URBAN LEDS
URBAN LOW EMISSION DEVELOPMENT STRATEGIES

solutionsgateway
Low Carbon Solutions for Urban Development Challenges

Solutions Gateway Sourcebook

Low Carbon Solutions for Urban Development Challenges

Easy-to-use guidance for local governments

www.solutions-gateway.org

ICLEI Local Governments for Sustainability

UN HABITAT FOR A BETTER URBAN FUTURE

Acknowledgements

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We also warmly thank the Solutions Gateway's pioneer users – staff from the Urban-LEDS project cities – along with many local governments whose case studies continue to inspire other cities around the globe.

Last but not least, we express our gratitude to the Solutions Gateway Supporters. Your cooperation and valuable partnerships continue to enrich the Solutions Gateway!

Author: Ana Marques (ICLEI World Secretariat)
Reviewers: Lucy Price, Maryke van Staden (ICLEI World Secretariat)
Design and layout: Simon Broich

Urban-LEDS project implementing partners:

ICLEI – Local Governments for Sustainability (ICLEI): ICLEI, established in 1990, is the world's leading network of over 1,000 cities, towns and metropolises in 86 countries, committed to building a sustainable future. By helping its Members to make their cities and towns sustainable, low carbon, resilient, biodiverse, ecomobile, resource-efficient, healthy and happy, with a green economy and smart infrastructure, ICLEI impacts over 20% of the global urban population.
ICLEI World Secretariat, Kaiser-Friedrich Str. 7, 53113 Bonn, Germany
urban-leds@iclei.org / Twitter: @Urban_LEDS

United Nations Human Settlements Programme (UN-Habitat): UN-Habitat is the United Nations' agency for sustainable urban development. Through its World Urban Campaign, normative activities and technical support, it promotes the development of more compact, better integrated and connected cities that foster equitable, sustainable and low-emissions urban development, and that are resilient to climate change.
UN-Habitat, P.O. Box 30030, GPO, Nairobi, 00100, Kenya
urban-leds@unhabitat.org

Funded by:

The Urban-LEDS project is funded by the **European Union**. In 2011 the European Union (EU) outlined its Agenda for Change, guiding its development and cooperation activities. This supports actions that address poverty reduction and good governance, as well as inclusive and sustainable growth. All these issues are directly related to tackling climate change and transitioning towards sustainable energy.

Contents

Foreword

Maryke van Staden
Manager of ICLEI's
Low Carbon City Agenda
and ICLEI's international
coordinator of the
Urban-LEDS project

The local government plays a crucial role in defining and harnessing the benefits of urban low emission resilient development pathways for its community. However, this is also the level of government which has to deal with severe capacity constraints, both staff and financial, and faces conflicting priorities on a daily basis. This implies the need to optimize time and staff capacity wisely. The Solutions Gateway supports this view, to guide, showcase examples of good practice, with a focus on proven solutions for low emission and sustainable development.

Opportunities offered through urban low emission development are extensive and diverse. It is important to make the right choices when identifying options for policy, technology and financing. This is why the Solutions Gateway was developed, providing a simple structured approach to sketch recommended generic "solutions" that can be applied locally, in context.

All local governments are encouraged to explore the Solutions Gateway and plan their transition to a low emission pathway, whether their cities are megacities or smaller jurisdictions such as towns or districts. We know that cities in the Global South are expected to grow during the coming decades. Their leadership understand the need to plan ahead to ensure their urban infrastructure is resilient, adequate and minimizes its impact of climate change. Yet, this is an approach every local government can take.

This sourcebook provides a snapshot overview of the guidance, for those readers who do not have access to the internet or who wish to take time to ponder the guidance offered.

We invite you to explore the Solutions Gateway and experience its multiple benefits firsthand!

1 Introducing the Solutions Gateway

The Solutions Gateway is an online knowledge sharing platform for local governments addressing low emission development. It offers political decision-makers the big picture on relevant "hot" topics, it provides detailed guidance and practice-oriented resources to technical staff, and it is also a platform to showcase local best practice by leading cities and towns. This sourcebook provides a summarized overview of the type of guidance provided in the Solutions Gateway, making it also accessible to offline users.

Guidance is structured to help local governments identify, screen, prioritize, detail, implement and successfully monitor locally-relevant programs and projects that contribute to sustainable urban development and have a low (or no) emission impact.

With this in mind, the Solutions Gateway was developed as a single entry point, to support and expedite the development and implementation of urban low emission development policies, plans, programs and projects. Guidance outlined is based on proven solutions. However, any solution also needs to be tailored to the local context to enhance the delivery of climate change mitigation and other benefits.

The contents of the Solutions Gateway are:

- Based on proven practices and technologies
- Developed by experts and peer-reviewed
- Built on partnerships with renowned expert organizations
- Based on an integrated multidisciplinary approach to maximize results
- Focused on enabler and multiplier actions which go beyond technology and finance to also cover policy, governance, capacity-building, stakeholder engagement, etc.

The guidance on Low Emission Development includes:

- Contents aligned to the typical mandates of a local government, as well as its roles and interests
- Free, easy access to knowledge on proven technologies and practices
- Key target sectors, such as waste, water, buildings, energy, transport, and land use
- Cross-sectoral themes such procurement
- Support for peer-learning
- Visibility to leading cities and towns through case studies
- Access to a group of experts from various disciplines
- Practice-oriented resources to support implementation, such as tools, standards and guides
- Decision-making finance map to identify relevant financial models and instruments

The Solutions Gateway was developed under the Urban-LEDS project (www.urban-leds.org), funded by the European Union, and jointly implemented by ICLEI – Local Governments for Sustainability and UN-Habitat. It aims to support local governments in the transition to urban low emission development. The project offers a comprehensive methodological framework - the GreenClimateCities (GCC) program - to integrate low carbon strategies into all sectors of urban planning and development. The Solutions Gateway is a key resource to support the implementation of ICLEI's GCC program.

Initially available to the 37 Urban-LEDS project network cities in Brazil, India, Indonesia, South Africa and Europe, the Solutions Gateway is now freely available for use to all local governments and key stakeholders involved in the low-emission development processes.

The Solutions Gateway as an entry point to Low Emission Development (LED):

