United **4** Smart Sustainable Cities

Factsheet
Pully, Switzerland

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VILLE DE **pully**

ITU

Factsheet

Pully, Switzerland

Foreword

This publication has been developed within the framework of the United for Smart Sustainable Cities (U4SSC) initiative. It provides an overview of the reporting and implementation of key performance indicators (KPIs) for smart sustainable cities (SSC) in the City of Pully, Switzerland. This set of KPIs for SSC was developed to establish the criteria to evaluate ICTs' contributions in making cities smarter and more sustainable, and to provide cities with the means for self-assessments.

Acknowledgements

Disclaimer

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Abbreviations

AMI	Advanced Metering Infrastructure
BIP	Pully IT Department
CO_2	Carbon Dioxide
DER	Distributed Energy Resources
DRR	Disaster Risk Reduction
DTSI	Department of Works and Industrial Services
EU	European Union
EV	Electric Vehicles
GDP	Gross Domestic Product
GHG(s)	Greenhouse Gas Emission(s)
GIS	Geographic Information System
ICT(s)	Information and Communications Technology/Technologies
IoT	Internet of Things
ITU	International Telecommunication Union
IWB(s)	Interactive Whiteboard(s)
KPI(s)	Key Performance Indicator(s)
MCR	Measurement, Control, Regulation
MHI	Mandatory Health Insurance
NO_2	Nitrogen Dioxide
O_3	Ozone
OECD	Organisation for Economic Co-operation and Development
PHEV	Plug-In Hybrid Electric Vehicle
PM	Particulate Matter ($_{2.5}$ and $_{10}$)
QR	Quick Response (Code)
R&D	Research and Development
SDG(s)	Sustainable Development Goal(s)
SIB	Sustainable and Intelligent Building
SME(s)	Small and Medium Size Enterprise(s)
SO_2	Sulphur Dioxide
SSC	Smart Sustainable City/Cities
U4SSC	United for Smart Sustainable Cities
UN	United Nations
VHI	Voluntary Health Insurance
VOIP	Voice Over Internet Protocol
WHO	World Health Organization

Executive Summary

The United for Smart Sustainable Cities (U4SSC) has developed a set of international key performance indicators (KPIs) for Smart Sustainable Cities (SSC) to establish the criteria to evaluate information and communication technologies' contributions in making cities smarter and more sustainable, and to provide cities with the means for self-assessments in order to achieve the sustainable development goals (SDGs). In 2017, Pully, Switzerland agreed to pilot these U4SSC KPIs.[1] This Factsheet documents the key findings of the Pully's project:

- It starts by introducing the U4SSC initiative within the context of digitalization and the importance of the standardization of data in fostering smart sustainable city transitions.

- The subsequent sections describe the various smart sustainable city activities adopted by Pully, with notable KPIs from the three U4SSC dimensions (Economy, Environment, and Society and Culture) providing a clear picture of Pully's efforts in each of these areas.

- The factsheet also outlines current projects underway, as well as planned future smart, sustainable development projects. Since one of the aims of the project was to improve the feasibility and applicability of the KPIs to all cities, Pully provided inputs on the existing KPI definitions, along with practical solutions to improve the data-collection process. The key findings from this will contribute to the development of the very first 'U4SSC Smart Sustainable Cities Index'.

The results from Pully's collection and reporting of data in accordance with the KPIs and the verification process undertaken are summarized in the following table. Key findings taken from across the different areas are highlighted underneath.

	Total	Reported	Verified	% KPIs Verified
Economy				
Core KPIs	23	23	23	100 %
Advanced KPIs	22	21	21	95 %
Environment				
Core KPIs	12	11	11	92 %
Advanced KPIs	5	5	5	100 %
Society & Culture				
Core KPIs	20	20	20	100 %
Advanced KPIs	9	8	8	89 %
Overall				
Core KPIs	55	54	54	98 %
Advanced KPIs	36	34	34	94 %
Total	**91**	**88**	**88**	**97 %**

Pully: Key Findings from across the KPIs

- To further optimize a *smart, sustainable ICT infrastructure*, Pully could utilize Recommendation ITU-T Y.4901/L.1601: 'KPIs related to the use of ICT in smart sustainable cities' and Recommendation ITU-T Y.4902/L.1602: 'KPIs related to the sustainability impacts of ICT in smart sustainable cities', or Recommendation ITU-T L.1400: 'Overview and general principles of methodologies for assessing the environmental impact of ICTs' and Recommendation ITU-T L.1440: 'Methodology for environmental impact assessment of ICTs at city level'.

- *Public sector procurement* does not yet achieve the benchmark and procurement opportunities need to transition to e-procurement.

> **Why not help improve quality of life for your citizens or evaluate the urban functionality of your own city by piloting the U4SSC KPIs? Contact us at u4ssc@itu.int to find out more!**

- Pully's rate of *youth unemployment* is significantly lower than the national average, where unemployment among youth is already lower than many other European countries. This is largely attributable to Switzerland's youth apprenticeship programme for vocational and professional training.

- Pully could continue to monitor its rate of non-revenue water through the employment of bestpractice water-loss accounting methods. Other actions can be taken to mandate the conservation of *water resources*, such as the implementation of smart water meter programmes.

- Pully's *electrical supply management* is effective, with 100 per cent access and little interruption. However, ongoing monitoring via widespread installation of household smart electricity meters and the prevalent use of ICTs to monitor the electrical supply systems could help the city in the long term.

- The city could investigate the use of *sustainability certification programmes* for on-going building operations. Pully may consider implementing Recommendation ITU-T L.1370 'Sustainable and Intelligent Building Services'.

- *Public transport* and *vehicle sharing* can be encouraged further, and investment can be made into providing support infrastructure for low-carbon EV and PHEV.

- In *urban planning* terms, Pully has reportedly implemented all five principles (compactness, connectivity, integration, social inclusiveness and resilience to climate change), which makes it a sustainably planned city, although there is still a high reliance on cars. Urban planning can be optimized further by creating more pedestrian zones and deploying measures to encourage foot traffic.

- An integrated approach to *climate change and air pollution* should be considered, in order to make tangible progress towards meeting the targets of the Paris Agreement.

- Pully performs well across KPIs for *public space and nature, environmental quality*, although these can be optimized through ensuring greater accessibility to green spaces. In addition, noise exposure can continue to be measured, monitored and mitigated through targeted programmes.

- Pully should evaluate peak day and time *water consumption trends*, in addition to the overall demand and production trends – taking into account seasonal temperature and precipitation trends. ITU Supplements such as ITU-T L Suppl. 14: ITU-T L.1500 'Standardization gap analysis for smart water management' and ITU-T L Suppl. 15: ITU-T L.1500 series: 'Requirements for water sensing and early warning systems' can be utilized by cities when actualizing smart water management.

- Best practices such as enhancing, reinforcing public communication and outreach, evaluating contracts, recycling markets and pricing levels, modifying collection techniques, legislating/funding smart recycling and leveraging lessons learned regionally can help optimize *waste recycling*, as can following Recommendation ITU-T L.1030: 'E waste management framework for countries', amongst others.

- A notable percentage of Pully's electricity comes from renewable sources – at a rate higher than the average reported by the OECD European countries. It is still recommended that the city encourages best practices in *energy management* through appropriate policies, incentives and procedures.

- Within the *Society and Culture dimension*, KPIs are widely reached thanks to a high adult literacy rate, positive health-related outcomes and a wide range of national, government-funded cultural offerings. Nevertheless, democratic participation through voting could be encouraged further.

- It is recommended that Pully reviews the KPIs reported at the lowest levels of the benchmarks, in particular, and Pully should work closely with other cities on its SSC efforts, in order to leverage any best practices and their shared experience with developing and instituting smart and sustainable policies and initiatives in the region.

- ITU would like to invite cities around the world to implement the U4SSC KPIs for SSC, enabling the cities to establish clear data-collection methodologies, collect data, and develop goals and targets.

Background: The United 4 Smart Sustainable Cities (U4SSC) Initiative

The United for Smart Sustainable Cities (U4SSC) is a UN initiative created to foster standardization, integration and interoperability of digital technologies within cities to make them smarter and more sustainable.

The initiative has developed a set of international **key performance indicators (KPIs) for Smart Sustainable Cities (SSC)**[2] to establish criteria to evaluate ICTs' contributions to making cities smarter and more sustainable, and to provide cities with the means for self-assessment in the move towards smartness and sustainability.

The aim is to help cities worldwide use technology to serve the best interests of the people and the environment. For this reason, environmental aspects as well as socio-economic factors also play a key role in the U4SSC framework.

Helping cities become smarter and more sustainable: The U4SSC KPIs

The U4SSC KPIs offer a common format to report the progress of smart sustainable city strategies. These indicators also enable cities to measure their progress relative to the United Nations Sustainable Development Goals (SDGs).[3]

ITU's objectives for the U4SSC KPIs for SSC project in cities are as follows:

- **Assisting** cities with implementing the KPIs in order to measure and evaluate a city's progress in becoming smarter and more sustainable in the move towards meeting the SDGs within the local context.

- **Learning** from cities' experiences and **sharing** this rich and varied knowledge, insights and feedback to other cities around the world, enabling them to refine their own smart sustainable city strategies.

- **Evaluating** the strengths of this system of KPIs and identifying any areas for improvement, and obtaining practical and actionable feedback towards supporting the international standardization work of ITU-T Study Group 20: Internet of Things and Smart Cities and Communities.

- **Providing** cities with a consistent and standardized method to collect data and measure performance and progress.

The KPIs are categorized into three dimensions:

ECONOMY

SOCIETY AND CULTURE

ENVIRONMENT

A further seven sub-dimensions are:

🛜	ICTs
⌛	Productivity
🏛	Infrastructure
🌿	Environment
☀	Energy
🎓	Education, Health and Culture
🏠	Safety, Housing and Social Inclusion

The KPIs are further subdivided into **core** and **advanced** indicators.

Core indicators are those that all cities should be able to report. They provide a basic outline of the city's smartness and sustainability – higher levels of performance are generally achievable within these KPIs.

Advanced indicators provide a more in-depth view of a city and measure progress on more advanced initiatives.

Details on each indicator are available online in the Collection Methodology for Key Performance Indicators for Smart Sustainable Cities.

