



Planning Smart Cities in SAARC Countries

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Smart Infrastructure – Key Features

1. Two-Way Communication
2. Resiliency incase of Disasters (Natural and Man-made)
3. **Energy Efficiency**
4. **Emission Free or Clean**
5. **Smart Mobility**
6. Flexibility in Usage (and Obsolescence Proof in foreseeable time frame)
7. Wastage Free or Minimal Wastage
8. **Instrumented – Interconnected – Intelligent**
9. Sustainable



Smart Infrastructure – Lasting Centuries

- How to design buildings, roads and other public infrastructure that last several centuries – if not millenniums
- What is serving the needs of today may not serve good after few decades or centuries
- Some of the ancient monuments do survive natural disasters where as our modern buildings collapse
- What planning tools are available for designing the infrastructure that can support the needs – jobs, mobility, trade, health, education, recreation.....



3. Energy Efficiency

- ❑ Commercial buildings in most countries consume >200 kWh/SqM per Year
- ❑ Present technologies and materials can bring this down to below 50 kWh/SqM per Year
- ❑ All new buildings should be mandated to have energy consumption below 100 kWh/SqM/Year
- ❑ Large Campuses to be smart microgrids that can island from the main grid when required
- ❑ DC (48 volt) distribution system in parallel with AC distribution system
- ❑ Regenerative Lifts

Energy Efficient Buildings



Commercial Building



Net Zero Emission Building



4. Emission Free

- ☐ Zero Emission Buildings (ZEB) and Zero Emission Campuses
- ☐ LEED/GRIHA certified buildings
- ☐ PEER certified campuses and towns
- ☐ E-Vehicles ONLY Zones
- ☐ Walk-to-Work neighborhoods
- ☐ Dust free constructions – no open earth between roads and buildings
- ☐ EV charging infrastructure in buildings and campuses
- ☐ Clean Energy
 - ☐ Solar, Wind, Wave, Geothermal, OTEC
 - ☐ Waste-to-Energy plants
- ☐ Smart Grids, Microgrids, Energy Storage Systems

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Coal Power Plant to Solar and Wind Farms



Coal Power Plant
3-5 years to build



Solar and Wind Farm
12-18 months to build



Smart Microgrids, Grid Interactive Buildings and Campuses

☐ Microgrids

- ☐ Self Generation – solar PV, wind, fuel cells, gas turbines, DG sets
- ☐ Energy storage systems (ESS)
- ☐ Load control – demand response
- ☐ Vehicle-Grid Integration (VGI) – car batteries as virtual power plants (VPP) offering V2G services
- ☐ Islanding feature - peak hours (price arbitrage), major grid faults, cyber attacks, weather events

☐ Grid Interactive Buildings and Campuses

- ☐ Building Management System (BMS) integration with Distribution Management System (DMS) of the electric utility
- ☐ Rooftop PV and EV charging infrastructure integration
- ☐ Buying and selling electricity from the market (or P2P sellers) in real-time

☐ Smart Appliances – Grid Interactive

- ☐ Grid interactive smart appliances could buy electricity from cheapest sources in real-time through smart contracts executed on Blockchain and schedule its consumption accordingly



5. Smart Mobility

- ☐ Minimum commute for daily needs
 - ☐ Walk (or Bike) to work/school/shopping/recreation
 - ☐ Long escalators, ropeways where cost-effective
- ☐ Electric Vehicles friendly infrastructure
- ☐ Autonomous Vehicles friendly infrastructure
- ☐ Promoting Shared Mobility – electric buses and shared taxis and 3Wheelers
 - ☐ Shenzhen Example
- ☐ Delivery Drones and Passenger Drones friendly infrastructure
 - ☐ Drone Pads for landing of drones
 - ☐ Future navigation systems for drones (similar to ATCs for planes)
 - ☐ Charging Infra for drones
- ☐ Vertical Takeoff Vehicles (flying cars) friendly infrastructure

Glimpses of the evolving Future of Transport

Future of Transport



Transit Elevated Bus



Hybrid Flying Car



Velocopter



Passenger Drone



Delivery Drone



Future of Transport



Hyperloop



Autonomous Car

Future of Transportation: <https://youtu.be/ETpXydVmSfo>



Future of Transport – the Evolving Revolution

☐ Electric Vehicles

- ☐ No fuel, no lubricants – warranty for unlimited mileage
- ☐ Less than 20 moving parts (compared to >2000 in ICE vehicles), no need for regular servicing - automobile servicing stations and repair shops will disappear

☐ Autonomous Vehicles and Self Owned Vehicles

- ☐ Millions of drivers redundant
- ☐ Accidents almost NIL
- ☐ Ten times more vehicle utilization: >20 hours per day driven compared to 2 hours driving average
- ☐ Total vehicles on the road will be reduced by 50-70%
- ☐ Parking space requirement will be much less
- ☐ Lower insurance premium
- ☐ Self-owned Vehicles: owned by themselves, paying mortgage, insurance, charging fee, management software license fee and toll charges from the vehicle's e-Wallet which earns money from the service it provides

☐ Ariel Transportation – Drones, Flying Cars

- ☐ Drone Pads instead of parking slots in buildings and apartment complexes
- ☐ Highways and roads (flyways) designed for flying cars



8. Instrumented – Interconnected – Intelligent

- Automation Systems for Key Infrastructure and Services
 - Electricity, Gas and Water Distribution
 - Traffic and Security Cameras
 - Mobile Crew Management Systems
- GIS Maps
- Utility Corridors - all cables (electricity, communication) and gas and water pipes in separate underground ducts
- Common Billing and CRM systems for multiple services
- Broadband Internet in all Buildings and Public Places
- Cloud Strategy
- Master System Integration
- Common Command and Control Centers
- Advanced Analytics
- Robotics



Thank you very much for your kind attention



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