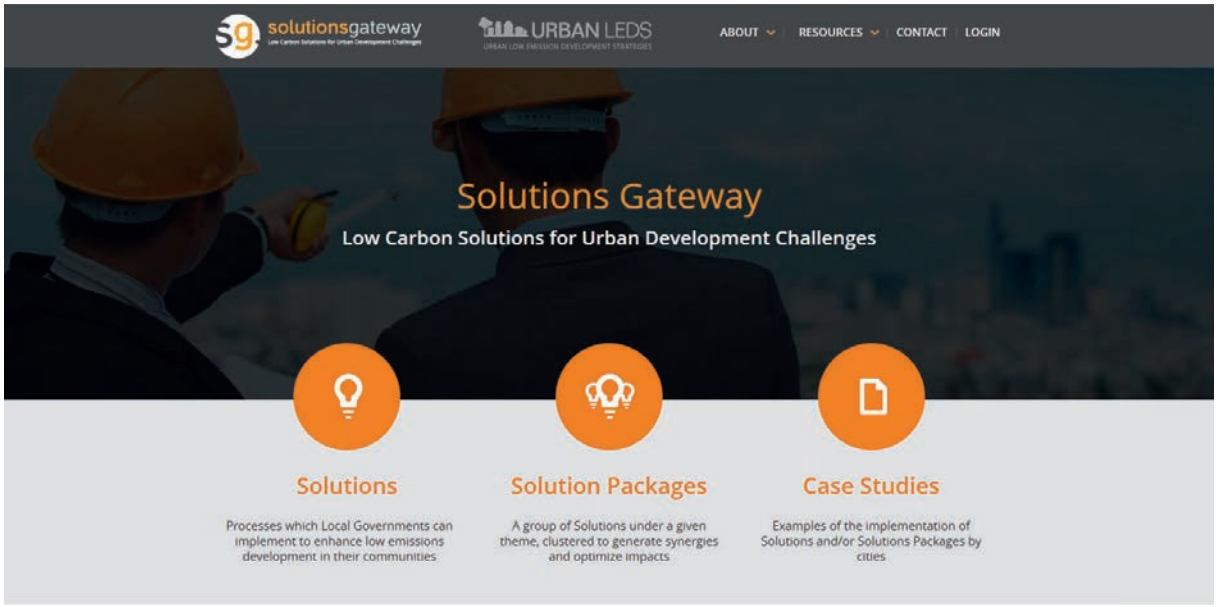


Table 1 – Benefits for users of the Solutions Gateway

Political decision-makers	Technical Experts	Solution author or reviewer

• Get the "big picture" in one place:
  • Short to long-term benefits
  • Drivers
  • Overview of enabler and multiplier actions needed
  • Examples from other cities
  • Advantages of cooperation with other levels of government
• Inspirational case studies
• Access to experts in strategy, governance and finance
• Profile your city's best practices
• Profile your staffs' experience and expertise
	• Get guidance on thematic Solutions which contain:
	  • Reality-check, including information on conditions under with the Solution is applicable, risks and success factors
	  • Step-by-step guidance for implementation
	  • Detailed guidance on enabler, core and multiplier actions
	  • Suggested indicators for performance monitoring
	  • Information on greenhouse gas mitigation potential
	• Selected case studies that demonstrate results
	• Tools and other resources to support implementation
	• Access to experts
	• Finance decision-making support tool to support choice of finance model or instrument
		• Share knowledge and work concepts
		• Connect with local decision-makers and other technical experts
		• Gain visibility as an expert:
		  • Invitations to speak at workshops and events
		  • Explore possibilities for cooperation
		• Support the development of urban Low Emission Development Strategies (LEDS), action plans and projects.

1.1 How the Solutions Gateway may help your city

The Solutions Gateway can help your local government build internal capacity for Low Emission Development for the different stages of policy and project development, including:

*KPIs – suggested Key Performance Indicators

1.2 How to use the Solutions Gateway

Gain full access
To gain full access to the available guidance, resources and interactive functionalities, visit the online platform at www.solutions-gateway.org/login and register for free.

Explore a Solutions Package
A Solutions Package is a group of clustered Solutions under a given theme for maximized synergies and impact.

Deep dive into a Solution
A Solution is a process, which the local government can implement to enhance low emission, sustainable development in its communities. Each Solution offers an integrated multidisciplinary approach, which includes guidance on technology, funding and finance, organizational aspects, policy, regulation, capacity building, stakeholder engagement and awareness-raising. Each action type is covered in detail in the **Enabler**, **Required** and **Multiplier Actions** sections of the Solution.

Read case studies of proven solutions, or provide your own!
Case studies demonstrate concrete results achieved by local governments.

Finance Desicion-making Support Tool
A tool that helps local governments identify possible financing options to implement selected projects.

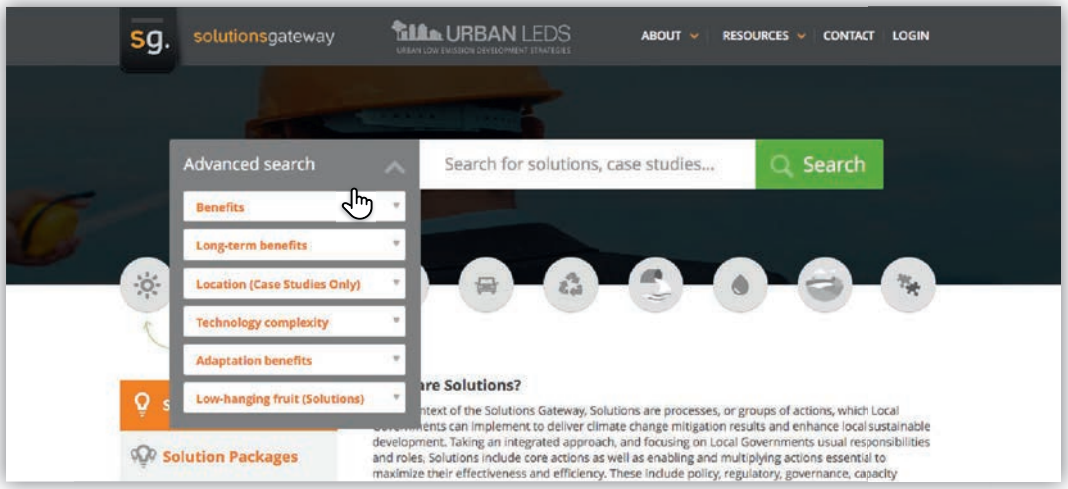
The Pool of Experts
A global multi-disciplinary network of professionals, who can offer expertise in LED to local governments.

Sectors covered

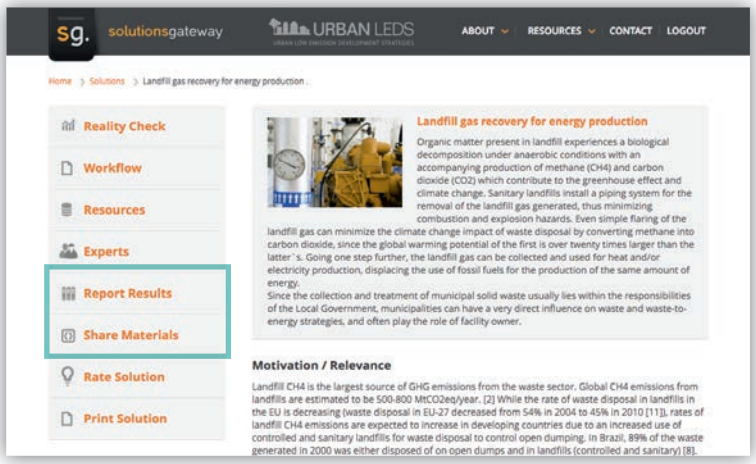
Local government operations | Transport | Waste | Water | Buildings | Energy | Land use | Cross sectorial

To learn more about the Solutions Gateway:
- watch the introduction video in the Solutions Gateway homepage.
- explore the online tutorial: www.solutions-gateway.org/show?page=tutorial
- browse the online Frequently Asked Questions (FAQ): www.solutions-gateway.org/show?page=faq
- use the online glossary: www.solutions-gateway.org/show?page=glossary

Use the search functions to find the contents that interest you the most.

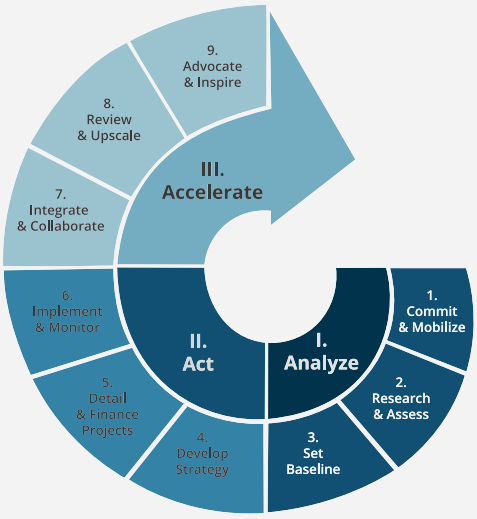


Profile your local best practices and expertise
We warmly invite you to share your city's best practices and to contribute your expertise to benefit others.



