THE CHALLENGES OF CITIES TODAY FOR FUTURE CITY LIFE THROUGH SUSTAINABLE DEVELOPMENT

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Abstract: Future city life: Cities are the core of global development. The need to improve quality of life, economic competitiveness and environmental viability will drive a new way of living. In the future, high-rise buildings will be like small towns, with homes, shops, workshops – even gardens and farms – all under one roof. The spaces around us will be flexible, changing to match our needs. Instead of owning things, we will pay to use a space or an item, then give it back, hand it off, or recycle after use. In the future, buildings will be self-sufficient, producing a surplus of energy, recycling their own waste, minimizing water usage, collecting rainwater, and reusing and recycling gray water. Buildings will also be fully automated and intelligent, with thousands of sensors making sure that lights are switched on or off, and that rooms are optimally heated only when they are occupied. Sensors throughout the city will provide essential information to keep it running efficiently and to keep people safe. The city will become a living organism, seeing, hearing and thinking. It will be intelligent and responsive. Real-time information will flow into the city control center, where it will be integrated and visualized. Journeys across the city will take people and packages from one mode of transport to another – via mega hubs. When we set out to meet friends, a navigation assistant will plan our route.

Challenges of the cities today: The megatrend of urbanization will dramatically shape not only cities, but the entire world. Urbanization has created a pressing need for infrastructure investment, regardless of budget limitations and austerity programs. Cities must have functioning traffic systems, intelligent logistics, efficient energy supplies, and environmentally compatible buildings. Urbanization has radically changed the dynamics of urban-based manufacturing. Over the last 50 years, employment in cities has stabilized around a diverse and vital mix of businesses, from traditional forms of fabrication to technology-oriented activities. The most competitive cities will be the ones that anticipate the challenges of growth and balance these three fundamental goals: economic competitiveness, quality of life, and environmental protection.

Sustainable mobility: Sustainable mobility is key for cost-effective and environmentally friendly urban development. People and goods must be transported within and between cities, so traffic patterns must be adapted accordingly. By relying on renewable energy, electro mobility will significantly reduce environmental impact. New technologies will reduce harmful local emissions and reduce the CO2 footprints of individual vehicles.

Efficient Buildings: Today we face rising power consumption, higher energy prices, and resource shortages. Yet demand for networked smart buildings is growing. Energy consumption in efficient buildings can be reduced by up to 50% by using intelligent and energy efficient technologies.

Safety and security: While considering the location of an urban development project, long-term security is among the most important site characteristics. Local civic authorities must be able to meet a variety of security challenges. Places like airports, harbors, railway stations, tunnels, stadiums and other public venues are particularly important to protect. High-traffic areas must be closely monitored. Advanced technologies protect cities, buildings, campuses, and critical infrastructure. Access control systems ensure that only authorized individuals can enter a facility. Evacuation systems help save lives by combining crowd flow simulations with voice alarms and emergency communications. Video surveillance systems monitor sensitive areas in real time.

Power grids: Cities often face challenges such as integrating renewable and distributed generation, limited capacities, aging infrastructures and reducing costs and emissions while using a reliable power supply. Smart Grid technologies shift energy management away from a centralized, reactive and producer-controlled network to a decentralized, proactive and demand-controlled grid. It incorporates two-way communication for digital sensing and automated analytics across the energy conversion

chain, from power generation to consumption. This turns our power grid into a demand-controlled tool, enabling us to generate and deliver power efficiently. Smart Grid enterprise IT platform, industry knowledge, and deep understanding of the energy conversion chain enables us to customize our solutions to the specific needs of utility companies.

Water and waste water: Supplying the world's population with clean, potable water is one of the greatest challenges facing us. The requirements for urban water management are growing – today and into the future, our water supply networks must be more efficiently operated and intelligently controlled. Existing capacities must be used as effectively as possible in order to minimize operating costs. Simulations of various operating states enable the risk-free testing and optimization of plant operation.

Efficient energy: Power is indispensable when developing a sustainable energy system. Electricity offers numerous ways to integrate renewable energy sources and reduce greenhouse gas emissions. There are four major challenges to managing power supplies effectively: economic efficiency, climate change, reliable power, and resource efficiency. In addition, power generated from renewable energies is increasing. The sustainable energy system of the future will depend on electrification and the ability to feed fluctuating renewables into the power grid.

