SUSTAINABLE DEVELOPMENT GOALS AND SMART CITIES DEVELOPMENT ENGINEERING OPPORTUNITIES IN THE MAURITIAN CONTEXT

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Contents

1 FOREWORD

In 2015 Mauritius launched an ambitious economic development programme: **The Smart City Scheme**.
The vision of this programme aims at consolidating the Mauritian International Business and Financial Hub by creating ideal conditions for working, living and spurring investment through the development of smart cities across the island. These smart cities will leverage the latest advances in urban planning and digitalised technologies.
In the same year 2015, the United Nations have adopted key measures to combat Climate Change through the Paris Agreement, to prevent new and reduce existing disaster risks through the Sendai Framework for Disaster Risk Reduction, and to provide sustainable development goals through **the 2030 Agenda for Sustainable Development**.

Mauritius being a party to the United Nations and signatory of key agreements adopted, the author wishes to raise general awareness on the commitments for sustainable development in the smart cities and wishes further to raise specific awareness on key engineering aspects and opportunities of the sustainable development goals in the Mauritian context as a Small Island Developing State.

2 BACKGROUND INFORMATION

2.1 The Sendai Framework for Disaster Risk Reduction – March 2015

The Sendai Framework for Disaster Risk Reduction 2015–2030 [reference 1] was adopted at the Third United Nations World Conference on Disaster Risk Reduction, held from 14 to 18 March 2015 in Sendai, Miyagi, Japan, which represented a unique opportunity for countries:

(a) To adopt a concise, focused, forward-looking and action-oriented post 2015 framework for disaster risk reduction;
(b) To complete the assessment and review of the implementation of the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters;
(c) To consider the experience gained through the regional and national strategies/ institutions and plans for disaster risk reduction and their recommendations, as well as relevant regional agreements for the implementation of the Hyogo Framework for Action;
(d) To identify modalities of cooperation based on commitments to implement a post 2015 framework for disaster risk reduction;
(e) To determine modalities for the periodic review of the implementation of a post 2015 framework for disaster risk reduction.

2.2 Transforming our world: the 2030 Agenda for Sustainable Development – September 2015

The 2030 Agenda for Sustainable Development [reference 2] was adopted at the seventieth session of the General Assembly of the United Nations, held on 25 September 2015.
This Agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom. The United Nations recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development.
All countries and all stakeholders, acting in collaborative partnership, will implement this plan. The United Nations are resolved to free the human race from the tyranny of poverty and want to heal and secure our planet. The United Nations are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path.
The 17 Sustainable Development Goals and 169 targets demonstrate the scale and ambition of this new universal Agenda.

They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental.
The Goals and targets will stimulate action over the next 15 years in areas of critical importance for humanity and the planet.

2.3 The Conference of the Parties COP 21 - Paris Agreement - December 2015

With 196 Parties, the United Nations Framework Convention on Climate Change (UNFCCC) has near universal membership and is the parent treaty of the 1997 Kyoto Protocol. The Kyoto Protocol has been ratified by 192 of the UNFCCC Parties.
The ultimate objective of both treaties is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system.

The twenty-first session of the Conference of the Parties (COP21) and the eleventh session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol took place from 30 November to 11 December 2015, in Paris, France.

Paris, 12 December 2015 **-** An historic agreement to combat climate change and unleash actions and investment towards a low carbon, resilient and sustainable future was agreed by 195 nations.
The Paris Agreement [reference 3] and the outcomes of the COP21 cover all the crucial areas identified as essential for a landmark conclusion:

- Mitigation – reducing emissions fast enough to achieve the temperature goal
- A transparency system and global stock-take – accounting for climate action
- Adaptation – strengthening ability of countries to deal with climate impacts
- Loss and damage – strengthening ability to recover from climate impacts
- Support – including finance, for nations to build clean, resilient futures

As well as setting a long-term direction, countries will peak their emissions as soon as possible and continue to submit national climate action plans that detail their future objectives to address climate change.