Adjusting Solutions to the local context
Each city is unique. Solutions provide guidance on general conditions, which may differ from conditions in your city. To best prioritize and tailor-make a Solution to your particular local context, ICLEI recommends using the GreenClimateCities methodology.

Visit www.iclei.org/gcc and contact ICLEI.

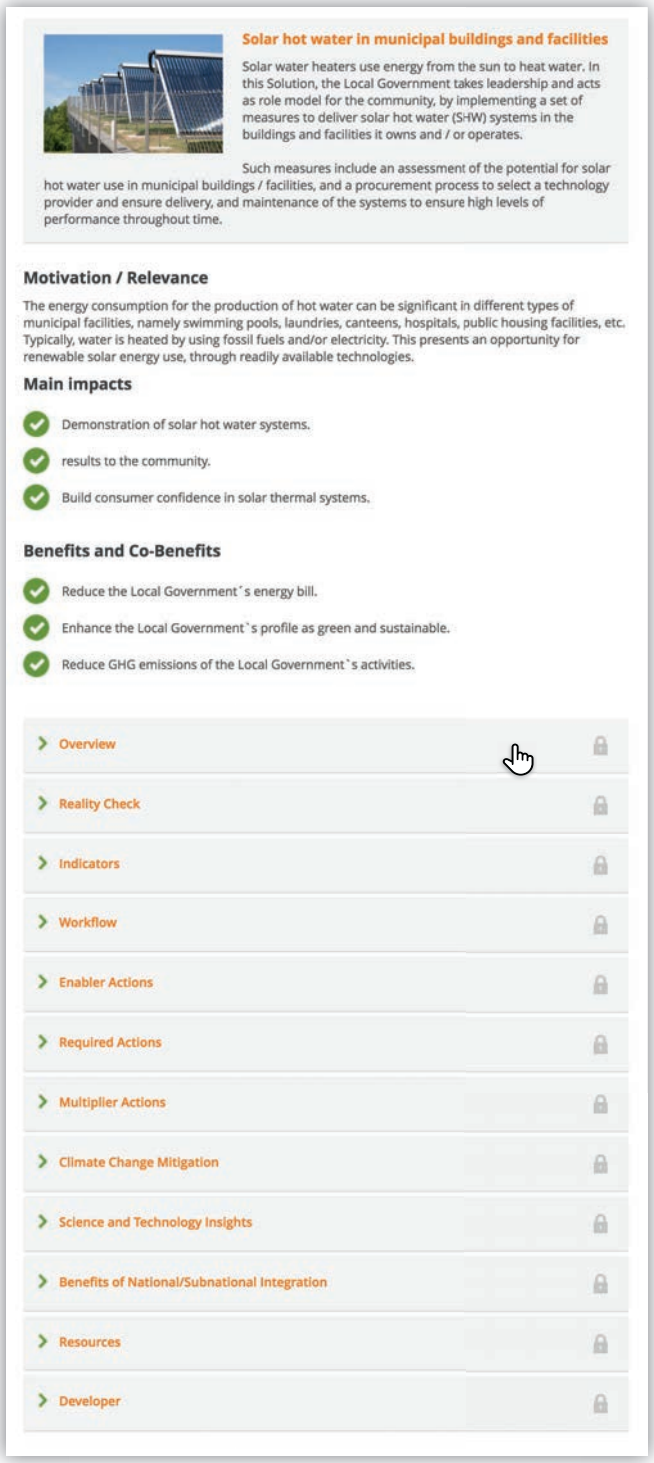


1.3 How to use this guide

The Solutions Gateway Sourcebook summarizes key messages of the Solutions Gateway online **tutorial**. It provides a summarized overview of 16 Solutions and 6 Solution Packages, with a selection from the 80 Case Studies that demonstrate the results of implementation.

Other key resources such as the **Pool of Experts** and the **Finance decision-making support tool** are also presented briefly.

This Sourcebook includes examples of each section to illustrate the wealth of in-depth guidance available in the Solutions Gateway online platform.



An "**exclusive sneak-peek**" is shared on the structure of each Solution. To access the details, please login.

2 Solutions and Solutions Packages

TRANSPORT

2.1 Solutions Package: Sustainable Urban Transport

Transport poses a major challenge to cities worldwide, particularly to those experiencing rapid population growth and growing motorization rates. Overall demand for transportation (for both passengers and freight) is predicted to double between 2005 and 2050. While transport systems are absolutely necessary to the economy and to give citizens access to jobs, goods, and services such as health and education, they also generate significant negative impacts. These include road traffic and congestion, air pollution and noise, increased health risks and traffic accidents, decrease in the cities' GDP, high consumption of fossil fuels, diminished access, as well as biodiversity loss particularly due to loss and fragmentation of habitat and high greenhouse gas emissions.

Many cities worldwide have control or significant influence over urban planning, public transportation systems and roads. The Sustainable Urban Transport Solutions Package is comprised of key complementary Solutions which a local government can implement to increase the sustainability of urban transport within its territory. These Solutions can be implemented in tandem to generate synergies, maximize the benefits and have higher success in discouraging the use of personal automobiles.

Solutions included in the Sustainable Urban Transport Package

Transit Oriented Development (TOD)

Urban transport performance measurement

Public transport development

Parking management

Non-motorized transport

Urban freight transport

Main benefits and long term impacts:

- Sustainable mobility
- Green economy
- Socially vibrant communities
- Enhanced environmental quality

The Solutions highlighted in orange will be briefly described below.
To learn more visit Sustainable Urban Transport Solutions Package online: www.solutions-gateway.org/package?code=6

Case study: Copenhagen, Denmark

The Nørrebrogade Project: revitalizing a major road corridor for enhanced public transport and urban life

Approach:
Less than a decade ago, major transportation routes such as the Nørrebrogade road were heavily congested with traffic from private vehicles. An innovative multi-stage process was designed to test and examine public acceptance of a series of traffic calming measures. Public acceptance of the initial pilot experiments (poll, 2008) enabled the local government to push forward with the implementation of Stage 2 of the project.

Results:

- Bus travel time decreased by an average of 10% and bus punctuality improved.
- Increase in public transportation ridership and cycling.
- Reduction of private automobile use by 45% and ambient noise by 50% in the area.
- Increase in businesses, employment and commercial revenue between 2005 and 2010.
- Public acceptance

Source: ICLEI Case Stories: Urban-LEDS Series – No. 01, April 2015, Copenhagen
www.urbanleds.iclei.org/fileadmin/user_upload/Resources/UrbanLEDS_case_story_Copenhagen_2015_Web.pdf

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Case study: Seoul, South Korea

Reviving the soul in Seoul: Seoul's experience in demolishing road infrastructure and improving public transport and urban life

Approach:
A river that crosses Seoul was covered by a road and an elevated expressway since 1978. The demolition of the expressway and restoration of the river was concluded in 2005, in parallel with the improvement of public transport.

Results:

- Down-town traffic: −2.3%
- Public transport ridership: subway +4.3%; bus +1.4%
- Subsidies for public transport (2003 to 2009): −421 million USD
- Surrounding temperature (heat island effect): −3.6°C.

Source: In www.sutp.org

2.1.1 Solution: Transit Oriented Development (TOD)

Transit Oriented Development (TOD) is urban development that relies on public transport, while maintaining a closely knitted urban fabric through high-density, mixed land use and human-scale design, within walking distance from transit stations. Key features of TOD include: high-quality public spaces which are sensitive to community needs; variety of housing types and prices, frequent reliable, fast and comfortable transit; and measures discouraging the use of private cars, including walkable and cycling-friendly environment, parking management, traffic calming measures promoted through street design and others. TOD is a key strategy for integrating land use and transportation planning and enabling sustainable urban mobility.