Healthcare Demographic change is one of the greatest challenges of our age. Not only is the world's population growing rapidly, but life expectancy is also significantly longer. Municipalities today need to invest in healthcare, not only for ethical and compassionate reasons, but also to remain competitive in ways that are environmentally and economically sound. By implementing customized solutions, healthcare providers save energy and reduce their emissions. These factors not only improve time and cost management, but also increase the quality of patient care.

Keywords: Sustainable mobility, Efficient Buildings, Safety and security, Power grids, Water and wastewater, Efficient energy, Healthcare

INTRODUCTION

Sustainable development refers to a mode of human development in which resource use aims to meet human needs while ensuring the sustainability of natural systems and the environment, so that these needs can be met not only in the present, but also for generations to come. The term 'sustainable development' was used by the Brundtland Commission, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs [1][2] ". Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges faced by humanity. As early as the 1970s, "sustainability" was employed to describe an economy "in equilibrium with basic ecological support systems [3]". Ecologists have pointed to The Limits to Growth [4], and presented the alternative of a "steady state economy"[5] in order to address environmental concerns. The concept of sustainable development has in the past most often been broken out into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability. More recently, it has been suggested that a more consistent analytical breakdown is to distinguish four domains of economic, ecological, political and cultural sustainability. This is consistent with the UCLG move to make 'culture' the fourth domain of sustainability[6]. Other important sources refer to the fourth domain as 'institutional'[7] or as 'good governance'[8]. The United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection[9]. Based on the triple bottom line, numerous sustainability standards and certification systems have been established in recent years, in particular in the food industry[10][11]. An international survey found that attitudes to sustainable development differ in 12 participating nations (China, Czech,Spain, Ireland, Korea, Macedonia, Norway, Portugal, Sweden, Serbia, United Kingdom). The perceived importance is lower in Czech, Ireland, Iran and South Korea [12].

In the **Circles of Sustainability** approach, the **economic domain** is defined as the practices and meanings associated with the production, use, and management of resources, where the concept of 'resources' is used in the broadest sense of that word. Arrow et al. (2004)[13] and other economists (e.g. Asheim,1999[14] and Pezzey, 1989[15] and 1997)[16] have advocated a form of the weak criterion for sustainable development – the requirement than the wealth of a society, including human capital, knowledge capital and natural capital (as well as produced capital) not decline over time. Others, including Barbier 2007[17], continue to contend that strong sustainability – non-depletion of essential forms of natural capital – may be appropriate. Economic development has traditionally required a growth in the gross domestic product. This model of unlimited personal and GDP growth may be over[18]. Sustainable development may involve improvements in the quality of life for many but, particularly for the affluent, may necessitate a decrease in resource consumption[19].

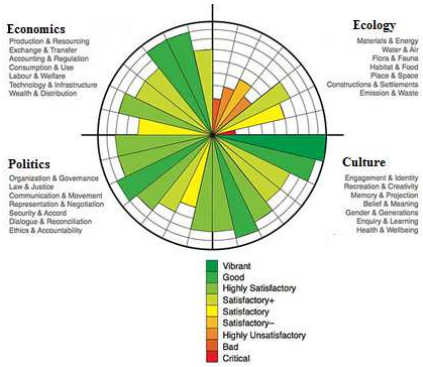

Figure 1: Circles of Sustainability

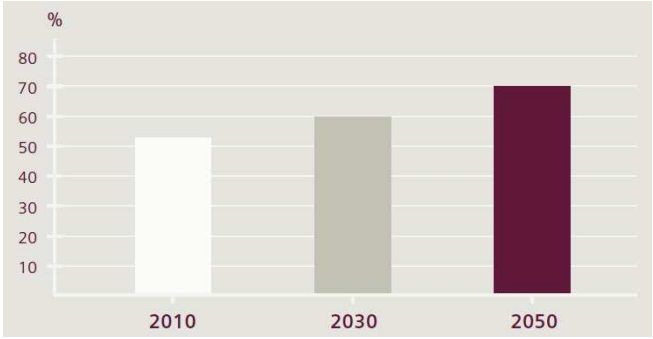

Figure 2: World's population living in urban areas

Figure 3: Bangkok:Suvarnabhumi Airport Express connects the airport and city center.