Each indicator has been chosen through a process of review and input by international experts and UN bodies to ensure that the data collected support the SDGs in a local context. City leaders will benefit from these KPIs in terms of strategic planning and the measurement of their cities' progress towards their individual smart sustainable city (SSC) goals. The indicators will enable cities to measure their progress over time, compare their performance with those of other cities, use the data and insights gleaned as policy tools toward informed policy-setting and decision-making and – through analysis and sharing – allow for the dissemination of best practices and set the standards for progress in meeting the SDGs.

Benchmarks and Scoring Methodology

As part of the U4SSC KPI project, benchmarks were developed for most KPIs to develop a reporting framework to demonstrate to cities how their performance could be reported.

The benchmarks were set based on several factors:

- Meeting the aligned SDG fully.
- Performance compared to other international and transnational targets (e.g. OECD, European Commission).
- Performance against UN agency goals (e.g., International Telecommunication Union).
- Evaluation of city performance using UN and other international statistical data.
- Performance measured versus leading city performance globally.

Performance to benchmarks were then scored in four ranges for every KPI and data point reported:

- 0 – 33 % of target – 1 pt
- 33 – 66 % of target – 2 pts
- 66 – 95 % of target – 3 pts; and
- 95 + % of target – 4 pts

The scores for each reported KPI and data point were added to give a percentage score for categories, sub-dimensions and dimensions and reported based on the above target scores. KPIs or data points that are not reported or have no benchmarks yet defined were excluded.

Example: Education 4 KPIs

- If all 4 are reported and the scores are 1 pt, 3 pts, 4 pts and 1 pt

  Total score 9 pts out of 16 = 56.25 % reported as 33 – 66 % of target;
- If only 3 are reported and the scores are 3 pts, 4 pts and 2 pts

  Total score 9 pts out of 12 = 75 % reported as 66 – 95 % of target.

U4SSC unique method

The originality of U4SSC's method lies in the fact that it regards ICTs and digital technologies not as an end in themselves, but rather as tools with which to make a meaningful contribution to achieving the SDGs in an increasingly digitalized landscape. Approximately one-third of the U4SSC KPIs concern digitalization (for example, Student ICT Access) and two-thirds primarily concern sustainable development and environmental impact (for example, Noise Exposure). As such, U4SSC forms a necessary bridge between digitalization and sustainable development.

Pully and the U4SSC KPI Project

In response to questions on the level of its digital development and sustainability, the **City of Pully decided to join this ITU-led project**, utilizing the needs, aims and solutions of the U4SSC. This ambitious project would help Pully **measure and compare** its degree of **digitalization and sustainability.**

Findings from this project are expected to form an SSC development trajectory to which administrators of other municipalities and cities similar in size and capacity to Pully will be able to adapt when developing their own smart sustainable strategies. The KPIs will also help demonstrate how Pully is progressing in its achievement of the SDGs. The continuation of the project could also assist Pully in conducting a periodic internal review of its current ICT-related efforts, thereby allowing the city to benchmark how its ICTs can best be used to monitor and improve its smart city processes and operations. Pully plans to measure its U4SSC KPIs every 5 years, in conjunction with other local KPIs. This project can, therefore, play a key role in planning Pully's SSC future.

City Profile: Pully, Switzerland

City Profile			
Inhabitants	17 979	**City GDP**	USD 1 244 000 000
Area	6 km^2	**Household Income**	USD 73 295
Households	8 214	**Inflation Rate**	−0.43 %

Pully is part of the suburban area around the city of Lausanne in the canton of Vaud, which is located in the district of Lavaux-Oron. Archaeological evidence shows the area to be settled as far back as the Neolithic era. As a formal town, Pully dates back to the early 16th century. Its historic character has been maintained throughout the centuries in a manner that complements the beautiful natural setting beside which it resides on the shores of Lake Geneva (Lac Léman) and at the foot of the vineyards of Lavaux on the road to Vevey and Montreux. The villages of Chamblandes, La Perraudettaz, Port, Rochettaz and La Rosiaz are also part of Pully's 6 square kilometre official municipal area.

Similar to other aspiring smart sustainable cities in Switzerland, Pully resides in a noteworthy region for study. Due to its innovative policies and projects focusing on smartness and sustainability, Pully, in particular, provides an interesting lens through which to study the evolution of and best practices established within local smartness and sustainability.

Given its relatively small size and corresponding agility, Pully's public commitment to its technological and smart sustainable city (SSC) initiatives makes it ideal for the implementation of the U4SSC KPIs on Smart Sustainable Cities. Furthermore, the vital knowledge gained through Pully's experience will continue to be an important part of ongoing efforts to make not only the U4SSC KPIs, but also the upcoming Global Smart Sustainable Cities Index the most effective methods to measure progress and provide guidance to cities on their journey towards becoming smarter and more sustainable.

Pully's location relative to Lausanne, in particular, positions the city well for a truly multifocal, smart sustainability strategy. Its strategy can be formulated to align with further growth in any number of areas, such as technological and service-based growth. Leveraging as much as is feasible any functional integration made possible through vital regional partnerships can allow the relatively small city of Pully to realize the broader benefits of agglomeration in key areas relevant to its smart sustainability progress. Transport, ICT infrastructure, spatial planning, economic development and housing are areas, for example, where Pully can utilize the network effects of broader agglomeration to foster further growth in its smart sustainability efforts.

With the active support of ITU, the first year of Pully's U4SSC KPIs project has concluded successfully.

Pully and the KPIs: A Snapshot

The following chart provides an overview of how the KPIs are being met. Starting from the centre, the benchmark performance is indicated for: Dimensions, Categories and KPIs.

Legend:
- 95+ % of Target
- 66 - 95 % of Target
- 33 - 66 % of Target
- Less than 33 % of Target
- No Data or No Target
- Data Reported - No Targets Yet Available

KPI Dimension 1: Economy

The first U4SSC KPIs dimension is Economy. This dimension covers the sub-dimensions of Information and Communication Technologies (ICTs), Productivity and Infrastructure.

In the ICTs sub-dimension, the KPIs include those related to a city's ICT infrastructure, water and sanitation, drainage, electricity supply, transport and public sector. These KPIs aim to assess the availability and use of the ICT infrastructure in cities that facilitates smart sustainable city services.

The Productivity sub-dimension includes KPIs related to innovation and employment. These KPIs aim to assess the use and impact of ICTs in the economic development of cities. They cover innovation, job creation, trade and productivity. These KPIs are also expected to play a pivotal role in assessing a city's adoption of the ICTs that support socio-economic growth.

The Infrastructure sub-dimension relates to water and sanitation, waste, electricity supply, transport, buildings and urban planning. These KPIs aim to assess the impact of ICTs on city infrastructure, development and sustainability.

The key theme assessed by the Economy KPIs is the level of implementation of ICTs. A smart sustainable city (SSC) requires fixed and mobile ICT infrastructures to allow for the deployment of applications that will:

1.   facilitate the development of smart and sustainable cities;
2.   promote civic engagement; and
3.   foster improvements in sustainability (gained though efficiencies in operations).

There are also KPIs within this dimension that are meant to help analyse the general economic well-being and innovation of a city and to measure the support from ICTs in the process.

The following diagram summarizes Pully's KPI performance detailing the categories within the Economy dimension against the current U4SSC benchmarks.

ECONOMY
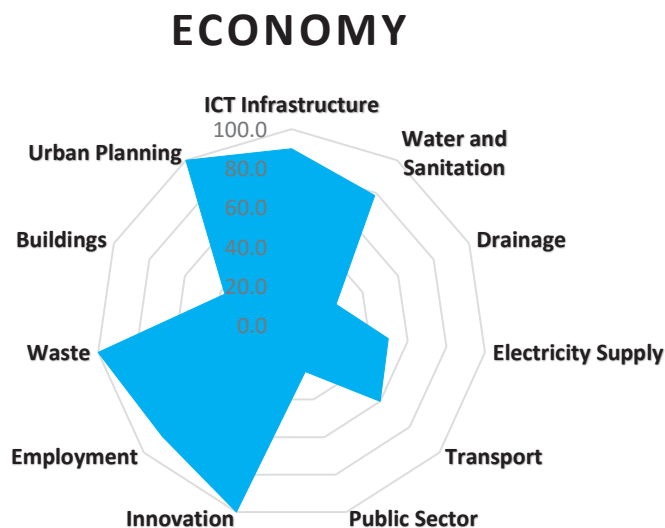
Information and Communication Technology (ICT) Infrastructure

Category	KPI	Result	Performance to Benchmark	SDG
	Fixed Broadband Subscriptions	44.80 %		
	Wireless Broadband Subscriptions (per 100 000 inhabitants)	101 200.00		
	Household Internet Access	91.00 %		
	Wireless Broadband Coverage: 3G and 4G	100.00 %		
	Availability of Wi-Fi in Public Areas	5.00 Spots	No Benchmark Available	

The reporting of Pully's economy starts with its connectivity and ICT infrastructure KPIs. Such a high level of online connectivity (in particular, 4G wireless connectivity) is the hallmark of a true smart city. Connectivity minimizes geographical constraints, which, in general, especially benefits smaller or more rural cities. Notably in today's telecommuting work model, connectivity is a significant determinant of sustained economic prosperity and flow of income to those cities. This bodes well for Pully, where so many individuals have a 4G connection, that even the use of public Wi-Fi is decreasing.

Smaller cities and municipalities in general tend to benefit from high connectivity in several ways. First, planning and implementing high levels of connectivity consistently across the board is usually less complex in smaller, agile and less densely populated areas. Secondly, high connectivity allows smaller cities the ability to retain a higher percentage of their educated and talented native labour force that would otherwise move to larger urban centres for employment. High connectivity levels also make a small city an attractive destination for tech entrepreneurs and young people in nearby areas. All of these factors would have implications for Pully's economic future.

Optimizing smart, sustainable ICT infrastructure: To capture the ICT usage state at that time and to conduct even deeper analysis, Pully could utilize Recommendation ITU-T Y.4901/L.1601: 'KPIs related to the use of ICT in smart sustainable cities' and Recommendation ITU-T Y.4902/L.1602: 'KPIs related to the sustainability impacts of ICT in smart sustainable cities'. Also useful are Recommendation ITU-T L.1400: 'Overview and general principles of methodologies for assessing the environmental impact of ICTs' and Recommendation ITU-T L.1440: 'Methodology for environmental impact assessment of ICTs at city level'.