While this Solution has urban planning at its core, TOD cannot function without well operating mass transit systems, among other aspects. In TOD, the local government plays a key role in planning, coordination, stakeholder engagement and partnerships, public investment in urban infrastructure, and operation of mass rapid transit, among others. In the implementation of this Solution, local governments need to be well familiar with the existing national and regional spatial and transport planning governance frameworks.

Exclusive sneak-peek: "overview"

This section gives an overview of the main actions which constitute this Solution, including required, enabler, and multiplying actions, aligned with Local Government's roles and mandates.

Enabler actions	Required actions	Multiplier actions
• Ensure a unified transport authority for public transport • Create an overarching long-term strategy • Build awareness and support for TOD among municipal officials and key stakeholders • Manage multi-stakeholder processes to facilitate TOD preparation and implementation • Remove regulatory and other barriers to TOD	• Critically review strategic spatial and transportation planning • Evaluate transport needs and TOD opportunities • Conduct a comprehensive site and context analysis to identify areas appropriate for TOD • Revise zoning rules to facilitate mixed land-use and increased density • Create a working group with all departments involved in urban planning and transit • Design the transport and urban plans in parallel • Ensure participatory planning • Evaluate TOD infrastructure needs and elaborate projects for delivery • Establish partnerships for financing and delivery • Attract new businesses and residents to the TOD district • Coordinate the implementation of the TOD program with transport and other infrastructure projects • Ensure high-quality transit service	• Plan for TOD at the system-wide scale • Develop TOD guidelines to support its wider use • Include TOD principles and standards in future urban plans and regulations • Promote walking and cycling • Create a transport system that is attractive and affordable • Implement parking management techniques • Implement transportation demand management programs • Develop a TOD strategy for the city

Main benefits and long term impacts of this Solution:

- Smart and resource efficient investments in urban infrastructure
- Efficiency and productivity gains from improved integration of transportation, land use, development and urban infrastructure systems
- Stimulation of local economic development and creation of value for public and private land and property owners
- Contribution to economic viability of mass transit systems with higher occupancy rates
- Greater affordability due to decreased transportation costs
- Social inclusion associated with better access to housing, services, jobs, education, etc.
- Reduced socio-economic losses associated with traffic congestion
- Relief of traffic and congestion pressures on the city center
- Reduced fossil fuel consumption
- Better air quality and reduced greenhouse gas emissions
- More efficient use of the urban built environment, along with conservation of green field lands and ecological communities
- Increased sense of community, as a product of compact, mixed-use zoning and targeted density
- Creation of more livable and walkable communities.

To learn more visit Transit Oriented Development Solution online: www.solutions-gateway.org/solution?code=14

Case study: Portland, USA

Portland transit development

Approach:

Portland, Oregon, provides a learning case of multiple strategies and achievements towards sustainable urbanization and transport, and fighting against urban-sprawl. Early initiatives starting as early as the the Great Depression provided a framework that for several decades enabled urban development centered on public transport through transit oriented development (TOD), inspired by the concept of making "cities for people not cars". Protecting the dense, human-scale and lively urban center and instituting both regional planning and governance for land use and transport have been crucial to the achievements. A range of supporting measures from local, regional, state and national levels have also contributed.

Results:

- In comparison with average US city dweller:
  - Portland's residents are 2× as likely to use public transport,
  - travel 20% less distance per day,
  - and are 7× more likely to bicycle to work.
  - Public transport use increased much more than car travel from 1996 to 2006, population +27%, public transport use +46%, car-travel +19%.
  - Household budget for transportation: 75% of national average.

Source: In www.wwf.panda.org

2.1.2 Solution: Urban transport performance measurement

Often local governments invest huge amounts in providing urban transport infrastructure to combat the effects of rapid motorisation and to ensure citizens have access to work, markets and services. Typically feasibility studies focus only on the specific project and seldom report on the overall transport system performance, lacking an integrated and strategic approach. A tool to measure the existing transport performance is essential for local governments to identify gaps and priority areas for investment - a pre-condition to design projects that effectively address these gaps.

This Solution provides a process for local governments to Measure, Monitor, and Verify the performance of the urban transport systems in their territory, including walking, cycling, public transport, and personal vehicles (excluding freight), and to establish a path for continuous improvement. It is based on the Ecomobility Shift methodology. The performance characterization and evaluation is based on a set of 20 indicators classified into three broad categories: Enablers, Transport systems and services, as well as Results and impacts.

Main benefits and long term impacts of this Solution:

- Enable policy-makers to identify mobility gaps and the areas requiring intervention
- Reduction in transport infrastructure expenses (construction, operation and maintenance)
- Enhanced sustainable mobility modes (walking, non-motorized and public transport)
- Increased use of public transport
- A short-term action plan which can be used to create momentum for long-term strategic action

Exclusive sneak-peek: "workflow"

This section gives a brief "step-by-step" description of the main process which the local government undertakes for the implementation of the Solution. Process phases vary from Solution to Solution.

Step 1: **Preparation**	✓ Form a working group by bringing together relevant departments overseeing urban transport operations and planning. ✓ Conduct a workshop on the EcoMobility SHIFT Assessment. ✓ Prepare for the assessment: appoint an advisor (in-house expert or a consultant).
Step 2: **Assessment**	✓ Measure the city's transport performance against a set of indicators. ✓ Upon completion of the assessment a score is obtained. ✓ The areas for further improvement are identified depending on the score obtained per indicator.
Step 3: **External audit (optional)**	✓ Get the score audited by an external auditor for increased transparency and credibility.
Step 4: **Labelling (optional)**	✓ Benchmark performance against other cities that have performed a similar assessment and audit. ✓ A bronze, silver or a gold label is awarded depending on the score attained by the city in the audit.
Step 5: **Follow-up measures**	✓ Policy review based on the assessment results. ✓ Short-term action plan is submitted to the City Council. Its nature will be very context specific, taking into account the results of the audit, the gaps identified, the local resources, priorities, stakeholder engagement, etc. ...

To learn more visit Urban Transport Performance Measurement Solution online: www.solutions-gateway.org/solution?code=4

Case study: Lund, Sweden

EcoMobility Shift in the City of Lund, Sweden

Approach:

The city has worked for many years towards sustainable mobility in a well-planned, conscientious way that is continually being developed and improved. Lund developed its first sustainable urban mobility in 1998. This strategy document has been the cornerstone of transport policy in Lund for the past 15 years. Since then it have been revised twice, and is now a working strategy aiming at 2030. In this context, the Lund applied the Ecomobility Shift assessment methodology to measure the city's transport performance and thus inform the strategy development process.

Results:

- Modal share: 30% bicycle, personal automobiles <30%
- Lund was the only city to receive a Gold Label for its urban transport performance through the Ecomobility Shift project.

Source: In www.ecomobility-shift.org

2.2 Solutions Package: Sustainable waste management

Local governments worldwide are typically responsible for residential solid waste collection within their territory. However, solid waste management is a great challenge from an organizational, technical, and financial perspective, and municipalities are often overburdened by the task. Cities are facing increasing quantities and variety of waste, including hazardous wastes, due to population growth, industrialization, and economic growth.

This Solutions Package focuses on the processes local governments can undertake to promote sustainable waste management in their communities through a long-term approach called Integrated Solid Waste Management (ISWM). ISWM has great potential to enhance economic, ecological and social progress in cities, by maximizing resource conservation and resource efficiency, generating employment and contributing to a green economy. It also offers the possibility to reduce operational costs of waste management. A specific Solution is dedicated to the overall ISWM process, giving an overarching perspective in its different dimensions, including technical, political, institutional, social, economic, and financial. The remaining Solutions zoom in on a particular component of the ISWM process. These should be implemented in tandem with the ISWM Solution, and should take into account the local context.