Figure 4: Lisbon: eTicketing and smart systems support intermodal travel

Figure 5: Crystal: One of the most sustainable buildings in the world

Figure 6: Tornado Tower: Sustainability landmark

Figure 7: TAIPEI 101: The world's tallest green building

Figure 8: Safe and secure: integrated command centers speed response times

Figure 9: Preventive action: video surveillance cameras enhance public safety

The **ecology domain** has been difficult to resolve because it too has a social dimension. Some research activities start from the definition of green development to argue that the environment is a combination of nature and culture. However, this has the effect of making the domain model unwieldy if culture is to be considered a domain in its own right. Others write of ecology as being more broadly at the intersection of the social and the environmental - hence, ecology. This move allows culture to be used as a domain alongside economics and ecology[20]. The sustainability of human settlements is implicit in the focus of study into the relationship between humans and their natural, social and built environments. Also termed human ecology, this broadens the focus of sustainable development to include the domain of human health. Fundamental human needs such as the availability and quality of air, water, food and shelter are also the ecological foundations for sustainable development[21]; addressing public health risk through investments in ecosystem services can be a powerful and transformative force for sustainable development which, in this sense, extends to all species[22].

Working with a different emphasis, some researchers and institutions have pointed out that a fourth domain i.e. **culture domain** should be added to the dimensions of sustainable development, since the triple-bottom-line domains of economic, environmental and social do not seem to be enough to reflect the complexity of contemporary society.

The United Nations Global Compact Cities Programme has defined sustainable political development is a way that broadens the usual definition beyond states and governance. The **political domain** is defined as the domain of practices and meanings associated with basic issues of social power as they pertain to the organisation, authorisation, legitimation and regulation of a social life held in common. This definition is in accord with the view that political change is important for responding to economic, ecological and cultural challenges. It also means that the politics of economic change can be addressed. This is particularly true in relation to the controversial concept of 'sustainable enterprise' that frames global needs and risks as 'opportunities' for private enterprise to provide profitable entrepreneurial solutions.

So it's our prime duty to sustain the resources for further generation as by doing so they can learn from us.

MATERIALS AND METHODS

Cities are the core of global development. This is where our future takes shape, where economic growth springs from the bustling activities of more than half the world's population, and where our most pressing environmental challenges are most evident.

Future city life

The look and feel of cities in the future will be different from today. The need to improve quality of life, economic competitiveness and environmental viability will drive a new way of living.

A scenario for future city life

In the future, high-rise buildings will be like small towns, with homes, shops, workshops – even gardens and farms – all under one roof. The spaces around us will be flexible, changing to match our needs. Instead of owning things, we will pay to use a space or an item, then give it back, hand it off, or recycle after use. For example, we will invite friends to ride along in shared e-cars and rent space in community gardens. We may even order produce from our community gardens! Technology and fluidity will enable us to live efficient lives. Many people will work from home, switching between business and leisure, the real and the virtual. Our new lifestyle will allow neighbors to join together in vibrant, dynamic communities.

Buildings will get smart

Buildings today account for the bulk of a city's energy consumption and greenhouse gas emissions. They therefore represent enormous potential for energy savings and are key to sustainable city development. In the future, buildings will be self-sufficient, producing a surplus of energy, recycling their own waste, minimizing water usage, collecting rainwater, and reusing and recycling gray water. Buildings will also be fully automated and intelligent, with thousands of sensors making sure that lights are switched on or off, and that rooms are optimally heated only when they are occupied.

From consumer to prosumer

The lifeblood of urban existence – renewable energy – will flow along main arteries to power the city. After a windy night that generated a surplus of energy, prices will go down. The smart grid will respond, communicating with all producers and consumers. But residents will not just consume electricity; they will generate and store it. They can then use surplus energy to do things like charge their electric cars. The city will make energy miners and energy traders of us all.

Responsive cities

Sensors throughout the city will provide essential information to keep it running efficiently and to keep people safe. The city will become a living organism, seeing, hearing, thinking. It will be intelligent and

responsive. Real-time information will flow into the city control center, where it will be integrated and visualized. Traffic lights and information systems will be adapted so traffic flows smoothly. Data will also be used for urban planning. Residents will be invited to take an active part in the planning process and help decide the future of their communities. Residents will have a direct connection to public services and can participate at every level. This will be a city that responds to the needs of its population.