For the expansion of high-speed broadband in rural areas, in particular, Recommendations ITU-T Y.3000 to Y.3499: 'Future networks' can help guide forward-looking implementation.

Public Sector
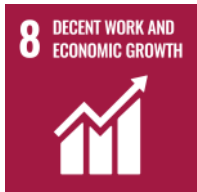
Category	KPI	Result	Performance to Benchmark	SDG
	Open Data Sets Published	0.00	No Benchmark Available	
	Open Data Sets Availability	0.00 %		
	e- Government Services	9.00	No Benchmark Available	
	Public Sector e-procurement	Not Reported		

Pully underperforms in this category. The role of e-governance as a building block to a true smart city has been emphasized by the UN and the OECD. E-governance increases citizens' participation in decision-making. It makes public services delivery more effective, accessible and responsive to people's needs. Open data and public sector e-procurement help establish government transparency and accountability.

Therefore, performance in these indicators needs to be improved significantly.

Optimizing public sector activities: The city develops, or has access to, 500 open data sets. Making a sizeable percentage of these available publicly online will help ensure the transparency mentioned above. It is also recommended that the city tracks and reports the percentage of public sector procurement activities that are conducted electronically in subsequent reporting years. Lastly, the city should increase the number of public services that it delivers through electronic means in order to achieve the aforementioned effectiveness, accessibility and responsiveness. Pully may find Recommendation ITU-T Y.3600: 'Big data standardization roadmap' particularly helpful towards its e-services and e-processes, along with Recommendation ITU-T Y.4461: 'Framework of open data in smart cities' when preparing its open data offerings.

Innovation and Employment

Category	KPI	Result	Performance to Benchmark	SDG
	R&D expenditure (relative to GDP)	3.53 %		
	Patents (per 100 000 inhabitants)	129.60		
	Small and Medium-Sized Enterprises (SMEs)	99.40 %		
	Unemployment Rate	3.52 %		
	Youth Unemployment Rate	2.63 %		
	Tourism Sector Employment	4.10 %		
	ICT Sector Employment	2.71 %		

Unemployment levels are low in Pully, as compared with the Swiss overall unemployment rate of 4.7 per cent (Q4- 2018),[5] while its rate of youth unemployment is significantly lower than the 2018 national level of 7.9 per cent.[6]

Pully over-performing on youth unemployment relative to other European localities of its size and population makeup is typical of the national trend, where time-series data indicate that unemployment among Swiss youth is lower as compared with unemployment rates of up to 20.3 per cent (2015) among the European Union (EU) countries.[7] Switzerland's apprenticeship programme for vocational and professional training successfully graduates close to 70 per cent of Swiss youth, which, when combined with mandatory school-based education, helps to keep youth unemployment and (the oft-related) adult poverty levels relatively low.[8] Swiss youths who complete apprenticeship are three times less likely to be unemployed, which is consistent with results seen in Germany and Austria, which implement similar programmes.[9]

Water and Sanitation, Drainage and Waste

Category	KPI	Result	Performance to Benchmark	SDG
	Smart Water Meters	0.00 %		
	Water Supply ICT Monitoring	94.18 %		
	Basic Water Supply	100.00 %		
	Potable Water Supply	99.10 %		6 CLEAN WATER AND SANITATION
	Water Supply Loss	11.07 %		
	Wastewater Collection	100.00 %		
	Household Sanitation	100.00 %		
	Drainage/Storm Water System ICT Monitoring	0.00 %		
	Solid Waste Collection	100.00 %		11 SUSTAINABLE CITIES AND COMMUNITIES

While Pully's performance is largely positive in these categories, the rate of water loss through the water distribution systems warrants further mitigation.

Optimizing water resources, smartly: To this end, Pully has developed and enacted the PDDE: Plan Directeur de Distribution de l'Eau, which was approved by the municipality in 2018. The plan mandates the conservation of the city's water resources by requiring public drinking water utilities to submit a water conservation plan. Additionally, Pully has deployed sensors for leak detection.

There are no household smart water meters installed, however, nor is there ICT-based monitoring of the city's drainage/storm water system. The former is especially important to address. It is recommended that

Pully mandates the installation or retrofitting of smart meters in homes throughout the city. New smart meters can utilize an advanced metering infrastructure (AMI) system to provide remote meter reading, data analysis and alerts for possible leak or flow problems. This real-time data could help ensure billing accuracy, and allow city staff and residents the ability to detect potential issues and avoid unnecessary water costs.

Another advantage to using smart meters is that with traditional meters, city employees have to visit homes to read water meters (usually on a monthly basis). Advanced metering systems eliminate this requirement, thereby taking vehicles off the road, which reduces a city's carbon footprint and provides a fairer, and more accurate and efficient, way to administer water use in the city.

It is recommended that Pully rolls out the smart meters in phases, with communication regarding each phase disseminated to residents in advance. A letter should be sent to residents 1–2 weeks prior to installation in their area, with a website set up to keep residents up to date on the progress of installations. A web-based reporting system should also be set up by the utility or city to help residents track their daily water use after installation, and learn about strategies for saving water and reducing their utility bill.

The communication to residents should also include information on the typical amount of time that the installation of a new meter and communication module is expected to take. Testing will likely be conducted to ensure that the installation is properly complete, and this should also be incorporated into the communication with residents.

Furthermore, residents should be informed about:

• how the smart water meter system works and how it benefits them;

• the total cost and payback period for implementing the meters;

• whether the wireless technology used will affect residents' health and privacy;

• what residents can do to prepare for the installation;

• who has been contracted to conduct the installations (and whether their employees can be identified with a uniform, identification badge and/or vehicles with the company name and logo); and

• where residents can obtain more information.

Recommendations ITU-T Y.4000 to Y.4999: 'Internet of things and smart cities and communities' contain guidance on IoT applications and ubiquitous sensor networking. All cities can also benefit from Supplement ITU-T Y Suppl. 36: ITU-T Y.4550-Y.4699: 'Smart water management in cities'.

Electricity Supply

Category	KPI	Result	Performance to Benchmark	SDG
	Smart Electricity Meters	0.00 %		
	Electricity Supply ICT Monitoring	0.00 %		
	Demand Response Penetration	0.00 %		7 AFFORDABLE AND CLEAN ENERGY
	Electricity System Outage Frequency	0.06		
	Electricity System Outage Time	512.88 Minutes		
	Access to Electricity	100.00 %		

Pully's electrical service is effective, with few interruptions, and ongoing monitoring via widespread installation of household smart electricity meters. The average reported length of the interruptions is somewhat high, though, at 512.88 minutes, which points to weather-related causes as a probable reason. It is recommended that the city studies and confirms the factors behind its protracted average outage time, and takes steps to reduce the time for each incident.

Optimizing Electrical Supply: Installation of household smart electricity meters and introduction of ICTs to monitor its electrical supply systems will take place in Pully in keeping with a national law requiring smart meters to be implemented by 2027. This will further help the city in reducing any interruptions in electrical supply. Recommendations ITU-T Y.4000 to Y.4999: 'Internet of things and smart cities and communities' contain guidance on IoT applications and ubiquitous sensor networking, including, for example, Recommendation ITU-T Y.4409/Y.2070: 'Requirements and architecture of the home energy management system and home network services'.

The above will also enable the city to move towards, and take advantage of a more local distributed energy resources (DER) market, which is gathering momentum through Europe as technology costs come down. Developing this demand-response capability will be vital in keeping costs down in the future by: providing load reductions during periods of extreme load; curtailing demand on overstretched power generation capacity as a city's population and economy grow; and helping to avoid unnecessary investments in new grid capacity.

Buildings

Category	KPI	Result	Performance to Benchmark	SDG
	Public Building Sustainability	0.00 %		
	Integrated Building Management Systems in Public Buildings	64.51 %		

Optimizing building services: It is recommended that Pully invests in sustainability assessment and certifications for its public buildings, and expands the public building area that is monitored via automated and integrated building management ICT systems (like it is doing with its public school buildings, as seen in the section on 'Goals and Projects'). Buildings with such ICT systems have the capacity to provide a secure living and working environment by ensuring that aspects like energy efficiency and water consumption are maintained at acceptable levels. Additionally, such buildings also account for the dynamic utilization of space based on need and availability.

Pully should also consider implementing Recommendation ITU-T L.1370 'Sustainable and Intelligent Building Services'. This recommendation sets the minimal requirements for the efficient and sustainable management of the building as a unit. It also defines the services enabled by the sustainable and intelligent building (SIB) concept, the way it contributes to the goals of sustainability, its features, its different possible functioning modes, or its internal architecture and requirements with the Internet of Things (IoT) node at its core.

Furthermore, it is recommended that Pully keeps apprised of the ITU-T Study Group 5: 'Environment, Climate Change and Circular Economy' upcoming Draft Recommendation ITU-T L.SP_OB: 'A methodology for improving, assessing and scoring the sustainability performance of office buildings', which will provide a framework to critically assess ten key areas of environmental performance and management, including:

- Energy
- Water
- Air
- Comfort
- Health and Wellness

- Purchasing
- Custodial
- Waste
- Site
- Stakeholders

Transport

Category	KPI	Result	Performance to Benchmark	SDG
	Dynamic Public Transport Information	100.00 %		
	Traffic Monitoring	100.00 %		
	Intersection Control	100.00 %		
	Public Transport Network (per 100 000 inhabitants)	133.60 km		
	Public Transport Network Convenience	99.99 %		
	Bicycle Network (per 100 000 inhabitants)	24.92 km		11 SUSTAINABLE CITIES AND COMMUNITIES
	Transportation Mode Share: Private Vehicles	69.00 %		
	Transportation Mode Share: Public Transport	24.00 %		
	Transportation Mode Share: Walking	5.00 %		
	Transportation Mode Share: Cycling	1.00 %		
	Transportation Mode Share: Para Transport	1.00 %		
	Travel Time Index	1.14		
	Shared Bicycles (per 100 000 inhabitants)	0.00		

Category	KPI	Result	Performance to Benchmark	SDG
	Shared Vehicles (per 100 000 inhabitants)	50.06		
	Low-Carbon Emission Passenger Vehicles	0.18 %		

This section covers Pully's road and transportation infrastructure, including the diffusion and utilization of ICTs to monitor and optimize these areas.