Solutions included in the Sustainable waste management Package

Integrated Solid Waste Management (ISWM)

Waste prevention / reduction at source

Recycling / material recovery

Centralized composting / organic recovery

Integration of the informal waste sector

Optimizing solid waste collection

Main benefits and long term impacts:

- Improvement of waste management in the city
- Improvement of urban hygiene and quality of life of the population
- Protection of the environment and of freshwater sources
- Improve the image of the city and the local government
- Contribute to a green economy by:
  - efficient use and conservation of natural resources,
  - reduced production costs of products and goods through use of locally recovered materials
  - employment opportunities
- Contribute to climate change mitigation

The Solutions highlighted in orange will be briefly described below.
To learn more visit Sustainable Urban Transport Solutions Package online: www.solutions-gateway.org/package?code=5

2.2.1 Solution: Integrated Solid Waste Management

ISWM is a process which can be implemented for the delivery of technically and financially viable, sustainable waste management concepts in communities. It follows a waste management hierarchy aimed to reduce the amount of waste and thus reducing the cost of collection, handling, treatment and disposal, while maximizing resource conservation and resource efficiency. The hierarchy starts on waste prevention (reduce), moving to resource and energy recovery (recycle and re-use). Another fundamental aspect of ISWM is that waste management is not considered a purely technical issue but also addressing political, institutional, social and economic factors. ISWM requires long-term planning, seeks integration at different geographical scales, explores integration of waste management with neighboring communities, and promotes stakeholder engagement.

Without disregarding the importance of national and regional legal and institutional frameworks, this Solution focuses on the processes a local government can undertake to promote sustainable waste management in its communities through ISWM.

Main benefits and long term impacts of this Solution include:

- Increase service levels to the population on waste collection, transport, treatment and disposal
- More effective and efficient waste management operations and services
- Maximize percentage of MSW collected, treated and disposed of in a hygienic and environmentally sound way, improving urban hygiene and quality of life of the population
- Maximize percentage of Municipal Solid Waste (MSW) reused as raw materials or as energy source, contributing to efficient use and conservation of natural resources
- Protection of the environment and of freshwater sources
- Job creation and employment opportunities, including for low-skilled workers
- Contribution to a green economy, also through poverty alleviation
- Improve the image of the city and the local government
- Facilitate orderly urban development and reduce land area necessary for waste disposal
- Minimize risk of flooding due to obstruction of rainwater drainage by waste
- Climate change mitigation by minimizing GHG emissions from waste disposal and through the replacement of raw materials and fossil fuels.

Exclusive sneak-peek: "climate change mitigation"

Did you know that ISWM reduces emissions not only from the waste sector but also from other sectors? Recovery of waste as secondary materials and energy avoids emissions in all other sectors of the economy: energy, forestry, agriculture, mining, transport, and manufacturing.

Several life-cycle studies recently carried out demonstrate that 10–15% of global greenhouse gas emissions could be avoided by effective waste management and recycling. For example, in Germany 20% of the overall GHG emission reduction which occurred from 1990 to 2005 was achieved through waste management activities.

To learn more visit Integrated Solid Waste Management (ISWM) Solution online: www.solutions-gateway.org/solution?code=8

Case study: City of Surrey, Canada

City of Surrey: Sustainable Waste Management

Approach:

A regionally mandated target of 70% waste diversion by 2015 and its own Sustainability Charter led City of Surrey to unveil a holistic approach to sustainable waste management (2012). Three interconnected measures were devised to close the loop on waste: a new waste collection provider with a requirement that its fleet be comprised exclusively of alternate fuel vehicles; a curbside collection system for household organic waste (Rethink Waste Collection Program); and the construction of an organic waste biofuel facility to process the collected organic waste into a vehicle grade renewable natural gas.

Due to the low cost of natural gas compared to diesel, and the switch to a cart-based collection system with an alternating service schedule, the city will realize up very significant cost savings per year on its waste collection services while significantly reducing landfill-bound garbage.

Results:

- Up to $3 million savings per year on waste collection
- CNG collection fleet emits less than traditional diesel trucks: 23% less GHG; 90% less air particulates
- Diversion of 70% of residential waste from landfill
- Significant extension of landfill's useful lifetime

Source: In PCP 2012 Report, ICLEI Canada.

2.3 Solutions Package: Turning waste into energy

The organic fraction of municipal solid waste and domestic waste water have the potential to generate methane, which can be used to produce electricity and heat, can be purified for fuel vehicles that run on compressed natural gas, or for injection in the natural gas grid. Waste may also be used as an energy source directly through combustion, for example incineration with energy recovery of comingled municipal solid waste or the use of forest biomass pellets in highly efficient boilers to heat buildings. This Solutions Package brings together different technological options that are available to recover energy from waste.

Solutions included in the Turning waste into energy Package

Anaerobic digestion of sewage sludge

Anaerobic digestion of organic waste

Waste incineration with energy recovery

Landfill gas recovery

Refuse-derived fuel

Wood-based-biomass cogeneration

Biodiesel from used cooking oil

Main benefits and long term impacts:

- By turning waste and wastewater into a source of revenue through energy extraction ensure collection and proper treatment
- Reduces waste volume significantly
- Rational use and preservation of natural resources
- Displacing fossil fuel consumption
- Reduce GHGs

The Solutions highlighted in orange will be briefly described below.
To learn more visit Turning waste into energy Solutions Package online: http://www.solutions-gateway.org/package?code=3

2.3.1 Solution: Anaerobic digestion of sewage sludge

Wastewater treatment plants generate sludge as a by-product. The sludge must be adequately treated and disposed of to avoid health and environmental problems as it contains high concentrations of pathogens, organic matter, nutrients, metals and other substances, also with an offensive odour. Anaerobic digestion is one of the best ways to treat sludge because it significantly reduces the amount of residue, destroys pathogens and is a net-energy positive mechanism as it produces biogas. The biogas contains methane and can be used for small-scale heat/electricity production, purified for injection in the natural gas grid or used as fuel for vehicles.

The local government, often the wastewater treatment plant operator, is responsible for ensuring that the anaerobic sludge digestion takes place in an environmentally sound way and that the waste-to-energy conversion process is efficient. Proper planning, implementation and regulation are required to ensure viability of the biogas plant.

Main benefits and long term impacts of this Solution include:

- Reduced likelihood of soil, air and water pollution and odours due to improper sludge disposal.
- Generation of employment for operation and maintenance.
- Renewable energy generation and substitution of fossil fuels.
- Potential source of revenue through the sale biogas, electricity, heat, organic fertilizer.
- Contribution to energy security and conservation of natural resources.
- Direct and indirect reduction of greenhouse gas emissions.

Exclusive sneak-peek: finance guidance in the "required actions"

Did you know that incentives to renewable electricity favour the use of biogas for cogeneration rather than other alternatives?

Key recommended actions include:

- **Investigate the local market** for electricity, heat, biogas, and biomethane, as well as for organic waste materials which can be used as substrate to guarantee a reliable supply and profitability.

- **Build a viable business plan and financing model** exploring different technological options, plant locations and identifying the break-even point, i.e., the price for the produced biogas which has to be achieved to break even on production costs. The location of the plant should be chosen carefully to minimize distances travelled. Alternative methods of transport/ conveyance should be investigated as transport greatly influences costs, energy consumption and emissions.