In its introduction, the Paris Agreement welcomes the adoption of United Nations General Assembly resolution A/RES/70/1, **"Transforming our world: the 2030 Agenda for Sustainable Development"** adopted on 25 September 2015.

3 THE SUSTAINABLE DEVELOPMENT GOALS OF THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

3.1 The 17 Sustainable Development Goals

The 17 Sustainable Development Goals of the 2030 Agenda for Sustainable Development are recalled below:

- Goal 1. End poverty in all its forms everywhere
- Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 3. Ensure healthy lives and promote well-being for all at all ages
- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- Goal 5. Achieve gender equality and empower all women and girls
- Goal 6. Ensure availability and sustainable management of water and sanitation for all
- Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Goal 10. Reduce inequality within and among countries
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 12. Ensure sustainable consumption and production patterns
- Goal 13. Take urgent action to combat climate change and its impacts*
- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

** Acknowledging that the UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change.*

3.2 Sustainable Development Goals and Engineering Opportunities

The author recognised that Engineers have an important role to play in many of the above listed goals.

For the purpose of this paper, the author wishes to focus on goals with direct Engineering opportunities, i.e.

- Goal 6. Ensure availability and sustainable management of water and sanitation for all
- Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
- Goal 12. Ensure sustainable consumption and production patterns
- Goal 13. Take urgent action to combat climate change and its impacts
- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

The first key goal presented is Goal 11 which is directly related to sustainable development of cities.
The author also wishes to touch on the key foreseeable engineering opportunities of goals 6, 7, 9, 12, 13, 14 and 15.

4 SMART CITIES DEVELOPMENT IN MAURITIUS AND SUSTAINABLE DEVELOPMENT GOALS

4.1 The Smart City Scheme – Legal Framework and Guidelines

The Smart City Scheme is set up under the Investment Promotion Act 2015 and **the Investment Promotion (Smart City Scheme) Regulations 2015** [reference 4]
Part II of the Investment Promotion (Smart City Scheme) Regulations 2015 refers to the Smart city Scheme.

Section 4: Objects of Scheme
The objects of the Scheme shall be –

(a) to promote the creation of smart cities across Mauritius which shall be of mixed use comprising office, business, residential and entertainment components, all integrated in a coherent Master Plan focussing on innovation, sustainability, efficiency and quality of life and, where appropriate, involving the creation of *technopoles*;

(b) to provide, in relation to the development of a smart city project, for –

(i). the creation of an environment-friendly working, living and leisure space aiming at generating its own resources in terms of energy and other utilities and providing for state-of-the-art connectivity, smart modern transportation and reducing traffic congestion;

(ii). the promotion and co-ordination of the orderly and economic use and development of land;

(iii). the proper management, development and conservation of natural and man-made resources for the purpose of promoting the social and economic welfare of the community and a better environment;

(iv). ecologically sustainable development; and

(c) to promote targeted economic activities and increase foreign direct investment and extend export promotion strategically to rapidly growing economies, while at the same time strengthening the industrial and service base and an economic diversification path.

Section 5: Project under Scheme

(1) Every smart city project, other than a *technopole* project, under the Scheme shall be developed on an area of land of an extent exceeding 21.105 hectares (50 *arpents*) within which the development incorporates a mix of compatible land use including commercial, leisure and residential land use and consisting of a combination of office, light industrial, hotel, retail, public entertainment and housing so that the inclusive development achieves physical and functional integration and creates a pedestrian oriented urban environment.