Optimizing transport: Pully has noted that it is prioritizing investment in public transportation in order to decrease the individual transportation mode. All of Pully's population has convenient access within 0.5 km to public transport. So, an answer could lie in extending Pully's public transport network beyond its current one-way length of 133.6 km per 100 000 inhabitants by introducing more direct transport lines and convenient arterial connections to other urban areas within the region.

It is recommended that Pully also incentivize vehicle sharing services and carpool programmes, in addition, as transit alternatives. Bicycle-sharing programmes should also be supported and funded, as currently no shared bicycles have been reported in Pully. This will lead to better utilization of the existing bicycle paths and lanes in and around the city, and could increase the overall percentage of people cycling regularly.

Travel mode share
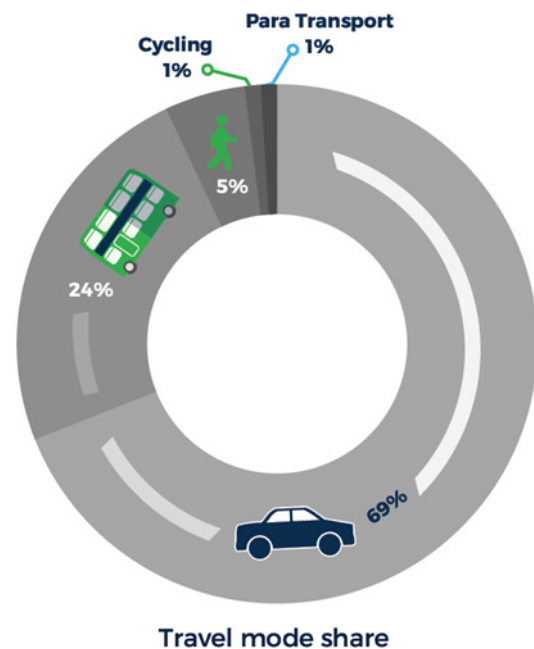
Many ITU Recommendations could be a resource, such as Recommendations ITU-T Y.1300 to Y.1399: 'Transport' and Recommendations ITU-T Y.1700 to Y.1799: 'Operation, administration and maintenance'. In private vehicle heavy cities, Recommendation ITU-T Y.4456: 'Requirements and functional architecture for smart parking lots in smart cities' can also help guide measures to alleviate vehicle congestion or to optimize flow.

Information on some of Pully's latest traffic optimization projects can be found in the section on 'Goals and Projects'.

Urban Planning

Category	KPI	Result	Performance to Benchmark	SDG
	Pedestrian Infrastructure	2.86 %		
	Urban Development and Spatial Planning: Compact	YES		
	Urban Development and Spatial Planning: Connected	YES		11 SUSTAINABLE CITIES AND COMMUNITIES
	Urban Development and Spatial Planning: Integrated	YES		
	Urban Development and Spatial Planning: Inclusive	YES		
	Urban Development and Spatial Planning: Resilient	YES		

To be considered 'sustainable', urban plans should have all of the following five principles or elements, as demonstrated through evidence-based and innovative methodology (including data innovations like spatial analytics, GIS and Big Data):

1) **compactness:** avoiding urban sprawl;

2) **connectivity:** places and locations to demonstrate high connectivity;

3) **integration:** mixed urban land use;

4) **social inclusiveness**; and

5) **resilience to climate change**.

Optimizing urban planning: Walking more can be encouraged by designating more city areas as a pedestrian/car-free zone. Creating more pedestrian zones will also provide more places for citizens to engage in and create a sense of community. It is recommended that in creating more pedestrian zones, Pully designs those spaces for the pedestrian speeds over those of cars and keep in mind community outcomes during design of such zones and their land-use planning.

KPI Dimension 2: Environment

The second U4SSC KPIs dimension is Environment. This dimension includes the sub-dimensions of Environment and Energy. The Environment sub-dimension covers a range of indicators classified according to categories, some of which can also be found in the first (Economy) dimension. The KPIs include those for air quality, water and sanitation, waste, environmental quality, and public space and nature. They aim to assess the use of ICTs in supporting urban environmental services and improving the overall environmental quality in cities.

The Energy sub-dimension includes all KPIs that report on energy. These KPIs aim to assess the use of renewable and sustainable sources of energy, as well as the energy efficiency and energy reduction measures in a city. This dimension examines the level of ICT integration in supporting environmental sustainability and energy efficiency. These KPIs also provide a key baseline for future comparison, because achieving efficient use of resources via ICTs will be fundamental to Pully's, and every other aspiring smart sustainable city's long-term environmental sustainability.

The following diagram summarizes Pully's KPI performance detailing the categories within the Environment dimension against the current U4SSC benchmarks.

ENVIRONMENT
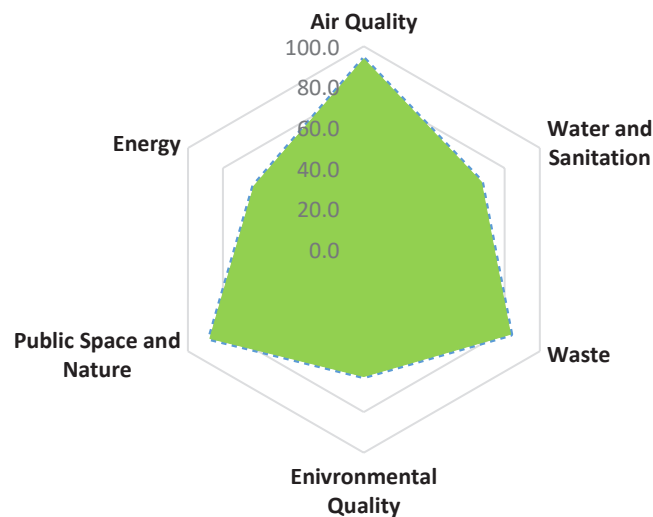
Air Quality

Category	KPI	Result	Performance to Benchmark	SDG
	Particulate Matter (PM$_{2.5}$)	Not Reported		
	Particulate Matter (PM$_{10}$)	15.8 µg/m^3		
	Nitrogen Dioxide (NO$_2$)	21.30 µg/m^3		11 SUSTAINABLE CITIES AND COMMUNITIES
	Sulphur Dioxide (SO$_2$)	Not Reported		
	Ozone (O$_3$)	47.30 µg/m^3		
	GHG Emissions (eCO$_2$ / capita)	6.36 tonnes		

According to the World Health Organization (WHO) guidelines on the major components of air pollution, Pully's performance is within acceptable levels. This is positive for the fight against climate change and for the overall health of the city's environment and residents.

Optimizing air quality: However, it is recommended that Pully measures and reports levels of small particulate matter (PM$_{2.5}$), as it is known to affect health by increasing mortality and morbidity (daily and over decades).[10]

Although Pully's reported value for greenhouse gas emissions (GHGs) are not much higher than the European average of 5 tonnes, the current benchmark does not yet reflect the goals of the Paris Agreement. Consequently, despite the benchmark rating, the level of Pully's GHG emission will need to be improved substantially if the goals of Paris Agreement are to be reached.

Pully should make use of Recommendation ITU-T L.1460: 'Connect 2020 greenhouse gas emission guidelines'. It will provide the city with a roadmap with which to address the Connect 2030 GHG emissions target, while considering SDG 13 and the objectives of the Paris Agreement. Specifically, the Recommendation will help Pully assess the impact of its ICT sector and usage on GHG emissions, and will prescribe actions to limit such emissions. Other Recommendations such as Recommendation ITU-T L.1470: 'GHG emissions trajectories for the ICT sector compatible with the UNFCCC Paris Agreement', Recommendation ITU-T Y.4207: 'Requirements and capability framework of smart environmental monitoring' and Recommendation ITU-T Y.4700/F.747.2: 'Deployment guidelines for ubiquitous sensor network applications and services for mitigating climate change' can be of help in smart sustainable cities' efforts to monitor and mitigate air pollution.

Public Space and Nature, and Environmental Quality

Category	KPI	Result	Performance to Benchmark	SDG
	Green Areas (per 100 000 inhabitants)	2 244.86 ha		
	Green Area Accessibility	53.47 %		11 SUSTAINABLE CITIES AND COMMUNITIES
	Protected Natural Areas	58.03 %		
	Recreational Facilities (per 100 000 inhabitants)	6 582 346 m²		
	EMF Exposure	98.70 %		16 PEACE, JUSTICE AND STRONG INSTITUTIONS
	Noise Exposure	37.40 %		11 SUSTAINABLE CITIES AND COMMUNITIES

Rest of Pully 42%

Green areas 58%

Green and protected natural areas
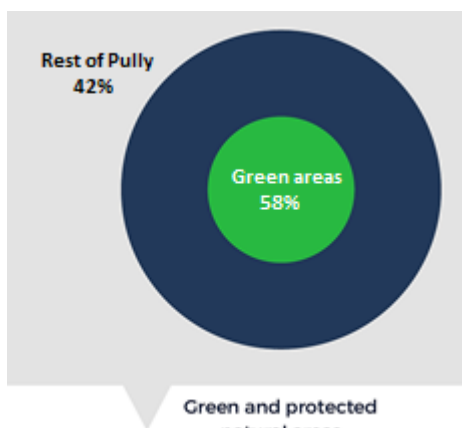
Pully performs well across the majority of these KPIs, especially with regard to green areas. A locality's natural areas should be expansive, contiguous and easily accessible to the majority of citizens. A high percentage of Pully's population has easy accessibility, i.e. lives within 300 meters of a publicly accessible green space.
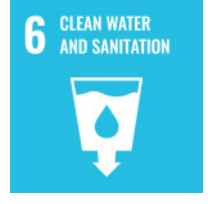
Optimizing public spaces: It is recommended, however, that Pully continues to monitor noise exposure, as prolonged levels of noise can lead to negative health effects and also impacts the ability of residents to enjoy outdoor/indoor city life.

A comprehensive, long-term approach to noise management is best and should include: policy interventions (for example, traffic management, building code standards, equipment performance standards, and noise bylaws), and education and engagement of the public. Other approaches that

can be used to reduce exposure to noise should also be incorporated into the plan, including choosing technologies that are quieter.

In regard to EMFs, Recommendations in the ITU-T K-series: 'Protection against interference' can provide further insight into limiting and managing their effects.