- **Enact legally binding contracts for the delivery of sludge or other organic waste** to be used as feedstock. This may contribute to the long term sustainability and return on investment. Anaerobic digestion of sludge and energy recovery from biogas has significant capital and operational costs. Sludge production and processing needs sufficient scale to enable a return on the investment.

- **Secure funding.** Financing options may include: long-term municipal debt, non-debt financing based on rates and charges ("pay as you go"), leasing and privatization.

To learn more visit Anaerobic digestion of sewage sludge Solution online: www.solutions-gateway.org/solution?code=12

Case study: Regional District of Nanaimo, Canada

Regional District of Nanaimo: Pollution Control Centre

Approach:

The Greater Nanaimo Pollution Control Centre is a mid-sized wastewater plant relying on anaerobic digestion to treat and stabilize sludge from residential wastewater and generate biogas. Initially most of the biogas generated was flared. Since 2010, a 330 kW cogeneration facility uses biogas to generate both heat and electricity, meeting the heating demands of the wastewater facility.

Results:

- Electricity generation: 2,000,000 kWh of electricity per year
- Energy cost savings: $200,000 per year
- GHG emissions reduction: 50 tonnes per year
- Prolonged life of submarine cables that bring electricity to Vancouver island
- Covers the heating demands of the wastewater facility
- Contribution to aspirations for local energy self-sufficiency

Source: In PCP report 2011, ICLEI Canada

Case study: Almada, Portugal

Energy valorization of Biogas in Almada's Treatment Plants

Approach:

The Waste Water Treatment Plant (WWTP) of Portinho da Costa treats 24% of the waste water of Almada (an average flow rate of 9,500 m³/day), serving approximately 80,000 inhabitants. The anaerobic digestion of sewage sludge and biogas cogeneration was integrated into the WWTP design from the early project development stages through the inclusion of such requirement into the public procurement process.

Results:

- Two cogeneration units convert the biogas with 93% efficiency (33% electricity plus 60% vapor and hot water).
- The cogeneration system meets 40% of the annual energy needs of the WWTP which correspond to approximately 550 MWh, avoiding an absolute reduction of greenhouse gas emissions of 180 t CO_2e per year.
- The digested sludge is used as fertilizer for agriculture and the treated water is used to for outdoor washing operations and watering green spaces.

Source: ICLEI Case Study Series n. 189

2.3.2 Solution: Waste incineration with energy recovery

Waste incineration with energy recovery - Waste-to-Energy (WtE) - is a widely applied technique. WtE plants process Municipal Solid Waste (MSW) and similar wastes that remains after waste prevention, re-use and recycling. The choice of WtE needs to be developed within an integrated waste management approach and a clear framework for emissions control, to ensure adequate installation design, operation and quality control, in order to deliver the desired environmental performance.

Since the collection and treatment of municipal solid waste usually lies within the responsibilities of the local government, municipalities can directly influence waste and waste-to-energy strategies, and are often the facility owner.

The main benefits of this Solution include:

- WtE plants treat waste hygienically and pollutants are destroyed and/or captured
- Significant waste volume reduction (by about 90%)
- Energy recovery for electricity and /or thermal energy (steam or hot water) production
- Source of revenue from the sale of electricity and/or heat to industry or district energy networks
- Reduce consumption of fossil fuels for energy purposes
- Contribute to energy independence through local, reliable and partly renewable energy
- Avoided land-use conversion for landfill waste disposal
- Climate change mitigation by reducing methane emissions from MSW landfilling

Exclusive sneak-peek: "reality-check"

When is this Solution applicable?

- **This solution can be attractive to large and densely populated metropolitan areas lacking wide areas to place landfill site and where landfills are a long distance from the urban centre, since it reduces the volume of waste dramatically up to 10 fold.**
- **The waste composition that is delivered to the plant should allow at least for a lower calorific value of 6 MJ/kg throughout the year and the annual average should not be less than 7 MJ/kg.**
- **For middle and low income countries, the annual amount of waste supply for incineration should be no less than 50,000 metric tons, and weekly variations should not exceed 20%.**

Pre-conditions

- **Strict emission standards should be used that are at least comparable with the ones prescribed in the European Union.**
- **This solution requires municipalities to have a mature waste collection system in place: small fractions of hazardous waste which household waste can contain, such as batteries and some electric and electronic equipment waste should be collected and treated separately upstream from the WtE plant, to decrease technology and costs of the gaseous emissions control system.**
- **Funds might be necessary to buy technical equipment that is not nationally available.**

Success Factors

- **Early stakeholder involvement including the municipal utilities, the energy and waste sector, NGOs and the population will ease the implementation of this complex technology.**
- **The presence of a district heating system or power lines close to the plant can augment its profitability.**
- **The presence of industry close to the incineration plant that requires heat can reduce costs and ease implementation – the plant can then provide heat to industry without having to transform it into any other form of energy which would result in additional costs.**

To learn more visit Waste incineration with energy recovery Solution online: www.solutions-gateway.org/solution?code=2

Case study: Paris, France

Waste-to-energy: Helping to keep the Mona Lisa smiling

Approach:

The case of Paris illustrates how Waste-to-Energy (WtE) can address multiple challenges simultaneously within a very large city, namely waste management and heat generation.

The City of Paris has extensive experience with district heating with its first concession dating back to 1927, driven by the need to reduce the city's dependency on coal, the associated logistics, and improve air quality. Currently heat is produced at eight facilities, including three waste-to-energy plants. These WtE plants treat the non-recyclable household waste of the city of Paris. The electricity produced is sold to the power grid. The heat is sold to the district heating company to supply cheap, safe and reliable heat and hot water to households, offices, hospitals and other buildings, equivalent to 500,000 households.

Results:

- Treatment of waste from 3.6 million Parisian households
- Provides heating to 50% of Paris
- Avoids consumption of 300,000 toe of fossil fuels per year
- Avoids release of 900,000 tonnes of CO_2 per year

Source: In www.cewep.eu

2.3.3 Solution: Landfill gas recovery for energy production

Organic matter present in landfill experiences a biological decomposition leading to the production of methane (CH_4) and carbon dioxide (CO_2) which contribute to the greenhouse effect and climate change. Sanitary landfills install a piping system for the removal of the landfill gas generated, thus minimizing combustion and explosion hazards. The landfill gas can be collected and used for heat and/or electricity production, displacing the use of fossil fuels for the production of the same amount of energy.

Since the collection and treatment of municipal solid waste usually lies within the responsibilities of the local government, municipalities can have a direct influence on waste and waste-to-energy strategies, and often own the facility.

Main benefits and impacts of this Solution include:

- Reduced risk of aquifer contamination minimizing pollutants migration in the soil
- Improvement of the health and environmental quality for the population living close to landfills
- Energy-recovery from landfill gas, during and after the landfill lifespan
- Reduction of the amount of the fossil fuels used as primary energy source
- Revenue for local governments by selling electricity to the national grid
- Reduction of the release of GHG gases into the atmosphere

Exclusive sneak-peek: "resources"

Examples of resources that support the implementation of this Solution:

- **Landfill gas generation modeling tools – Developed under the Landfill Methane Outreach Program, ran by U.S.A. Environmental Protection Agency (EPA), which assessed the technical and economic feasibility of energy project development at selected landfills in a number of countries around the world. Field Procedures Handbook for the Operation of Landfill Biogas Systems – Publication prepared by International Solid Waste Association Working Group for Sanitary Landfills**
- **Guidance Note on Landfill Gas Capture and Utilization – Publication of the Inter-American Development Bank Infrastructure and Environment Sector (2010)**
- **Manual for the recovery of biogas – Volume 1 – Sanitary landfills (Portuguese only) - Publication developed by ICLEI.**

To learn more visit Landfill gas recovery for energy production Solution online: www.solutions-gateway.org/solution?code=13

Case study: City of Vancouver, Canada

City of Vancouver landfill gas recovery system

Approach:
The city owns and operates a large municipal waste facility. Since 2003, as a result of a joint venture, landfill gas is piped to a nearby cogeneration facility, where it generates electricity and heat which are then sold for power supply and district heating.