(2) Every smart city project, other than a *technopole* project, under the Scheme shall –

(a) provide for the development referred to in paragraph (1);

(b) adhere to the live, work and play concept and shall provide for a majority of the residential population to live and work in the same location;

(c) comply with planning laws and such social obligations as may be specified in the guidelines;

(d) provide for 3 or more categories of land use and shall include –

(i). business facilities, with a mandatory innovation cluster;

(ii). the construction of residential properties on the condition that the land area planned for that purpose does not exceed 50 per cent of the total land area;

(iii). civic centres and leisure amenities; and

(iv). high quality public spaces that help promote social interaction and a sense of community, including but not limited to gardens, open plazas, cycle routes and pedestrian precincts;

(e) contain, in relation to subparagraph (d)(ii), affordable housing units for middle-income earners;

(f) provide for day to day management services through a Smart City Management Company;

(g) include –

(i). high-performance energy efficiency measures;

(ii). the use of information and communication technology to sense, analyse and integrate the key information to provide intelligent urban management and services.

(3) A *technopole* project may be developed on an area of land of less than 21.105 hectares (50 *arpents*) with high-tech industrial research and development facilities and shall –

(a) provide for business facilities, with a mandatory innovation cluster;

(b) provide for day to day management services through a Smart City Management Company;

(c) include –

(i). high-performance energy efficiency measures;
(ii). the use of information and communication technology to sense, analyse and integrate the key information to provide intelligent urban management and services.

(4) At least 25 per cent of the residential properties in a smart city project, other than a *technopole* project, under the Scheme shall be sold to citizens of Mauritius or members of the Mauritian Diaspora registered under the Mauritian Diaspora Scheme.

(5) In this regulation –

"high-performance energy efficiency measures" means measures which –

(a) use technology products or practices resulting in substantial operational cost savings through reduced energy consumption and utility costs; and

(b) to the extent possible –

(i). generate their own energy requirements through eco-friendly mechanisms such as solar plants and wind farms;

(ii). produce their own water needs; and

(iii). are autonomous in their waste management systems.

Chapter 11 of the **Smart City Guidelines** [reference 5] provides the project design modalities of the Smart City Development.

The design of a smart city project requires a combination of smart efforts to improve inhabitants' quality of life, promote economic growth and protect the environment from degradation.
A promoter is required to plan the spatial development of a smart city project taking into consideration the:

i. economic development
ii. sustainability; and
iii. high quality of life.

A Smart City project has to bring together people, infrastructure, technology, information, and management services into a coherent programme of urban and service improvements and achieve the following goals:

- a smart economy
- a smart environment
- smart governance
- smart mobility
- smart people
- smart living

4.2 Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 11 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines [reference 4]

11.1 By 2030, ensure access for all to adequate, safe and affordable **housing** and basic services and upgrade slums 11.2 By 2030, provide access to safe, affordable, accessible and sustainable **transport systems** for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons 11.3 By 2030, enhance inclusive and sustainable **urbanization** and capacity for participatory, integrated and sustainable human settlement planning and management in all countries 11.4 Strengthen efforts to protect and safeguard the world's **cultural and natural heritage**

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by **disasters**, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
11.6 By 2030, reduce the adverse per capita **environmental impact** of cities, including by paying special attention to air quality and municipal and other waste management
11.7 By 2030, provide universal access to safe, inclusive and accessible, **green and public spaces**, in particular for women and children, older persons and persons with disabilities
11.a Support positive economic, social and environmental **links** between urban, peri-urban and rural areas by strengthening national and regional development planning
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing **integrated policies and plans** towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

Whilst most of the above targets of Goal 11 are referenced in Smart City Scheme, the author wishes to raise general awareness on the following points:

- *The Mauritian Smart City Scheme relates rather to a high-end development with provision for a quantum of affordable housing units for middle-income earners;*
- *The concern for Environmental aspects rests in the "ability of a Smart City to increase sustainability and better manage natural resources". There is a need to specifically mention protection and safeguarding of the natural environment and reduction of the adverse per capita environmental impact of cities; there is a need to specifically mention protection and safeguarding of our cultural and natural heritage;*
- *There is a need for an essential linkage between the smart cities (urban), peri-urban and rural; integration is a key factor to a successful implementation of the Smart City scheme;*
- *Likewise, there is a need to design smart cities in the context of climate change, of necessary mitigation and adaptation to climate change, resilience to disasters in the context of the Small Island Developing State of Mauritius*