Water and Sanitation

Category	KPI	Result	Performance to Benchmark	SDG
	Drinking Water Quality	100.00 %		
	Water Consumption (per capita)	216.81 ℓ / day		
	Freshwater Consumption	0.00 %		6 CLEAN WATER AND SANITATION
	Wastewater Treatment: Primary	100.00 %		
	Wastewater Treatment: Secondary	100.00 %		
	Wastewater Treatment: Tertiary	0.00 %		

Water safety and quality are priorities in Swiss cities, including Pully, which is why the city performs well across these indicators. However, Pully's consumption figures are significantly higher than the average national levels of 160 to 170 litres per capita.[11] [12] Some of the difference could amount to per capita consumption variance between urban and rural areas, as well as between water companies with and without water meters.

Optimizing water consumption: It is recommended that Pully analyses this high variance and continues to monitor how much customer water demands (employment and residential) account for the city's total water production volume. Pully should evaluate peak day and time water consumption trends, in addition to the overall demand and production trends – taking into account seasonal temperature and precipitation trends. The city should then set average water production projections and targets based on its interval of choice according to customer demand and non-revenue water.

ITU Supplements such as ITU-T L Suppl. 14: ITU-T L.1500: 'Standardization gap analysis for smart water management' and ITU-T L Suppl. 15: ITU-T L.1500 series: 'Requirements for water sensing and early warning systems' should be utilized by cities when actualizing their smart water management policies.

Waste

Category	KPI	Result	Performance to Benchmark	SDG
	Solid Waste: Landfill	0.00 %		
	Solid Waste: Burnt	0.00 %		
	Solid Waste: Incinerated	41.93 %		
	Solid Waste: Open Dump	0.00 %		
	Solid Waste: Recycled	58.07 %		
	Solid Waste: Other	0.00 %		
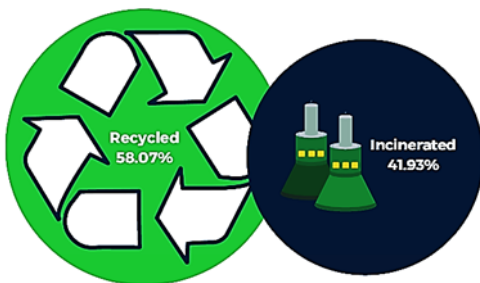
Methods of solid waste disposal

All cities are recommended to prioritize solid waste recycling in a regulated facility or solid waste incineration that leads to energy production over all other forms of disposal. While its overall waste disposal mix is effective sustainably, it is recommended that Pully continues to develop its recycling capability and culture further as part of its smart sustainability strategy.

Optimizing waste recycling: As part of this recommendation steps that cities or regions such as Pully can take to increase their recycling rates include the following best practices:

- Enhance (for non-recyclers) and reinforce (for recyclers) public communication and outreach in order to increase overall public participation in recycling.

- Evaluate the recyling markets and pricing levels for materials.

- Evaluate hauler contract(s).

- Modify collection techniques in order to enhance programme efficiency and diversity as part of a strategic plan.

- Legislate and fund smart recycling.

As increasing generation of e-waste is a particularly burgeoning issue for most cities, Recommendation ITU-T L.1030: 'E-waste management framework for countries', and Recommendation ITU-T L.1032: 'Guidelines and certification schemes for e-waste recyclers' (along with Supplement ITU-T L Suppl. 4: 'Guidelines for developing a sustainable e-waste management system') can be vital in governments' efforts to monitor and manage the issue.

Energy

Category	KPI	Result	Performance to Benchmark	SDG
	Renewable Energy Consumption	16.47 %		
	Electricity Consumption (per capita)	2 838.20 kWh / yr		7 AFFORDABLE AND CLEAN ENERGY
	Residential Thermal Energy Consumption (per capita)	37.33 Gj / yr		
	Public Building Energy Consumption (per year)	120.32 ekWh / m^2		
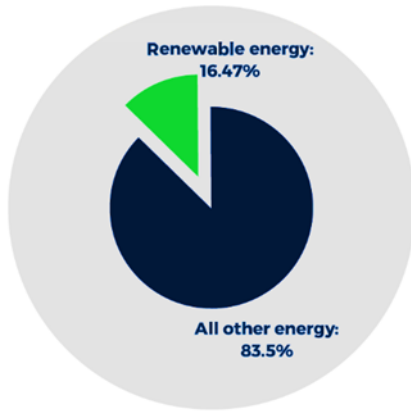
Percentage of renewable energy consumed

Lastly, Pully's annual residential thermal energy consumption is low and its overall electricity consumption per capita annually, while high, is in line with other cities in the region of comparable size.
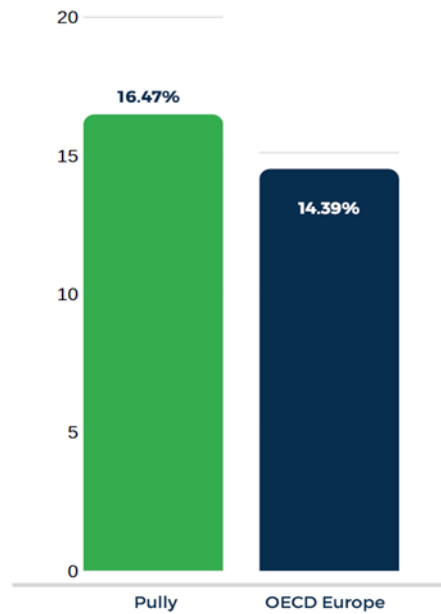
Pully's comparative renewable energy consumption

Although there is still room for further sustainable improvements to be implemented or expanded – in order to include more renewable sources such as: solar, wind, hydro, tide and wave energy – notably, 16.47 % of Pully's electricity comes from renewable sources. This rate is higher than the average reported by the OECD European countries.[13]

Recommendations that guide the modernization and optimization of various public energy use sources should be utilized, including, for example, Recommendation ITU-T Y.4458: 'Requirements and functional architecture of a smart street light service', Recommendation ITU-T L.1210: 'Sustainable power feeding solutions for 5G networks', and Recommendation ITU-T L.1316: 'Energy efficiency framework' (along with Supplement ITU-T L Suppl. 36: ITU-T L.1310: 'Study on methods and metrics to evaluate energy efficiency for future 5G systems').

KPI Dimension 3: Society and Culture

The third U4SSC KPIs dimension is Society and Culture. This dimension covers the sub-dimensions of Education, Health and Culture, as well as Safety, Housing and Social Inclusion. As with the first two dimensions, each sub-dimension covers a range of indicators classified according to its categories.

KPIs in Education, Health and Culture aim to assess the impact of the ICTs that improve citizens' quality of life. They focus on areas such as education, health and societal culture, among other aspects.

Safety, Housing and Social Inclusion contains a KPI related to food security, in addition to those related to safety, housing and settlements, along with social encompassment.

These KPIs aim to assess the impact of the use of ICTs to promote urban equity, citizen participation and to enhance social inclusiveness. They focus on the themes of openness, public participation and transparency in governance. The KPIs that measure the quality of life of citizens and the extent of ICT implementation in the education, health and safety sectors are also included here.

There is emphasis on developing the foundation that allows for the creation of electronic platforms for public and private sector use. Such platforms lay the groundwork for more transparent and efficient governance and maintain the inclusiveness of the city inhabitants as stakeholders pivotal to the city's decision-making processes. They ensure that the health, education and safety services are deployed with the least amount of disruption, waiting times and manual intervention possible.

The following diagram summarizes Pully's KPI performance detailing the categories within the Society and Culture dimension against the current U4SSC benchmarks.

SOCIETY & CULTURE
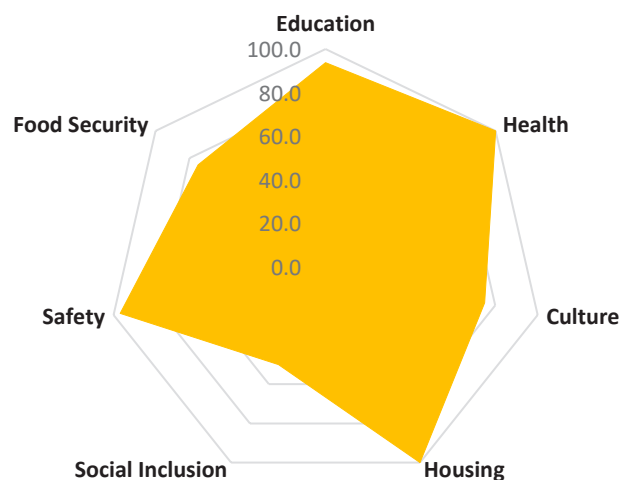
Education

Category	KPI	Result	Performance to Benchmark	SDG
	Student ICT Access	100.00 %		
	School Enrollment	99.96 %		4 QUALITY EDUCATION
	Higher Education Degrees (per 100 000 inhabitants)	38 939.87		
	Adult Literacy	89.61 %		

Pully performs well across all these indicators.

School enrolment is optimal as primary school is obligatory for every child in Switzerland. Public schools are free and are operated by the various cantons.

The ICT strategy for schools is set jointly by the Swiss Government (as part of its digitalization strategy)[14] and the cantons (in their joint blueprint).[15]

Pully's adult literacy rate is close to the national adult literacy rate[16] and levels of higher education are in line with the increasing higher education levels in the country.[17]

Health

Category	KPI	Result	Performance to Benchmark	SDG
	Electronic Health Records	Not Reported		
	Life Expectancy	83.00 yrs		
	Maternal Mortality Rate (per 100 000 live births)	8.88		3 GOOD HEALTH AND WELL-BEING
	Physicians (per 100 000 inhabitants)	218.00		
	In-Patient Hospital Beds (per 100 000 inhabitants)	476.09		
	Health insurance / Public Health Coverage	100.00 %		

This set of KPIs signifies mostly positive, health-related outcomes for Pully's residents.

Life expectancy is in line with the national average of 82.9 years (2016),[18] and all residents are covered by basic health insurance, as National Swiss policy (under the Federal Health Insurance Law from 1996) mandates that all inhabitants of Switzerland be covered through three streams of publicly financed health insurance:

1) direct financing for health care providers through tax-financed budgets for the Swiss confederation, cantons, and municipalities;

2) mandatory premiums for universal health insurance (MHI); and

3) social insurance contributions from health-related coverage of accident insurance, old-age insurance, disability insurance, and military insurance.