Effortless travel

Journeys across the city will take people and packages from one mode of transport to another – via mega hubs. When we set out to meet friends, a navigation assistant will plan our route. It will begin by booking a shared e-car to the local transport hub. Payment will be invisible; the public transportation network will recognize you and ensures a seamless journey. If there's a traffic accident or road construction, the navigation assistant will instantly respond by changing your route.

While most people sleep, the city will restock, recharge and recycle. Public transport will be used to deliver goods and packages. When energy demand is low, the smart grid will recharge the city's batteries and tasks that can be done overnight will be automatically activated. Our future city never sleeps – its cycle continues.

Challenges of the cities today

Growing cities increase complexity

The megatrend of urbanization will dramatically shape not only cities, but the entire world. Urbanization has created a pressing need for infrastructure investment, regardless of budget limitations and austerity programs. Cities must have functioning traffic systems, intelligent logistics, efficient energy supplies, and environmentally compatible buildings. Studies suggest that cities are investing on average €2 trillion a year. But managing growing cities with decreasing budgets and increasing complexity, along with the expectation of a higher quality of life, places heavy demands on both infrastructure and environment. The megatrends urbanization, demographic change and climate change will shape the future. City managers need to respond to these megatrends to make critical decisions about infrastructure today that will meet future demand.

For the first time in history, more than 50% of the world's population lives in urban areas. By 2030 this number will grow to 60%, and is expected to reach almost 70% by 2050.

Urbanization as a key driver for economic growth

Urbanization has radically changed the dynamics of urban-based manufacturing. Over the last 50 years, employment in cities has stabilized around a diverse and vital mix of businesses, from traditional forms of fabrication to technology-oriented activities.

All enterprises share the benefits of urbanization because of proximity and speed to market as well as specialization. They also benefit from the "agglomeration economies" of cities. Urban manufacturing enables local governments to create new jobs and generate a positive impact on the labor market. The most competitive cities will be the ones that anticipate the challenges of growth and balance these three fundamental goals: economic competitiveness, quality of life, and environmental protection.

The future of climate change is decided in cities

A city's ecological footprint contributes significantly to climate change, as they consume two-thirds of the world's energy and produce approximately 70% of the greenhouse gas emissions. At the same time, cities are ideal focal points for strategies on reducing greenhouse gas emissions. With their dense populations and often fragile infrastructures, cities are vulnerable to the effects of climate change, such as storms and flooding, and need to become more resilient. Instead of considering the cost of doing nothing, we should consider the benefit of doing something.

Urban residents need good air to breathe, good water to drink, and reliable electricity to power their lives. They need access to healthcare, and they need to be mobile.

RESULTS AND DISCUSSION

Sustainable mobility

Sustainable mobility is key for cost-effective and environmentally friendly urban development. People and goods must be transported within and between cities, so traffic patterns must be adapted accordingly. In Germany alone, congested roads result in 14 billion liters of fuel being wasted annually. This equals 17% of total vehicle consumption and 35 million tons of carbon dioxide emissions. The total annual cost of traffic jams in Germany has been estimated at a staggering €100 billion. In response, Siemens is offering comprehensive mobility solutions like operation controls for rail and road traffic, rail electrification systems, parking management and tolling solutions, energy-efficient subways, streetcars and electric buses within cities, as well as commuter and long-distance trains between cities. No matter which kind of transportation you use, integrated

mobility solutions help save energy and reduce emissions.

New technologies reduce emissions

By relying on renewable energy, electro mobility will significantly reduce environmental impact. New technologies will reduce harmful local emissions and reduce the CO2 footprints of individual vehicles.

Siemens is also developing intermodal traffic solutions such as eTicketing. Passengers use eTickets for public transit and mobility services such as car parking and sharing. Smart systems then automatically calculate their charges based on usage.

Complete airport rail link: Bangkok, Thailand

The Suvarnabhumi Airport Express, which connects Bangkok's airport and city center, is an integrated rail solution from Siemens. It comprises signaling and control systems, telecommunications, automatic fare collection, platform doors and tunnel equipment, traction power supply, track work, depot and service center equipment, baggage management, check-in systems, as well as rolling stock. Today, the nonstop Suvarnabhumi Airport Express is an attractive, convenient, and eco-friendly alternative to traveling by taxi or car.