4.3 Goals 6, 7, 9, 12, 13, 14 and 15 and Engineering Opportunities

4.3.1 Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 6 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

6.1 By 2030, achieve universal and **equitable access to safe and affordable drinking water** for all
6.2 By 2030, achieve access to adequate and **equitable sanitation and hygiene** for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3 By 2030, **improve water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4 By 2030, substantially **increase water-use efficiency** across all sectors and **ensure sustainable withdrawals and supply of freshwater** to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5 By 2030, **implement integrated water resources management** at all levels, including through transboundary cooperation as appropriate
6.6 By 2020, **protect and restore water-related ecosystems**, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in **water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies**
6.b Support and strengthen the participation of local communities in improving water and sanitation management

As mentioned above, section 5(5)(b) of the Investment Promotion (Smart City Scheme) Regulations 2015, every smart city project, other than a technopole project, shall

(b) to the extent possible –

(ii) produce their own water needs; and

(iii) are autonomous in their waste management systems

Mauritius being a water-stressed country where water scarcity is a serious constraint for sustainable development of the island, it is the opinion of the author that water and sanitation related aspects should be strengthened further and not be limited to incentive aspects, as per the Smart City Guidelines.

The Central Water Authority shall be as per the Act, the sole undertaker for the supply of water for domestic, commercial and industrial purposes throughout Mauritius. The Act does cater for independent potable water producers, such as it does in the energy sector.

Whilst it is understood that a Master Plan Study for the development of water resources in Mauritius (2025-2050) has been completed, this document was not available for review and to draw a parallel with the goal.

The author wishes to raise here some specific awareness on the main engineering aspects and opportunities of this Goal.
Water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies (target 6a), are fields where engineers from both the public and private sector should collectively come forward with a set of sustainable management plan. These would relate amongst others 1) to identify and secure the source of the potable water, 2) to safeguard its quality, 3) to ensure its sustainable withdrawals and supply, 4) to increase water-use efficiency, 5) to systematically make provision for wastewater treatment plants instead of still resorting to on site disposal.

4.3.2 Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 7 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

7.1 By 2030, ensure universal access to affordable, reliable and **modern energy services**
7.2 By 2030, **increase substantially the share of renewable energy in the global energy mix**
7.3 By 2030, **double the global rate of improvement in energy efficiency**
7.a By 2030, enhance international cooperation to facilitate access to **clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology**
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support

As mentioned above, section 5(5)(b) of the Investment Promotion (Smart City Scheme) Regulations 2015, every smart city project, other than a technopole project, shall

(b) to the extent possible –

(i) generate their own energy requirements through eco-friendly mechanisms such as solar plants and wind farms

Energy is critical to the continued development of Mauritius. Fossil fuels remain the dominant source of primary energy generated by the Central Electricity Board (CEB) and by Independent Power Producers.

The CEB has prepared the second Integrated Electricity Plan (IEP) for the period 2013–2022, with the aim of guiding Mauritius and Rodrigues towards an even more stable electricity future. Similar to the previous IEP, the cornerstones of this Master Plan also are: to optimise the use of the existing power system, to keep electricity prices as low as possible through least-cost capacity expansion, to encourage customers to participate in Demand-Side Management (DSM), and to provide for continued Private Sector opportunities in the electricity sector. These renewed commitments of the CEB will be made, while giving due consideration to emerging challenges, such as protection of the environment and maintaining grid stability with the increasing share of renewable energy sources.

It should be recognised that the Energy sector is developing fast in Mauritius, with the regulator targeting a significant increase in the share of renewable energy in the overall energy mix, in line with international commitments and the COP21.

