Built-in flexibility

100% – renewable energy target in Denmark by 2050

50% – share of households with water meters today

Built-in flexibility

The path to a connected, accessible and distributed infrastructure is fraught with complex, costly and risky issues: Upgrading and repurposing systems to make them more open plus on-going maintenance need significant resources.

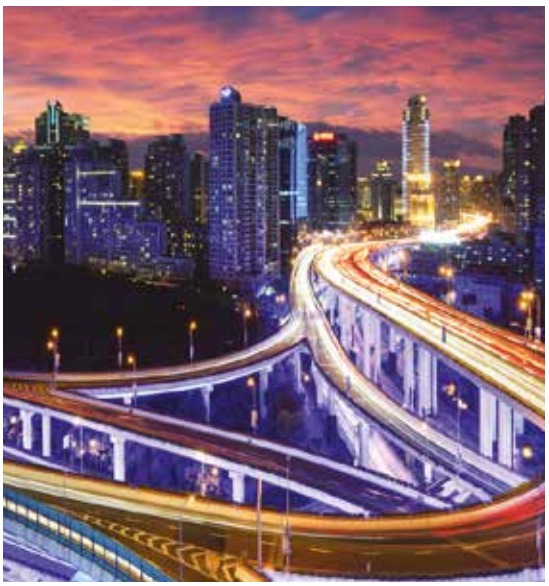
Infrastructure, the backbone of a functioning society, provides roads, buildings, power, water and communications systems. Much of the world around us today is shaped by legacy infrastructure, such as canals, railways and roads. Infrastructure through the years has naturally morphed as new opportunities are realized (the introduction of the steam engine to sailing fleets, and digital communications displacing analogue). Often, this world of large, often state-owned suppliers, distributing product to consumers in one direction only, was developed to operate individually. Why would electricity providers want to talk to water distributors? Indeed, regulatory bodies have a remit to prevent overzealous collaboration within a sector.

But today the infrastructure around us is changing in a different way. It is becoming more flexible, more open to multiple parties, and more capable of separating its various flows. The effects of this shift will be profound. By 2025, infrastructure will not only be smarter but also inherently adaptable. Energy flows will become more bi-directional and distributed as more prosumers – individuals who both consume and produce energy – come on line. Water supply will be more readily captured, treated (or not) and separated to make best use of individual water types such as grey-water, storm water and tap water for more specific usage. Transport will become smarter, with vehicles that know (or can be told) of errors and repairs, that can communicate with their manufacturer, owner and service provider, as well as with the environment and road around them - by 2018, EU cars will be required to be fitted with the ability for the car to contact emergency services after a crash.

As a move to intelligent infrastructure, buildings and communication systems today are already demonstrating smarter operations, via temperature, lighting controls and intelligent connectivity. The Global Change Institute's Living Building in Brisbane, for example, is a pacesetter in this space. The GCI states that the building generates more energy than it consumes, is naturally ventilated, captures its own power through solar panels and stores up to 60,000L of rainwater.

One driver for the rise in built-in flexibility is the need for increased efficiency, particularly where key resources are involved. Infrastructure providers and their regulators will continue to aim to do more with less, reuse products, produce less waste and avoid misdirected supplies. Doing so not only saves costs and (often precious) resources in the short term, but also feeds a hunger for the same organisations to develop longer-term plans. The creation of what have been termed "virtual plants" by aggregating swarms of smaller decentralised plants (i.e. wind and solar farms) into what the grid recognises as one is already under way. Grids in countries like Denmark, currently converting their energy/heating system to build a 100% renewable energy system by 2050, are managed so well that they can accommodate more than a 40% share of renewable electricity. When using ICT for modernising distribution grids, the share can even be higher.

Infrastructure will not only be smarter but also inherently adaptable.