Efficient Buildings

Today we face rising power consumption, higher energy prices, and resource shortages. Yet demand for networked smart buildings is growing. Energy consumption in efficient buildings can be reduced by up to 50% by using intelligent and energy efficient technologies. Siemens offers intelligent, integrated technologies and automated energy solutions for buildings and rooms that deliver maximum energy savings, performance and sustainability, without compromising comfort. Since 1995, Siemens has equipped 6,500 buildings worldwide with energy-efficient solutions. Siemens Total Building Solutions (TBS) integrate all technical infrastructure systems – from building automation to fire safety, security, and low-voltage power distribution, providing optimum comfort and security for occupants.

By incorporating cutting-edge technologies, the Crystal is a model for sustainable buildings. It generates its own energy through solar power and heat pumps. A highly efficient building management system optimally distributes electrical power, as well as heating and cooling. Rainwater is harvested for use and all waste water is recycled. As the first building designed to receive top BREEAM (outstanding) and LEED (platinum) ratings, the Crystal meets the world's highest energy-efficiency standards. For the office space, it uses 50% less energy than any other comparable office building to date.

The Tornado Tower is a sustainability landmark for Doha, Qatar, and building technology.

TAIPEI 101 is not only one of the tallest buildings on earth, but also one of the "greenest." Siemens helped meet its requirements for outstanding energy efficiency and environmental compatibility. This enabled TAIPEI 101 to earn LEED EBOM Platinum certification and save about 28,000 tons of water, 3,000 tons of carbon dioxide, and 4.8 million kWh of electrical energy – which add up to an annual cost savings of US$700,000.

Safety and security

While considering the location of an urban development project, long-term security is among the most important site characteristics. Local civic authorities must be able to meet a variety of security challenges. Places like airports, harbors, railway stations, tunnels, stadiums and other public venues are particularly important to protect. High-traffic areas must be closely monitored. Cities need a reliable partner that can provide state-of-the-art security technology for long-term protection.

Advanced technologies protect critical infrastructure

Advanced technologies protect cities, buildings, campuses, and critical infrastructure. Access control systems ensure that only authorized individuals can enter a facility. Evacuation systems help save lives by combining crowd flow simulations with voice alarms and emergency communications. Video surveillance systems monitor sensitive areas in real time. If there is a security issue, we can detect it early and respond quickly – essential when protecting public transportation and passengers. We can also integrate our network-based monitoring systems with our integrated command centers. These solutions allow us to plan for various scenarios so we can implement clear procedures and coordinate first responses to any incident.

Intelligent response takes security to the next level

Large buildings, campuses, and critical infrastructure requires emergency evacuation plans. If something unexpected occurs, we need to react fast. By intelligent response systems we can speed our reaction time and secure our buildings It integrate our security and fire safety systems, including fire and smoke detection, fire suppression, monitoring and surveillance, access control, and building automation and controls. Intelligent response systems enhance our real-time awareness and control, enabling better mobilization and evacuation in emergency situations.

Integrated security solutions for the Middle East

Siemens developed a world-class security system for the Middle East that has become a showcase for the entire region. It is a citywide video surveillance solution, managed from a single command and control center. To enable the solution, they established a nationwide wireless IP network, implemented terrestrial trunked radio (TETRA) communications, and delivered a turnkey integrated command center

Power grids

Cities often face challenges such as integrating renewable and distributed generation, limited capacities, aging infrastructures and reducing costs and emissions while using a reliable power supply. Smart power grids offer many advantages that help cities meet these challenges.

Smart grids: efficient, flexible and interactive

Smart Grid technologies shift energy management away from a centralized, reactive and producer-controlled network to a decentralized, proactive and demand-controlled grid. It incorporates two-way communication for digital sensing and automated analytics across the energy conversion chain, from power generation to consumption. This turns our power grid into a demand-controlled tool, enabling us to generate and deliver power efficiently. Smart Grid enterprise IT platform, industry knowledge, and deep understanding of the energy conversion chain enables us to customize our solutions to the specific needs of utility companies.