The author wishes to raise here some specific awareness on the main engineering aspects and opportunities of this Goal.
Clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promotion of investment in energy infrastructure and clean energy technology (target 7a) are fields where engineers have an important role to play, taking into account the Mauritian context as a Small Island Developing State.

4.3.3 Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 9 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

9.1 Develop **quality, reliable, sustainable and resilient infrastructure,** including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
9.2 Promote inclusive and sustainable **industrialization** and, by 2030, significantly **raise industry's share of employment and gross domestic product**, in line with national circumstances, and double its share in least developed countries
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to **financial services**, including affordable credit, and their integration into value chains and markets
9.4 **By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities**
9.5 **Enhance scientific research, upgrade the technological capabilities of industrial sectors** in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.a Facilitate sustainable and resilient infrastructure development in developing countries through **enhanced financial, technological and technical support** to African countries, least developed countries, landlocked developing countries and small island developing States
9.b Support **domestic technology development, research and innovation** in developing countries, including by

ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

9.c Significantly increase access to **information and communications technology** and strive to provide universal and affordable access to the Internet in least developed countries by 2020

Most targets of goal 9 are included in the Smart City Scheme. It can be recalled that a Smart City project has to bring together people, infrastructure, technology, information, and management services into a coherent programme of urban and service improvements and achieve the following goals: smart economy, smart environment, smart governance, smart mobility, smart people and smart living.

The author wishes to raise here some specific awareness on the main engineering aspects and opportunities of this Goal.

The Smart City Scheme is geared towards new developments. Upgrading existing cities, retrofitting existing facilities are yet to be formalised in another scheme.
Upgrading infrastructure and retrofitting industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, (target 9.4) are fields where engineers have an important role to play, taking into account the Mauritian context as a Small Island Developing State.

4.3.4 Goal 12. Ensure sustainable consumption and production patterns

Goal 12 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

12.1 Implement the **10-Year Framework of Programmes on Sustainable Consumption and Production Patterns**, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries

12.2 By 2030, achieve the **sustainable management and efficient use of natural resources**

12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

12.4 By 2020, achieve the **environmentally sound management of chemicals and all wastes throughout their life cycle,** in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

12.5 By 2030, substantially **reduce waste generation** through prevention, reduction, recycling and reuse

12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate **sustainability information** into their reporting cycle

12.7 Promote **public procurement practices that are sustainable**, in accordance with national policies and priorities

12.8 By 2030, ensure that people everywhere have the relevant **information and awareness** for sustainable development and lifestyles in harmony with nature

12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production

12.b Develop and implement tools to monitor sustainable development impacts for **sustainable tourism** that creates jobs and promotes local culture and products

12.c **Rationalize inefficient fossil-fuel subsidies** that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

Goal 12 is overarching and not specific to Smart City development. It calls for public and private action in as much as consumption and production patterns are concerned.

Although there seems to be significant potential for research and development of bio-agriculture in Mauritius, there may not be many opportunities for engineers in this field.

On the other hand, agro-energy, waste management, efficient use of resources are fields where engineers may have an important role to play, taking into account the Mauritian context as a Small Island Developing State.

4.3.5 Goal 13. Take urgent action to combat climate change and its impacts

Goal 13 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

13.1 Strengthen **resilience and adaptive capacity to climate-related hazards and natural disasters** in all countries
13.2 Integrate climate change measures into national **policies, strategies and planning**
13.3 Improve **education, awareness-raising and human and institutional capacity** on climate change mitigation, adaptation, impact reduction and early warning
13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
13.b Promote mechanisms for raising capacity for effective **climate change-related planning and management** in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

As already mentioned for Goal 11, there is a need to design smart cities in the context of climate change, of necessary mitigation and adaptation to climate change, resilience to disasters in the context of the Small Island Developing State of Mauritius.