Private insurance, i.e. supplementary and complementary voluntary health insurance (VHI), also exists for services not covered under basic MHI.

Optimizing health care and services:
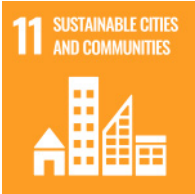
It is recommended that Pully gathers and reports data on the percentage of its citizens that have electronic health records. Recommendation ITU-T Y.4408/Y.2075: 'Capability framework for e-health monitoring services' and Recommendation ITU-T Y.4110/Y.2065: 'Service and capability requirements for e-health monitoring services' can help cities optimize their e-health service provision and measurement.

Culture

Category	KPI	Result	Performance to Benchmark	SDG
	Cultural Expenditure	2.00 %		11 SUSTAINABLE CITIES AND COMMUNITIES
	Cultural Infrastructure (per 100 000 inhabitants)	61.18	No Benchmark Available	

Cultural infrastructures create environments conducive to the emergence of dynamic and vibrant cultural sectors and clusters, as they are a source of cultural, social, as well as economic vitality in the areas in which they are located, especially through tourism. Pully's location on the shore of Lake Geneva and the natural beauty of its surroundings are an organic draw for tourists, which necessitates a certain level of investment in the upkeep and exhibition of the city's culture and historical heritage. Pully performs well on these indicators, prioritizing the preservation, protection and conservation of its cultural and natural heritage, including its three museums: the Centre Général Guisan, the Roman Villa of Pully and the Art Museum of Pully, as well as its Théâtre de l'Octogone and the Cinéma City Club.

Housing and Social Inclusion

Category	KPI	Result	Performance to Benchmark	SDG
🏠	Informal Settlements	0.00 %	🏠🏠🏠🏠	11 SUSTAINABLE CITIES AND COMMUNITIES
	Housing Expenditure	19.00 %	🏠🏠🏠🏠	
👥	Gender Income Equity (ratio of Female : Male)	0.81	👥👥👥👥	8 DECENT WORK AND ECONOMIC GROWTH
	Gini Coefficient	0.51	👥👥👥👥	10 REDUCED INEQUALITIES
	Poverty Rate	3.00 %	👥👥👥👥	1 NO POVERTY
	Voter Participation	46.00 %	👥👥👥👥	11 SUSTAINABLE CITIES AND COMMUNITIES
	Child Care Availability	29.00 %	👥👥👥👥	4 QUALITY EDUCATION

Ensuring gender parity outcomes: While its KPIs in this category are largely positive, it is recommended that Pully considers drafting a comprehensive Local Equality Action Plan as a roadmap for increasing gender parity outcomes in the areas of employment, participation in management mechanisms, education, health, and urban services. The UN Convention on the Elimination of All Forms of Discrimination Against Women and other national plans and international conventions are helpful

sources that can provide guidance in this regard.[19] The city should also conduct gender analysis of its city or municipal departments, commissions and boards.

As motherhood and lack of support in household duties are two of the most universally cited reasons for women either working fewer hours or choosing not to work, improving day-care availability for children will lead to more female labour market participation. Pully reports that 29 per cent of its resident pre-school age children (0–3 years of age) are covered by public and private day-care centres. Childcare availability should be assessed further for improvement, because increasing the number of institutes and facilities available for childcare in the city that are affordable while granting a good learning and safe environment for children will help women with children capitalize on equal opportunities in the labour force, as they would not be limited by the lack of affordable and quality childcare facilities. This latter outcome can also be achieved by adopting other progressive and equality-centred fiscal, wage and social protection policies.

Income distribution in Pully (as measured by the Gini Coefficient) is reported to be 0.51, which is higher than the national levels of 0.30 (2015) that lies close to the median values among OECD countries.[20] The rate of poverty is lower in Pully than the national average of around 7 per cent (2015).[21] Notably, Pully's rate of poverty is also much lower than the poverty rate of 8 per cent (2015) in the greater Lake Geneva region.[22] The national poverty rate is reported to be above average among people over the retirement age of 65 in particular, who find themselves relying on their savings to pay towards the cost of living. Many cantonal and municipal authorities in Switzerland, under pressure to implement spending cuts in the last few years, have been forced to reduce welfare payments or programmes to prevent poverty.

Optimizing social inclusion and democratic participation KPIs: It is recommended that Pully measures and monitors the level of risk of poverty or social exclusion among children, youth and seniors.

Finally, the voter participation rate in Pully is reported to be 46 per cent. As engaging people in decision making improves the quality and the inclusiveness of the decisions – and also helps improve on the existing laws and regulations – efforts should be directed at the municipal level to facilitate a higher participation rate.

Safety and Food Security

Category	KPI	Result	Performance to Benchmark	SDG
	Natural Disaster-Related Deaths (per 100 000 inhabitants)	0.00		CLIMATE ACTION 13
	Disaster-Related Economic Losses (relative to City GDP)	0.00 %		
	Resilience Plans	Yes		SUSTAINABLE CITIES AND COMMUNITIES 11
	Population Living in Disaster Prone Areas	16.00 %		
	Emergency Service Response Time	5 mins		GOOD HEALTH AND WELL-BEING 3
	Fire Service (per 100 000 inhabitants)	383.78 FTE		
	Traffic Fatalities (per 100 000 inhabitants)	1.11		
	Police Service (per 100 000 inhabitants)	284.78 FTE		PEACE, JUSTICE AND STRONG INSTITUTIONS 16
	Violent Crime Rate (per 100 000 inhabitants)	6.67		
	Local Food Production	63 %		ZERO HUNGER 2

Building preparedness and resilience: While Pully reported no natural disaster-related deaths and had no natural disaster-related economic losses, it considers 16 per cent of its inhabitants as living in a zone subject to low-risk natural hazards. Therefore, Pully is investing accordingly in the development (and subsequent implementation) of risk and vulnerability assessments for potential disaster mitigation in

line with the 'Sendai Framework for Disaster Risk Reduction (DRR) 2015–2030'. The Sendai Framework requires the following elements to be implemented:

a) city infrastructures and systems available for resilience;

b) risk and vulnerability assessments;

c) financial (capital and operation) plans to mitigate address the risks and vulnerabilities; and

d) technical systems to implement the plans.

Crime rates in Pully are low, emergency response times are fast and there is adequate law enforcement and emergency personnel coverage.

Recommendation ITU-T Y.4116: 'Requirements of transportation safety services including use cases and service scenarios' and Recommendation ITU-T Y.4119: 'Requirements and capability framework for IoT-based automotive emergency response system' can help make all smart sustainable cities safer and further prepared.

Finally, Pully's food security is relatively sound, as it reports that 63 per cent of all local food is supplied from within 100 kilometres of the municipal area. Further increasing local availability of food will have more positive social, economic and environmental impacts for the city's residents.

Goals and Projects for a Smart and Sustainable Future

Pully's smart sustainable city (SSC) goals are expected to align with national smart sustainability strategies, as well goals of the broader region in which the city resides. Furthermore, the city has taken a comprehensive approach in prioritizing current and upcoming smart sustainability projects, by focusing on technological progress and non-technological facets of sustainability. The four criteria on which Pully is focusing in its specific smart city vision relate to enabling human relationships through optimal leveraging of technology, which includes making municipal processes more efficient and services more practical to avail and use via technology. Other objectives prioritized previously in general municipal strategies or agendas can also play a part in driving Pully's smart sustainability forwards. Two examples of such objectives from the 2011-2016 strategic programme are 'city centre attractiveness' and 'housing policy'. It may be possible to use the United for Smart Sustainable Cities (U4SSC) KPIs for SSC to quantify and measure the progress of some of those previous objectives and report on their fulfilment or conclusion.

A key organization collaborating on the effort locally is Swisscom. In coordination with Ville de Pully, it has conducted the city's data measurement and collection for its U4SSC KPIs for SSC project. Its findings are expected to contribute to the city's smart sustainability framework for the foreseeable future, as well as helping the city's stakeholders set direction for the long term.

As the foregoing analysis of Pully's U4SSC KPIs in this report shows, the city is well positioned to develop structured and measurable smart sustainability strategies by way of planning for the next decades. It performs very well on the majority of indicators that it has reported. In conceptualizing its vision for the foreseeable future, therefore, Pully can employ a two-fold focus:

1. maintain performance levels in the KPIs that meet the corresponding SDG Targets and benchmark well in comparison to regional, national, or comparative global city data; and

2. build a framework of policies that will enact improvements in the KPIs that require potential interventions.

Leveraging as much as is feasible the functional integration made possible through regional partnership will allow the relatively small city of Pully to realize the expected benefits of agglomeration in key areas relevant to the city's smart sustainability progress. Transport, ICT infrastructure, spatial planning, economic development, housing and service delivery – among others – are areas where Pully can utilize the network effects of the agglomeration to foster further continual growth in its smartness and sustainability efforts.

The current smart sustainable city (SSC) projects in Pully span a variety of areas.

Mobility Observatory

A need was identified to mitigate the volume of traffic flowing through Pully's town centre. In 2015, Swisscom worked in partnership with the city and other stakeholders to propose and implement a solution that uses aggregated and anonymized mobile phone data to analyse mobility patterns within the town, seeking to optimize traffic flows and better plan future infrastructure investments. The success of the project was evaluated against previously defined key success criteria, and best practices and lessons learned were documented for future smart sustainability projects.

A second phase to the project is also planned, which will see Swisscom and Pully work together with academia and researchers to develop future simulation models using in situ measurements through sensors, which will lead to accurate traffic forecasts based on customizable inputs, for example, to predict traffic flows and volumes prior to major events. Again, data protection and its further enhancement will be a key consideration, with data remaining anonymized and aggregated in a form that cannot be traced back to individuals.

The Mobility Observatory has proved to be of national and international interest. The City of Pully and Swisscom were invited to present the project and its progress in 2016 at the General Assembly of the European Union for Research and Innovation, in Eindhoven, Netherlands.

VOIP Municipal Telephone Exchange

A project within municipal government has seen Voice Over Internet Protocol telephony, better known as 'VOIP', replace all of the civil service's central analogue phone system. This has facilitated more remote work, as civil employees now have access to their work number and electronic work profiles from anywhere. This could help attract new work talent to the city over the coming years.