Proven technologies for reliable power supply

Siemens offers a full range of medium- and low-voltage products, and integrates them into smart, reliable, efficient, and stable power distribution grids. Their low and medium voltage solutions have been proven in numerous industrial applications, like oil and gas, mining, chemicals, automotive and metals, as well as in cities. They boost the energy efficiency of buildings and industrial power infrastructure, from arc-fault detection units to highly complex switchgear.

Flexible storage solutions

In addition to switchgear, their portfolio includes busbar trunking systems; protection, switching, measuring and monitoring devices; switches and socket outlets; and customized solutions for power supply installations and distribution grids. All their solutions meet the strictest quality and safety standards. Their latest innovations include the SIESTORAGE battery storage system for distribution grid operators, and SIHARBOUR onshore power supply for ships. When power generation from renewable sources becomes variable, SIESTORAGE provides up to one megawatt primary control reserve for 30 seconds to the grid. By drastically reducing the spinning reserve of conventional power plants, SIESTORAGE significantly reduces CO2 emissions as well.

Supplying power for a safer pilgrimage

Every year, about three million people set out on the Hajj, the pilgrimage to Mecca. Siemens electrified the first metro system in this region – which transports up to 72,000 passengers per hour – in just 17 months, 10 months faster than usual. Siemens provided the entire power supply system, including the primary substations, switchgear, extended ring cable systems, traction substations, and the overhead contact line to various diesel generators. With this remarkable project, they not only delivered a state-of-the-art public transportation system, but helped save lives during the Hajj, making the annual pilgrimage much safer.

Water and wastewater

Supplying the world's population with clean, potable water is one of the greatest challenges

facing us. Today, about 1.2 billion people in developing countries lack access to potable water, and about twice that many have no access to sanitary facilities. But industrialized nations also need reliable water supplies – both industry and agriculture depend on this precious resource. As the world's population grows, sustainable stewardship of water resources should take the highest priority.

Advanced technologies for reliable water supply

The requirements for urban water management are growing – today and into the future, our water supply networks must be more efficiently operated and intelligently controlled. Existing capacities must be used as effectively as possible in order to minimize operating costs. Siemens provides answers for these challenges with a comprehensive portfolio of automation products. They help network operators in the water supply and water treatment industries realize their economic and technological optimization potential by, for example, detecting and locating leaks, which reduces water loss and the resulting damage. Their solutions can also calculate the most efficient operating schedules and reduce energy consumption and costs by optimizing pump operation. Simulations of various operating states enable the risk-free testing and optimization of plant operation. A number of cities – Warsaw, for example – already rely on automation solutions from Siemens to make their water supply more efficient.

Clean water for Warsaw

In order to treat the wastewater of 2.1 million inhabitants of Warsaw, the Czajka wastewater treatment plant had to upgrade and modernize. This included the construction of a thermal sludge drying facility, new transmission sewers, and a new monitoring and control system. A SIMATIC PCS 7 distributed control system from Siemens provides comprehensive visualization, control, and monitoring of all wastewater treatment processes. These upgrades, along with SCADA automation and monitoring, have made Czajka the largest and most modern plant in Eastern Europe. Its wastewater capacity increased from 240,000 m3/d to 435,300 m3/d, and the plant can handle 515,000 m3/d at peak times. Czajka plays a major part in improving the water quality of the Vistula River, Warsaw's most important source of potable water.

Efficient energy

Power is indispensable when developing a sustainable energy system. Electricity offers numerous ways to integrate renewable energy sources and reduce greenhouse gas emissions.

One solution is not enough

The energy system of the future will have little to do with the traditional energy conversion chain of the past. The original energy chain – from the power plant to the consumer – has become a complex system of central and distributed power producers and buyers. Their nodes are where supply and demand are balanced. The role of consumers is also changing: increasingly they will become power producers themselves and feed their surplus back into the grid.

The speed at which these changes occur varies worldwide, as countries and regions confront disparate challenges in managing their power supplies. That's why there isn't just one solution that applies everywhere.

Four major challenges

There are four major challenges to managing power supplies effectively: economic efficiency, climate change, reliable power, and resource efficiency.

In addition, power generated from renewable energies is increasing. The sustainable energy system of the future will depend on electrification and the ability to feed fluctuating renewables into the power grid.