Results:
- Reduces landfill odours
- Revenue generated for the city: $400,000 annually
- GHG emissions reductions: 250,000 tonnes/year
- The electricity is used to power 7,000 homes
- The heat is used to supply greenhouses and buildings

Source: In PCP report 2010, ICLEI Canada

WATER

2.4 Solutions Package: Resource-efficient urban water supply

Public water supply systems provide drinking water to the population in sufficient quantity to satisfy needs, and with sufficient quality to safeguard public health. Although drinking water is a valuable resource and its transportation, treatment and distribution is expensive, public water supply systems often have high water losses due to leakage, ruptures, and other inefficiencies. Water treatment and supply may also account for a high percentage of the municipal electricity consumption (for purifying, pumping) and budget.

Local governments have the opportunity to manage their water supply systems to enhance resource efficiency from the supply and demand side. This Package addresses both approaches and includes complementary Solutions to promote the efficient use of both energy and water in municipal water supply systems.

Solutions included in the resource-efficient urban water supply Package

Integrated Water Resources Management

Energy-efficient urban water supply

Water-loss reduction in urban water supply

Water metering and pricing

Main benefits and long term impacts:

- Increased access to safe drinking water
- Decrease risk of shortage or failure in supply
- Decrease pressure on natural fresh water resources
- Decrease water losses in the municipal system
- Decrease energy needed to produce and deliver drinking water
- Decrease the local government's energy bill
- Potentially lower water costs to the consumer
- Delay the need for large capital investments
- Decrease greenhouse gas emissions due to lower energy consumption

The Solutions highlighted in orange will be briefly described below.
To learn more visit Resource-efficient urban water supply Solutions Package online: http://www.solutions-gateway.org/package?code=4

Case study: Nagpur, India

Water sector audit enables efficient use of water and energy resources in Nagpur

Approach:
In 2005, 45% of the potable water produced was lost due to leakage and eventually, unaccounted for consumption, and water treatment and supply accounted for 57% of the municipal electricity consumption. Key actions included:

- Water audit, pipelines replaced with more durable material, and raw water metering
- Energy audit and follow-up interventions such as increase of water pumping efficiency.

Results:

- Increase in the amount of water supply by 13%
- Cumulative monetary savings of 1 million EUR per year
- Reduction of unaccounted water: 400,000 EUR savings
- Annual monetary energy savings: 250,000 EUR
- Annual energy savings of over 9.7 million kWh.

Source: In ICLEI Case Study n.110, 2010.

2.4.1 Solution: Water-loss reduction in urban water supply

Water supply systems water losses due to leakages can be as high as of 45-50%, corresponding to a significant waste of resources, not just water, but also energy, chemicals, and capital. Minimizing water-losses in water supply systems has high mitigation potential and multiple benefits, including economic savings and contributing to safeguard public health.

This Solution is tailored to local governments who have ownership or regulatory authority over the municipal water supply system. This Solution is applicable to new projects, expansions, renovation of existing systems, and to their operation. In this Solution, the Local Government takes a comprehensive approach throughout the different phases of the system's project and life cycle, to decrease water losses related to leakages, ruptures, unaccounted consumption. This Solution encompasses policy setting, project design, procurement, operation, monitoring, and maintenance of the water supply system.

Exclusive sneak-peek: "enabler actions"

This section provides a description of the main actions by the local government that facilitate the implementation of the Solution. These actions mostly target the internal stakeholders (City Council Staff) and other key professional groups that are crucial for delivery, and may include policy setting, regulation approval, governance structures, capacity building, awareness raising, and stakeholder engagement.

Policy

- **Policy for Integrated Water Resources Management**, which seeks to secure access to clean water to satisfy current and future needs, in an economically efficient, equitable, and environmentally sustainable way.
- **Policy for water metering and pricing** to create a cost recovery mechanism and ensure long-term service delivery and sustainability of the water supply system.
- **Green procurement policy** includes municipal water supply system projects and operation

Regulation

- **Regulate water tariffs** as a way to create a cost recovery mechanism to ensure funds to operate, maintain, repair and renovate the municipal water supply system, presently and in the future. Implement complimentary regulations, such as social tariffs, to ensure all the population has access to drinking water.
- **Regulation requires use of green procurement principles**, in the shape of technical specifications or criteria, when procuring services for the water supply system, from project design to construction, operation, maintenance and renewal.

Capacity Building

- **Train the technical staff responsible for water supply projects** on municipal Green Procurement policy requirements and guidance.

Stakeholder Engagement

- **Engage all relevant departmental internal stakeholders** to obtain their cooperation and active participation in IWRM, water audits, green procurement policies implementation, etc. ...

Technology

- **Meter and audit key points of the water supply system** to enable quantification of water losses.
- **Establish a baseline to quantify water losses** of the municipal water supply system.

To learn more visit Water-loss reduction in urban water supply Solution online: http://www.solutions-gateway.org/solution?code=7

Case study: Emfuleni, South Africa

Watergy case study

Approach:

In Emfuleni, Pressure Management and performance contracting applied to water supply deliver substantial savings. Due to relatively high pressures in Emfuleni's water network, many on-property plumbing fixtures failed prematurely, resulting in the loss of up to 80% of water flowing into certain residential districts. Various socio-political and socio-economic factors caused this to remain unchanged over lengthy periods of time, sometimes years. In response, the Emfuleni Local Municipality has sent out a call for proposals to install an advanced pressure management system. Advanced pressure management will not only reduce and control water pressure, but also allow pressure to be further reduced at night when full operating pressures are unnecessary due to low demand. This project has high potential replication potential in South Africa and around the world.

Results:

- Reduced water loss by over 30%
- Pay-back period of 3 months
- Annual cost savings: US$ 3.8 million
- Annual energy savings: 14 million kWh
- Annual water savings: 8 million kL
- GHG emissions avoided: 12,000 tonnes CO_2e/year.

Source: In www.ase.org

2.4.2 Solution: Energy-efficient urban water supply

This Solution was tailored to local governments who have ownership and/or regulatory authority over the municipal water supply system, and is applicable to new projects, expansions, renovation of existing systems, and to their operation. In this context, the Local Government's key leverages to deliver an energy-efficient system range from "policy" and "regulation" to "procurement", combined with "operation and maintenance".

The process of potable water production and supply, from water transportation (bulk transfer), to storage, treatment and distribution to the end user, can account for a high percentage of the municipal energy consumption, corresponding to high operating costs and indirect GHG emissions due to electricity consumption. Therefore, increasing the energy efficiency of the water supply system has high mitigation potential, among other benefits for operations and for society:

- Decrease the energy needed to produce and deliver drinking water
- Decrease the risk of shortage or failure of the municipal water supply system
- Decrease the local government's energy bill
- Potentially lower water costs to the end consumer
- Climate mitigation and adaptation benefits
- Indirect water savings due to the use of fresh water for electricity production
- Decrease the greenhouse gas emissions due to lower energy consumption

Exclusive sneak-peek: "indicators"

This section provides examples of key indicators that enable cities who implement this Solution to monitor and confirm its results.

