it?
  - ICT contributes to the energy used in a city
    - By reducing the energy requirement both CO2 emissions and the energy costs over the lifecycle can be reduced
    - This is the first order effect

  - ICT can help reduce the CO2 emissions of the city
    - E.G. ICT can be used for process transformation such as home working to eliminate transport to central offices
    - This is the second order effect
    - A reduction in overall emissions through efficiency improvements through the use of ICT is the desired outcome.

Assessing the CO_2 emissions of ICT in Cities

- ITU-T Recommendation L.1440 "Methodology for environmental impact assessment of information and communication technologies at city level"
  - Gives general guidance for city level environmental assessments related to ICT, and provides a description of methodologies to be used for the assessment of the environmental impact of ICT in cities.
  - The current assessment is limited to energy consumption and GHG emissions
  - Part I relates to the first order effects from the use of ICT goods and networks in a city´s organizations and households. Provides specific guidance in
    - setting the city boundaries
    - preparing and performing the assessment of ICT related GHG emissions and energy consumption at city level.
  - Part II relates to the first and second order effects from ICT projects and services applied in the city environment
- This Recommendation is currently under review by the ITU-T membership
  - Due to be released free of charge during the next few weeks

Source http://www.itu.int/itu-t/aap/AAPRecDetails.aspx?AAPSeqNo=3209

Conclusion and Recommendations

- It is recommended that
  - the coverage, speed and take up of broadband services should be targeted at 100% of the population with at least 30 Mbit/s download speeds
  - fixed lines should be provided to every new building, including at least one optical fibre and at least one twisted pair
  - the technical feasibility of providing twisted pair for sensor-layer networks in the urban environment is studied further; both for existing cities and for new build
    - The advantage of this is that a centrally backed-up power supply may be used avoiding the cost of replacing possibly thousands of batteries at the edge of the network
  - city planners with an interest in ICT read the reports produced by the FG-SSC and follow and/or contribute to the subsequent activities in the ITU as detailed in this report