London Array: the world's largest offshore wind power plant

To meet rapidly rising energy demands and cut carbon emissions by 34% below 1990 levels, the United Kingdom is developing renewable energy sources. The goal is for 15% of electricity to come from renewable sources, such as offshore wind power, by 2020. At 1 GW, London Array, located off the coast of Kent, is the world's largest consented offshore wind power plant. Rated at 630 MW once operational, phase one of London Array could generate enough energy to power more than 470,000 homes and displace more than 900,000 tons of CO2 a year – equivalent to taking nearly 300,000 cars off the road. Siemens is supplying 175 turbines for phase one. Each is rated at 3.6 MW, fitted with the new Siemens 120 m rotor, and has a hub height of around 87 m above sea level. We will also provide a warranty and five-year turbine servicing contract. Siemens installed the electrical systems for two offshore substations and performed onshore substation work.

The project incorporates four export cables, each over 50 km long, to connect the offshore substations to the onshore substation, and more than 200 km of inter-array cabling to connect the turbines to each other and to the offshore substations.

Healthcare

Demographic change is one of the greatest challenges of our age. Not only is the world's population growing rapidly, but life expectancy is also significantly longer. By 2050, 16% of the global population will be 65 years of age or older, an 11% increase over 2007. As a result of these shifts, demand for health- care and eldercare will rise – as will per capita healthcare costs. Because competence centers, research institutions, and medical experts are usually located in big cities, they help make them attractive places to live. Municipalities today need to invest in healthcare, not only for ethical and compassionate reasons, but also to remain competitive in ways that are environmentally and economically sound.

Sustainable healthcare around the globe

Worldwide, Siemens is known for healthcare solutions that help providers achieve their financial and environmental goals, while increasing the quality of patient care. Siemens takes a modular approach that enables healthcare organizations, large and small, to combine products and solutions from a wide range of application areas. These areas include: power generation and transmission, building automation, IT and communication infrastructure, and medical technology. By implementing customized solutions, healthcare providers save energy and reduce their emissions. These factors not only improve time and cost management, but also increase the quality of patient care.

Figure 10: Smart Grids: solutions for decentralized, proactive and demand-controlled power distribution

Figure 11: Siestorage: Battery energy storage system for a sustainable energy supply

Figure 12: Effective water management: An essential issue for city infrastructures

Figure 13: Clean water for Warsaw, Poland: Czajka Europe's largest and most modern wastewater treatment plant.

Figure 14: Installation of wind turbines (SWT-3.6-120) at London Array offshore wind power plant. The goal is to produce 18,000 MW by 2020.

Figure 15: Climate-friendly power generation at Ulrich Hartmann power plant in Irsching, Germany

Figure 16: Sustainability at its best: University Medical Center Hamburg-Eppendorf

Rating sustainability: University Medical Center Hamburg-Eppendorf

The University Medical Center Hamburg-Eppendorf, one of the leading hospitals in northern Germany demonstrated excellent performance. It particularly excelled in fiscal management, service efficiency, patient services, and energy efficiency.

CONCLUSION

Sustainable development refers to a mode of human development in which resource use aims to meet human needs while ensuring the sustainability of natural systems and the environment, so that these needs can be met not only in the present, but also for generations to come. The concept of sustainable development has in the past most often been broken out into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability. More recently, it has been suggested that a more consistent analytical breakdown is to distinguish four domains of economic, ecological, political and cultural sustainability. In the **Circles of Sustainability** approach, the **economic domain** is defined as the practices and meanings associated with the production, use, and management of resources, where the concept of 'resources' is used in the broadest sense of that word. The **ecology domain** has been difficult to resolve because it too has a social dimension. Some research activities start from the definition of green development to argue that the environment is a combination of nature and culture. Working with a different emphasis, some researchers and institutions have pointed out that a fourth domain i.e. **culture domain** should be added to the domains of sustainable development, since the triple-bottom-line domains of economic, environmental and social do not seem to be enough to reflect the complexity of contemporary society. The **political domain** is defined as the domain of practices and meanings associated with basic issues of social power as they pertain to the organization, authorization, legitimation and regulation of a social life held in common. So it's our prime duty to sustain the resources for further generation as by doing so they can learn from us.

REFERENCES

[1] Jump up^ United Nations. 1987."Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, 11 December 1987. Retrieved: 2007-04-12

[2] Jump up^ Smith, Charles; Rees, Gareth (1998). Economic Development, 2nd edition. Basingstoke: Macmillan. ISBN 0-333-72228-0.