Quartiers Solidaires (Solidarity Neighbourhoods)

Two *quartiers solidaires* projects were recently conducted in Pully-Nord and Pully-Sud to improve the quality of life of senior citizens by facilitating their ability to integrate into mainstream society through projects, activities, coffee meet-ups, outings and organized events. In Pully-Nord, a *quartier solidaire* took place between 2012 and 2016 and gave rise to the Mosaïque de Pully-Nord association. The community project is still underway in Pully-Sud.

As part of the projects, help was solicited from senior citizens in these two neighbourhoods to create a social network suited to their needs and expectations during workshops held over several months. The digital platform was developed in collaboration between Pro Senectute and the EPFL+ECAL Lab and is financially supported by the Leenaards Foundation.

Senior citizens first register on the site, after which they can find other members, as well as photographs, information, anecdotes about life in the community, and suggestions for activities in which they can join. This encourages social connections and makes it possible to organize outings and group activities.

Student Mobility

In 2016, a mobility project was undertaken by the City of Pully's Department of Youth, Social Affairs and Public Security. The initiative was meant to improve children's safety by identifying and mapping areas of potential danger on school routes. Another objective was to establish municipal regulations on school transportation for Pully, as required by the Canton.

The project commenced through a commissioned study on student mobility. The data gathered were analysed by geolocating the addresses of students and mapping their travel within municipal territory. The resulting maps are a useful tool for showing the most used critical routes, for enhancing the safety of certain sectors, and for offering parents recommendations for travel based on where they live.

Furthermore, two of the sectors within the study area – Chemin des Vignes in front of the Collège de Mallieu and the streets surrounding the Collège des Alpes – will undergo further analysis and concrete planning by the Department of Works and Industrial Services (DTSI). The city will take advantage of the replacement of the underground pipes on these sections to review traffic around the school complexes and to secure pedestrian access.

Smart School Equipment

A pilot project in operation since 2014 has seen several classes in some Pully school buildings equipped with interactive whiteboards (IWBs), which work with a computer projector and offer new methods and educational opportunities.

When not connected to a computer, these IWBs look like traditional whiteboards. However, once connected to the computer and projector, they turn into touch screens equipped with digital features, including the possibility of writing on their surface with 'virtual' pens. These IWBs allow teachers to save their coursework and any annotations added to the board on a server, to then share online. It is expected that these whiteboards could eventually be extended to all the high schools in the city.

Furthermore, eight school buildings were fully wired and interconnected using fibre optics as part of the project and Wi-Fi coverage was installed. Teachers can now freely access the educational network of the Canton of Vaud, and 'Guest Wi-Fi' has been enabled for any meetings that take place in school buildings.

E-Ticketing for Recreation

Certain municipal recreational facilities, such as swimming pools, are now equipped with a system that allows ticket purchase via text message. This has reduced waiting times at the cash registers on busy days, especially during summer weekends.

A text message can be sent to a central number, after which a link is received with a QR code to scan at the entrance gate. The costs of sending the QR code are fully covered by the civil service, which then refunds the amount of the text messages to the various telephone operators. The amount charged to the resident is the same as that paid at the desk, and is billed directly to the resident's phone bill.

The implementation of this e-ticketing system represents an investment of CHF 23 000 in the City of Pully.

Internal Ticketing

An internal ticketing system has also been set up within civil services departments by the Pully IT Department (BIP), referred to as the 'Service Desk'. The Service Desk allows various civil service employees to report incidents and make requests from IT. It allows for the provision of shared services by tracking queries, requesting assistance, resolving technical incidents and circulating information.

Remote Building Management

A 2014 study undertaken in the city showed that the consumption of certain buildings, especially primary and secondary schools, accounted for 80 per cent of the energy costs of the city's property assets. To address this, Pully has invested in a remote management platform to control its buildings. The system – known as 'Measurement, Control, Regulation' (MCR) – allows the city's caretakers and technical managers to control the heating and ventilation systems of city-owned buildings remotely. When a fault is detected, an e-mail alert is sent automatically via the platform. It is then possible to make a remote adjustment to correct the problem or to request the intervention of a specialist.

Since abnormalities are detected quickly, energy losses are limited, which has allowed Pully to reduce its energy costs. The city has also begun gradually to replace boilers in the buildings it owns in order to further improve performance in this area.

Managing water networks with open source software and Intermunicipal Collaboration

To improve the management of its drinking water network, Pully and several towns and municipalities have pooled their resources to develop a visualization and exploitation tool based on open source software development. It supports Pully, Lausanne Morges and SIGE (Vevey and Montreux) for the distribution of drinking water This drinking water module was put into production in Pully in 2016.

Collaboration then continued between the partners for development of a separate wastewater management module in partnership with new actors in Switzerland (QGEP group). The waste water module was put into production in Pully in 2019.

Pully and its partners are now piloting a new phase (2020-21) to ensure the software's sustainability and smooth operation.

Virtual Services for Citizens

Many administrative services are now available on the pully.ch website, which gives citizens the opportunity to perform their administrative tasks online. The Pully digital portal already includes certain services: e-excavation permits; an e-boutique selling wine and wood; a library catalogue with management of online loans and e-book lending; Octagone (theatre) ticketing with seat reservation; and ticket sales for the Pully Museum, with more to come in the near future.

Conclusion

This has been the first phase (2017-2019) of Pully's collaboration with ITU on this project that is designed, in part, to continue the evaluation of the feasibility of the U4SSC KPIs for SSC. The following conclusions have been derived based on Pully's experience in its U4SSC smart sustainable journey:

- As a part of the U4SSC KPIs refinement process, ITU undertook a two-part approach to the indicators by preparing a basic set of core indicators that can be reported easily by most cities, along with a list of advanced indicators. These advanced indicators can be reported by cities that have attained good scores on the basic indicators. Pully successfully reported 98 per cent of all core U4SSC indicators and 94 per cent of all advanced indicators.

- It is expected that the key findings from Pully's experience will also help to improve the existing definitions of the U4SSC KPIs, in order to enable a smoother data-collection process again for Pully and, potentially, for other Swiss cities in the future.

- Pully should build on its first year of reporting the U4SSC KPIs by instituting the necessary mechanisms and further developing the capabilities it needs to quantify, measure, collect and report data relevant to the remaining KPIs (that were not reported in its first year). Doing so will also allow for year-over-year progress benchmarking and analytics.

- In particular, it is recommended that Pully focus on improving its performance in areas related to:

  o open data

  o e-governance

  o public sector e-procurement

  o water loss

  o smart water meters

  o drainage system ICT monitoring

  o smart electricity meters

  o electricity supply ICT monitoring

  o demand response penetration

  o electricity system outage time

  o private vehicle (vs public transport) usage

  o pedestrian zones

  o small particulate matter ($PM_{2.5}$)

  o noise exposure

  o water consumption

  o recycling rates

  o renewable energy consumption

- electricity consumption

- maternal mortality rate

- gender income inequity

- electronic health records

- voter participation

- childcare availability

- Pully should collaborate with other European cities on its SSC efforts, in order to leverage any best practices and their shared experience with developing and instituting smart sustainable policies and initiatives in the region. Regular knowledge-sharing and discussions with ITU members and other international cities are also encouraged.

- Pully and its fellow aspiring smart sustainable cities should implement the recommendations and best practices mentioned in this Factsheet to improve the applicability of the KPIs across their cities and regions, and accelerate the achievement of their SSC goals in line with international instruments (such as the Paris Agreement, Connect 2030 Agenda, the UN Sustainable Development Goals and the New Urban Agenda).

- The vital knowledge gained through Pully's experience in implementing the U4SSC KPIs will continue to be a part of ongoing efforts to make not only the U4SSC KPIs, but also U4SSC's upcoming Smart Sustainable Cities Index the most effective methods for measuring progress and providing guidance to cities around the world on their journey to becoming smarter and more sustainable.

- Pully's reported KPIs will also feed into ITU's new maturity model. Recommendation ITU-T Y.4904: 'Smart Sustainable City Maturity Model (SSC-MM)' is an additional tool to not only set and measure performance levels of each KPI by Pully and other cities, but to also measure the progress of other key dimensions for the development of a SSC including strategy, ICT infrastructure, data, services and applications and assessments, as further detailed in the box below.

Box 1: Smart Sustainable City Maturity Model

The Smart Sustainable City Maturity Model (SSC-MM) defines five levels of maturity in the process of becoming a smart and sustainable city with each level achieved being a higher level of maturity. The requirement to reach the intended maturity level is to achieve the target KPI values set for each maturity level.

As an example, for KPI Household Internet Access, a level 1 maturity level could be to collect the initial benchmark data. The further four levels could then be set as performance levels such as level 2 achieved at 30 % access, level 3 at 50 % access, level 4 at 70 % access and level 5 at 90 % access.

This can then be overlaid with maturity level performance for the other dimensions to provide insight into the issues that need to be addressed within each city to become smarter and more sustainable.

Pully and other cities are encouraged to use Recommendation ITU-T Y.4904 as a framework to determine their interim target values for KPIs by taking into consideration their priorities, constraints, resources and optimal KPI performance levels. The SSC-MM is another tool that can be used to communicate progress to stakeholders, help to develop and then execute a SSC strategy and encourage the effective use of ICTs.

More information on the SDGs, the U4SSC initiative and the U4SSC Smart Sustainable Cities Index can be found in the Appendix.

At this time, ITU would like to invite cities around the world to implement the U4SSC KPIs for SSC. Using the U4SSC KPI definitions and data-collection methodologies, all cities will be able to better establish clear data-collection methodologies, collect data consistently in a structured way, develop goals and targets for each KPI and collect data regularly to track their progress towards smart sustainable goals.

United for Smart Sustainable Cities (U4SSC)

United for Smart Sustainable Cities (U4SSC) is a UN initiative coordinated by ITU, UNECE and UN-Habitat, and supported by CBD, ECLAC, FAO, UNDP, UNECA, UNOPS, UNESCO, UN Environment, UNEP-FI, UNFCCC, UNIDO, UNU-EGOV, UN-Women and WMO to achieve Sustainable Development Goal 11: 'Make cities and human settlements inclusive, safe, resilient and sustainable'.

U4SSC advocates public policy to encourage the use of digital technologies toward facilitating and easing the transition to smart sustainable cities (SSC) by catapulting key successful smart city measures into the spotlight for consideration.