The author wishes to recall the opportunities raised by the World Federation of Engineering Organisations (WFEO) in implementing measures related to Science and Technology and Capacity-building issues: "WFEO, through its Standing Technical Committees, could take the opportunity to reach a relevant status in undertaking, with UNFCCC and the different Organizations set up by this [Paris] Agreement, joint projects related to climate change mitigation, adaptation, technology transfer and capacity-building" *[reference 6]***.**

4.3.6 Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 14 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

14.1 By 2025, **prevent and significantly reduce marine pollution of all kinds**, in particular from land-based activities, including marine debris and nutrient pollution
14.2 By 2020, **sustainably manage and protect marine and coastal ecosystems** to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3 Minimize and address the impacts of **ocean acidification**, including through enhanced scientific cooperation at all levels
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and **implement science-based management plans**, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
14.5 By 2020, **conserve at least 10 per cent of coastal and marine areas**, consistent with national and international law and based on the best available scientific information
14.6 By 2020, **prohibit certain forms of fisheries subsidies** which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation
14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the **sustainable use of marine resources**, including through sustainable management of fisheries, aquaculture and tourism
14.a **Increase scientific knowledge, develop research capacity and transfer marine technology**, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries
14.b Provide access for small-scale artisanal fishers to marine resources and **markets**
14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"

Mauritius is an island in the middle of the Indian Ocean; some Smart Cities earmarked are located on the coastal frontage; Ocean Economy is to be a pillar of the "Second Economic Miracle and Vision 2030" [reference 7] of Mauritius; yet there is no reference to the ocean, sea and marine resources for sustainable development in the Smart City Guidelines.

The author wishes to raise here some specific awareness on the main engineering aspects and opportunities of this Goal.
Scientific knowledge, develop research capacity and transfer marine technology (goal 14.a) are fields where engineers have an important role to play, taking into account the Mauritian context as a Small Island Developing State.
In addition to the above and linking back to Goal 13, there are opportunities in as much as resilience and adaptive capacity to climate-related coastal hazards and natural coastal disasters are concerned.

4.3.7 Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 15 is reproduced in extenso below and discussed further against the Smart City Scheme and Guidelines.

15.1 By 2020, ensure the **conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services**, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.2 By 2020, promote the implementation of **sustainable management** of all types of forests, **halt**

deforestation, **restore** degraded forests and substantially **increase afforestation and reforestation** globally
15.3 By 2030, combat desertification, **restore degraded land and soil**, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world
15.4 By 2030, ensure the **conservation of mountain ecosystems**, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development
15.5 Take urgent and significant action to **reduce the degradation of natural habitats,** halt the loss of biodiversity and, by 2020, **protect and prevent** the extinction of threatened species
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local **planning, development processes**, poverty reduction strategies and accounts
15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

"Habitat loss is identified as the major historical cause of terrestrial biodiversity loss, through initial deforestation and the latter conversion to wide scale and intensive agricultural use" ***[reference 8]***.
"Sadly the Republic of Mauritius is today typified by highly degraded ecosystems, but despite this excellent conservation initiatives have been undertaken in recent years that provide hope for further success in the future" ***[reference 8]***.

Conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services *(goal 15.1) can be made possible in relation to protection and safeguarding of the natural environment and reduction of the adverse per capita environmental impact of cities (goal 11).*

The author believes that where the Investment Promotion (Smart City Scheme) Regulations 2015 recommends that to the extent possible Smart Cities should generate their own energy requirements, produce their own water needs and be autonomous in their waste management systems (section 5(5)(b)) , this should be done to a full extent, either on or off site and in a sustainable manner.

5 CLOSURE

No other word of closure seems as adequate as section 53 of the Resolution adopted by the General Assembly on 25 September 2015; which states:

"The future of humanity and of our planet lies in our hands. It lies also in the hands of today's younger generation who will pass the torch to future generations.

We have mapped the road to sustainable development; it will be for all of us to ensure that the journey is successful and its gains irreversible."

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