[3] Jump up^ Stivers, R. 1976. The Sustainable Society: Ethics and Economic Growth. Philadelphia:Westminster Press.

[4] Jump up^ Meadows, D.H., D.L. Meadows, J. Randers, and W.W. Behrens III. 1972. The Limits to Growth. Universe Books, New York, NY. ISBN 0-87663-165-0

[5] Jump up^ Daly, H. E. 1973. Towards a Steady State Economy. San Francisco: Freeman. Daly, H. E. 1991. Steady-State Economics (2nd ed.). Washington, D.C.: Island Press.

[6] Jump up to:a b United Cites and Local Governments, "Culture: Fourth Pillar of Sustainable Development".

[7] Jump up^ United Nations Commission on Sustainable Development. Report on the Third Session (11-28 April 1995.)Economic and Social Council. Official Records, 1995. Supplement No.12. E/1995/32 E/CN.17/1995/36. United Nations, New York, 1995

[8] Jump up^ Leadership Council of the Sustainable Development Solutions Network (2013). An Action Agenda for Sustainable Development. REPORT FOR THE UN SECRETARY-GENERAL, 6 June 2013. UR; : www.unsdsn.org. RETRIEVED: August 28, 2013

[9] Jump up^ 2005 World Summit Outcome Document, World Health Organization, 15 September 2005
[10] Jump up^ Manning, S., Boons, F., Von Hagen, O., Reinecke, J. (2011). "National Contexts Matter: The Co-Evolution of Sustainability Standards in Global Value Chains." Ecological Economics, Forthcoming.
[11] Jump up^ Reinecke, J., Manning, S., Von Hagen, O. (2012). "The Emergence of a Standards Market: Multiplicity of Sustainability Standards in the Global Coffee Industry"Organization Studies, Forthcoming.
[12] Jump up^ Meng, Jenia. Origins of attitudes towards animals 2009. Ultravisum, Brisbane. ISBN 9780980842517 page 352
[13] Jump up^ Arrow, K. J.; Dasgupta, P.; Goulder, L.; Daily, G.; Ehrlich, P. R.; Heal, G. M.; Levin, S.; Maler, K-G.; Schneider, S.; Starrett, D. A.; Walker, B. (2004). "Are we consuming too much?". Journal of Economic Perspectives 18 (3): 147–172. JSTOR 3216811.
[14] Jump up^ Asheim, G. (1999). "Economic analysis of sustainability". In Lafferty, W. M.; Langhalle, O. Towards Sustainable Development. New York: St. Martins Press. p. 159.ISBN 9264185321.
[15] Jump up^ Pezzey, J. (1989). "Economic Analysis of Sustainable Growth and Sustainable Development". Environmental department Working Paper No. 15 (World Bank).
[16] Jump up^ Pezzey, J. (1997). "Sustainability constraints versus 'optimality' versus intertemporal concern, and axioms versus data". Land Economics (University of Wisconsin Press) 73(4): 448–466. doi:10.2307/3147239. JSTOR 3147239. |accessdate= requires|url= (help)
[17] Jump up^ Barbier, E. 2007 Natural Resources and Economic Development, Cambridge University Press
[18] Jump up^ Korowitz, David (2012), Ignorance by Consensus, Foundation for the Economics of Sustainability
[19] Jump up^ Brown, L. R. (2011). World on the Edge. Earth Policy Institute. Norton. ISBN 987-0-393-08029-2 Check |isbn= value (help).
[20] Jump up^ http://citiesprogramme.com/aboutus/our-approach/circles-of-sustainability; Andy Scerri and Paul James, 'Accounting for Sustainability: Combining Qualitative and Quantitative Research in Developing 'Indicators' of Sustainability', International Journal of Social Research Methodology, vol. 13, no. 1, 2010, pp. 41–53.
[21] Jump up^ White, F; Stallones, L; Last, JM. (2013). Global Public Health: Ecological Foundations. Oxford University Press. ISBN 978-0-19-975190-7.
[22] Jump up^ Bringing human health and wellbeing back into sustainable development. In: IISD Annual Report 2011-12. http://www.iisd.org/pdf/2012/annrep_2011_2012_en.pdf43.