It currently works on 11 thematic groups:

- Guidelines on tools and mechanisms to finance SSC projects
- Economic and financial recovery in cities and urban resilience building in the time of COVID-19
- Guiding principles for AI in cities
- Blockchain 4 cities
- Impact of frontier technologies in cities
- Simple ways to be smart
- Practitioner guide to measure smart cities and communities (SC&C)
- Practitioner guide to monitor SC&C
- Procurement guidelines for SSC
- City platforms
- United for Smart Sustainable Cities Index

To find out more on the U4SSC initiative, visit: itu.int/go/u4ssc.

U4SSC Implementation Programme (U4SSC-IP)

The U4SSC Implementation Programme (U4SSC-IP) supports the implementation of projects and builds partnerships for smarter and more sustainable cities worldwide.

To find out more on the U4SSC Implementation Programme, visit: https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx.

U4SSC Smart Sustainable City Index

The U4SSC indicators for SSC will form the basis for the U4SSC Smart Sustainable City Index. The Index will utilize the reported indicator values, along with supporting data profiling each city, to provide a comparative ranking amongst a selection of cities.

U4SSC in the International Context

The United Nations Sustainable Development Goals (SDGs)

'A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects.'

(ITU and UNECE, 2015)

The Sustainable Development Goals (SDGs) are a collection of 17 global goals set by the United Nations (UN) in 2015 as an urgent call for action by all countries – developed and developing – in a global partnership. They recognize that ending poverty and other deprivations must go together with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

The goals are broad and somewhat interdependent, yet each has a separate list of targets to achieve. The SDGs cover social and economic development issues that include: poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, economic growth, innovation, sustainability, responsible consumption, environment, social justice and partnerships. There are 169 targets for the 17 goals; achievement of all targets signals the accomplishment of all 17 goals. Twenty of the targets are quantitative in nature, while the majority are more qualitative.

The SDGs were presented as part of the 'Transforming our World: 2030 Agenda for Sustainable Development'. The 2030 Agenda was developed to succeed the Millennium Development Goals (MDGs), which ended in 2015. Unlike the MDGs, the SDGs framework does not distinguish between 'developed' and 'developing' nations; instead, the goals are meant to apply to all countries.

Localization, i.e. implementation of the SDGs started worldwide in 2016. To further the progress of this localization, the SDGs are being promoted globally through several initiatives and advocacy platforms that are coordinated and supported by various UN programmes and agencies, including U4SSC in cities.

Meeting the SDGs is important for any city – particularly aspiring smart sustainable cities – because the SDGs framework is designed to help cities recognize priorities and establish long-term goals. The SDGs are designed to reveal the interdependent dynamics within various facets of sustainable development such as economic, social, and environmental conditions. The goals are meant to show, for example, how continued reliance on fossil fuels affects not only climate change and air quality but also public health, which then impacts poverty rates and economic opportunities. By working within the SDGs framework, policymakers can get to the root of their cities' issues.[23]

Also, the analytical framework of the SDGs lends itself to the use of clear baselines to improve internal planning and implementation. Other benefits include gap analysis, infusing priorities into a budget process, cutting programming redundancies and saving resources, and tracking outcomes. Cities can also engage across the global network of other governments and institutions that are pursuing the

same goals. The SDGs framework is also effective at different scales, offering the opportunity to align and harmonize policies and common goals vertically (up and down government jurisdictions), as well as horizontally (across city agencies). Therefore, if integrated and managed well, the SDGs can help strengthen local communities through values such as transparency, inclusion, and engagement.[24]

New Urban Agenda[25]

The New Urban Agenda represents a shared vision for a better and more sustainable future. It was adopted at the UN Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador, on 20 October 2016. Habitat III had the convening power to bring together all actors to identify solutions for the complex challenge of urbanization, including Member States, multilateral organizations, local governments, private sector and civil society. It helped to systematize the alignment between cities and towns and national planning objectives in their role as drivers of national economic and social development.

Urbanization is an unprecedented challenge, indeed. By the middle of the 21st century, four of every five people might be living in towns and cities. Urbanization and development are inextricably linked, and it will always be necessary to find a way to ensure the sustainability of growth.

The New Urban Agenda is premised on the basis that if well-planned and well-managed, urbanization can be a powerful tool for sustainable development and poverty reduction, for developing and developed countries. Governments can respond to this key development opportunity by promoting a new model of urban development that is able to integrate all facets of sustainable development to promote equity, welfare and shared prosperity. The model would focus on all levels of human settlements, including small rural communities, villages, market towns, intermediate cities and metropolises for social and economic growth.

Endnotes

1   International Telecommunication Union. 'KPIs for Smart Sustainable Cities.' www.itu.int/en/ITU-T/ssc/Pages/KPIs-on-SSC.aspx.

2   International Telecommunication Union (ITU). 'Collection Methodology for Key Performance Indicators for Smart Sustainable Cities'. 2017, https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Collection-Methodology/files/downloads/421318-CollectionMethodologyforKPIfoSSC-2017.pdf.

3   Ville de Pully, et al. 'Pully under the Microscope: Measuring the Level of Digitalization and Sustainable Development against the International Telecommunication Union's ITU-T International Standards'. 2019, www.itu.int/en/ITU-T/ssc/united/Documents/pully-under-the-microscope-u4ssc-E.pdf.

4   Benchmark performance is represented by four ranges (1) 0 – 33% of target, (2) 33 – 66% of target, (3) 66 – 95% of target and (4) 95+% of target. The number of coloured circles indicate where the city's data fits into those benchmarks.

5   The Local. 'Unemployment: Swiss Jobless Rate Lowest in a Decade.' The Local, 8 Jan. 2019, www.thelocal.ch/20190108/unemployment-swiss-jobless-rate-lowest-in-a-decade.

6   Organisation for Economic Co-Operation and Development (OECD). 'Unemployment- Youth Unemployment Rate.' OECD Data, 2018, https://data.oecd.org/unemp/youth-unemployment-rate.htm#indicator-chart.

7   Le News. 'How Switzerland Leads Europe on Youth Employment.' Le News, 14 Oct. 2015, www.lenews.ch/2015/10/14/how-switzerland-leads-europe-on-youth-employment/.

8   Unifor National. 'Switzerland: Youth Unemployment Strategy.' Unifor National, 22 June 2016, www.unifor.org/en/whats-new/briefs-statements/switzerland-youth-unemployment-strategy.

9   Nguyen, Duc-Quang. 'Young and Jobless? The Solution Isn't Always University.' SWI Swissinfo.ch, Swiss Broadcasting Corporation, 25 Aug. 2014, www.swissinfo.ch/eng/business/by-the-numbers_young-and-jobless--the-solution-isn-t-always-university/40518378.

10   World Health Organization (WHO). 'Ambient air pollution: Health impacts'. https://www.who.int/airpollution/ambient/health-impacts/en/.

11   Gnehm, Felix. 'The Swiss Water Footprint Report: A Global Picture of Swiss Water Dependence.' Water Footprint Network, WWF Switzerland; Swiss Agency for Development and Cooperation (SDC), 2012, www.waterfootprint.org/media/downloads/WWF-SDC-2012-SwissWaterFootprint.pdf.

12   Swiss Academy of Sciences (SCNAT). 'Water Exploitation, Water Use, Water Consumption.' https://naturalsciences.ch/topics/water/water_exploitation.

13   Organisation for Economic Co-Operation and Development (OECD). 'Energy- Renewable Energy.' OECD Data, 2018, https://data.oecd.org/energy/renewable-energy.htm.

14   Business Office Digital Switzerland (GDS). 'Digital Switzerland.' Federal Office of Communications (OFCOM), www.bakom.admin.ch/bakom/en/homepage/digital-switzerland-and-internet/strategie-digitale-schweiz.html.

15   Schweizer Medieninstitut für Bildung und Kultur Genossenschaft. 'Digitization and Education.' 5 Aug. 2019, www.educa.ch/en/digitization-and-education?_sm_au_=iVVfFHnHrGLsTnkF.

16   Ochsenbein, Gaby. 'Switzerland Puts Spotlight on Illiteracy.' 7 Sept. 2017, www.swissinfo.ch/eng/international-literacy-day_switzerland-puts-spotlight-on-illiteracy/43501694.

[17]   Swissinfo.ch. 'Half of Swiss to Have Higher Education Degrees by 2037.' 6 Feb. 2019, www.swissinfo.ch/eng/education-trend_half-of-swiss-to-have-higher-education-degrees-by-2037/44723132.

[18]   Google Public Data. 'Life Expectancy.' The World Bank Group, www.google.com/publicdata/explore?ds=d5bncppjof8f9_&met_y=sp_dyn_le00_in&idim=country%3ACHE%3ASWE%3ANOR&hl=en&dl=en.

[19]   Cahill, Felicity, and Elizabeth Ryan. 'Focus Area: Women and Cities.' Global Compact – Cities Programme, United Nations Global Compact (UNGC), 2019.

[20]   Organisation for Economic Co-Operation and Development (OECD). 'Inequality- Income Inequality.' OECD Data, 2018, https://data.oecd.org/inequality/income-inequality.htm#indicator-chart.

[21]   Swiss Broadcasting Corporation. 'Poverty up to 7% among Swiss Residents.' SWI Swissinfo.ch, 15 May 2017, www.swissinfo.ch/eng/the-hidden-poor_poverty-up-to-7-among-swiss-residents/43182490.

[22]   Le News. 'Poverty in Switzerland Has More to Do with Age than Any Other Factor.' Le News, 17 May 2017, www.lenews.ch/2017/05/17/poverty-in-switzerland-has-more-to-do-with-age-than-any-other-factor/.

[23]   Mesa, Nilda, et al. 'A Pathway to Sustainable American Cities: A Guide to Implementing the SDGs.' Sustainable Development Solutions Network, https://irp-cdn.multiscreensite.com/be6d1d56/files/uploaded/190123-2019-us-cities-guide-INT.pdf.

[24]   Mesa, Nilda, et al. 'A Pathway to Sustainable American Cities: A Guide to Implementing the SDGs.' Sustainable Development Solutions Network, https://irp-cdn.multiscreensite.com/be6d1d56/files/uploaded/190123-2019-us-cities-guide-INT.pdf.

[25]   http://habitat3.org/the-new-urban-agenda/.

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