The interconnected nature of the world around us is another driver of more flexible infrastructure. Commonly referenced as the Internet of Things, the 'connected' threshold before us is immense. The IoT really began to take off in 2013 once there were enough IP addresses, increased bandwidth and reduced costs of data storage.

How swift the change in 2025 depends, like the numbers of prosumers of energy we may see, on how many people will be sharing key assets like cars and how many will reuse and repurpose vital resources like water. The answers will come from heavily weighted subsidies, feed-in tariffs, tax breaks, market penetration and more. Of course, wider proliferation of smart metering will help greatly with forecasting; currently only half of the estimated 2 billion households and buildings worldwide have water meters installed. With $6,6bn of investment a year by 2025, global water metering is set to grow. But until this time, if the outputs of COP21 the 2015 UN Conference on Climate Change in Paris, are in any way adhered to, look for the pace of change in adaptability and openness of infrastructure to quicken. Efficiency, after all, matters to practically everyone.

In developed economies, the transition from the 'old state' to new thinking will predominantly come from innovations in and repurposing of existing systems instead of a new build, greenfield scenario, as there is too much legacy in play. For regions where infrastructure is absent, or obsolete, wholesale change is possible as illustrated in the 1990s with the arrival of mobile phone networks that 'leapfrogged' the need for building out further fixed telephony networks. For most situations, hard assets are still required – plumbing, roads, wires and buildings - and there could well be limits to leapfrogging.

Fuelling the whole of built-in flexibility and intelligent decision-making is data. Whether more data or Big Data, personalized or anodized, access to data and the ability to intelligently utilize it remains key. And of course, collaboration, because truly flexible infrastructure systems will require much coordination with other systems.

The Global Apollo Programme is calling for just such a collaborative spirit with regards to energy. With its stellar list of climate scientists and economists, including Lord Nicholas Stern and Sir David King, the authors of this report are calling for a major programme of sustained, publicly funded renewable energy research. It believes that only a global initiative can combat climate change and help contain the costs of production, storage and distribution of clean energy.

Providers and their regulators will continue to aim to do more with less.

Viewing water, resources, food and energy as an integrated system, not as individual industries, is the way ahead. Rather than independent conversations that pit one resource/industry aims against the other today, the increased ability for systems to communicate and change their flow/supply/direction will help the previously independent systems and managers of those systems to communicate with each other. One simple example of such a nexus is in using solar energy to operate water pumps to irrigate crops to feed local populations. Energy, Water, Food, People.

There is a price to pay, well beyond the pain and costs that transition brings: increasingly open and connected systems will, by their very nature, be more vulnerable to cyber-terrorism. Infrastructure is an enticing target for any group hoping to gain a little attention, cause disruption or worse. Infrastructure providers will need to be diligent in their cyber security measures, while at the same time opening up their systems to all and sundry. A balancing act, if ever there was one.

Benefits that we can expect to see are increased specificity of supply for particular uses, more adaptable supply/demand relationships, improved efficiencies and the much welcome by-product of helping infrastructure providers to incorporate a longer-term view. Built-in flexibility is not an either/or concept to fret over; rather it is a wave of change coming our way. Only the rate of adoption is still in question.

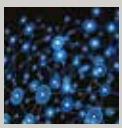
Wider proliferation of smart metering will help greatly with forecasting.

Related insights

Citizen-centric cities

Successful cities will be designed around the needs and desires of increasingly empowered and enabled citizens - who are expecting personalized services from the organisations that serve them

Everything connected



Over 1 trillion sensors are connected to multiple networks: everything that can benefit from a connection has one. We deliver 10,000x more data 100x more effectively but are concerned about the security of the information that flows.

Infrastructure deficit

Infrastructure again becomes a source of competitive advantage. Emerging economies invest in new railroads and highways for more effective movement of people and goods, while developed nations suffer from poor legacy.

Access to transport

The widespread need for individuals to travel short distances becomes a key feature of urban design and regeneration. Planners use transport infrastructure to influence social change and lower carbon living.