Suggested indicators for monitoring and evaluating performance:

- **Electricity consumed to produce and deliver one cubic meter of potable water** through the municipal supply system (kWh/m³); this indicator measures system's energy-efficiency.
- **Cost to produce and deliver one cubic meter of potable water** through the municipal supply system (currency/m³); this indicator is a measure of the cost-efficiency of the system.
- **GHG emissions for delivery of one cubic meter of potable water** through the municipal supply system (kg CO_2e/m^3); this indicator is a measure of the carbon-intensity of the system.
- **Cost reduction in the local government's energy bill associated with interventions** in the water supply system (currency/year); this indicator is not a measure of the cost-efficiency of the system because its value can vary due to other numerous factors (e.g.: occurrence of a drought).
- **GHG emissions reduction associated with the interventions in the water supply system** (tCO_2e/year); this indicator is not a measure of the carbon-intensity of the system because its value can vary due to other numerous factors (e.g.: drought).

To learn more visit Energy-efficient urban water supply Solution online:
http://www.solutions-gateway.org/solution?code=5

Case study: Veracruz, Mexico

Watergy Case Study

Approach:
The high contribution of energy to total operating costs and frequent service interruptions motivated the Veracruz water utility to become more energy efficient. Key actions included an energy diagnostic, feasibility analysis and implementation of energy saving measures (demand management and power factor optimization).

Results:
- Energy savings: 24% (24 million kWh/ year)
- Cost savings: US$ 394,000/year
- Improved reliability in water supply service:
- avoids service interruption when demand exceeds pumping capacity
- Elimination of user complaints.

Source: In www.ase.org

Case study: Pune, India

Watergy Case Study

Approach:
Municipal water utilities in India often spend more than 60% of their budget on energy for water pumping and savings of 20% are typically available from no- and low-cost efficiency measures. Pune benefited from energy audits on bulk water supply systems coupled with technical and managerial training (classroom and field work).

Results:
- Energy Savings: 3.8 million kWh/ year
- Cost Savings: US$336,000/year
- Water delivered to community: +10% without new capacity
- CO_2 emissions avoided: 38,000 tonnes/year.

Source: In www.ase.org

2.5 Solutions Package: Sustainable storm water management

If stormwater is collected and treated separately from wastewater, it can be utilized as an additional water resource for the city and significantly reduce the capital investment and energy intensity of sewer networks and treatment systems. In doing so cities can reduce flood risks, increase water security and reduce infrastructure costs. Additionally, creating a wetland system within the city to attenuate stormwater can improve carbon sequestration potential and provide additional recreational areas.

This Solutions Package looks at stormwater as a valuable resource and uses natural systems to control runoff. It focuses on two Solutions that have different urban land use and ownership scopes. The first Solution contains guidance on integrated stormwater management planning and coordination at city level for developing Sustainable Urban Drainage Systems (SUDS) in public open spaces, such as markets, squares and pavements. The second Solution focuses on actions for developing SUDS for residential, commercial and institutional buildings and facilities. It fits under the framework created by the first Solution, but it is complementary in the sense that it explores measures to enhance the intake of SUDS by the private sector.

Solutions included in the Sustainable Storm Water Management Package

Storm water retention and infiltration at city-scale

Storm water management in private lots and developments

Main benefits and long term impacts:

- Reduce flood risk in cities
- Reduction in capital investments in sewer networks
- Reduce the energy intensity and operational costs of wastewater treatment
- Reduction in per capita water consumption through reuse of stormwater
- Decrease pressure on natural fresh water resources and ecosystems
- Improving the aesthetic value of the city and community's quality of life
- Increase in property values in the city
- Modulate temperature in the city and reduce the heat island effect
- Reduction in the energy consumption of buildings for cooling
- Improve air quality
- Improve urban biodiversity

The Solutions highlighted in orange will be briefly described below.
To learn more visit Resource-efficient urban water supply Solutions Package online: http://www.solutions-gateway.org/package?code=7

Case study: Malmö, Sweden

Augustenborg, Malmö: Retrofitting SUDS for regeneration of an urban area

Approach:
The Augustenborg neighborhood experienced socio-economic decline in recent decades and frequently suffered from floods caused by overflowing drainage systems. Between 1998 and 2002 the district was regenerated focusing on the creation of sustainable urban stormwater drainage systems, including ditches, retention ponds, green roofs and green spaces. The new stormwater management system implemented was based on the principles of SUDS.

The project covered residential, commercial, industrial area as well as schools. The environmental improvements and the empowerment of the local community has resulted in Augustenborg becoming a financial attractive, multicultural and sustainable neighborhood. The dialogue and meaningful engagement of the local community was essential to the success of this transformation.

Results:
- Reduced flood risk due to overflowing drainage systems:
  - the open stormwater system now retains 70% of all rainwater
  - the green roofs reduce runoff by 50%
- Urban regeneration preserving and enhancing green spaces
- Improved quality of life and attractiveness of place
- Increased local biodiversity by 50%.

Source: In www.grabs-eu.org

2.5.1 Solution: Storm water management at city-scale

This solution caters to local governments that have the mandate to manage stormwater in a city, based on the principles of Sustainable Urban Drainage Systems (SUDS). It addresses the management of rainfall and runoff, especially, from public open spaces and transport infrastructure. The Solution promotes the creation and enhancement of permeable surfaces, waterscapes and networks of open drainage channels and watercourses which slow down runoff and maximize infiltration and treatment by natural processes such as channels, swales, vegetated trenches, retention basins, wetland systems and multiple use green spaces. The benefits and long-term impacts of this Solution are similar to those indicated for the Package.

Exclusive sneak-peek: "required actions and technical measures"

The required actions section provides a description of the main actions which the local government takes for the delivery of this Solution. The technology field in particular includes guidance on the core technical and technological measures within this Solution.

- **Develop a hydrological model for the city** to estimate the water balance baseline.
- **Categorize urban runoff volumes and pollution** concentration according to land use and identify appropriate measures to treat, infiltrate or use stormwater for multiple ends.
- **Via a participatory process, identify buffer zones and nature areas** in the city that can collect, treat and infiltrate stormwater.
- **Enact by-laws that support the management of stormwater** based on the principles of SUDS.
- **Design SUDS** – Design and implement a network of drainage channels for delivering rainwater to swales, retention ponds, infiltration basins and wetland areas within the city:
  - **Permeable pavements:** These are permeable surfaces that allow run-off to percolate naturally into ground and reduce run-off.
  - **Swales** are wide grassy shallow like-ditches designed to guide, infiltrate, and treat collected surface runoff during and after occurrence of rainfall. They form attractive features that bring amenity value to housing estates and roadsides. Periodic cleaning should be carried out to remove sediments and restore their storage capacity.
  - **Infiltration trench/ponds:** an infiltration trench is a shallow, excavated channel, filled with stone aggregate to create an underground storage reservoir and infiltrate directly to the ground. Infiltration systems are capable of removing a range of pollutants and can provide high attenuation rates of runoff peak flow.
  - **Retention basins:** retention basins are permanent depressions to hold water and create wetland habitats like temporary pools, wet grassland, wet woodland and reedbeds. They have the capacity to store additional storm runoff, releasing it at a controlled rate during and after the peak flow has passed, and forms the last stage in the SUDS system before release of clean water into receiving watercourse..
  - **Filter beds:** This is vegetation planted in a series of lines/beds with a separate unit for trapping hydrocarbons, oil and grease, trash, and other storm pollutants. They are commonly used as pre-treatment for other stormwater management systems in areas where higher concentrations of pollutants are likely to occur, such as gas stations, high density roads and parking lots. Routine maintenance should be carried out after the first storm to remove debris carried along with stormwater on to the filters.
- **Green Street designs** – features include vegetated curb extensions, sidewalk planters, landscaped medians, vegetated swales, permeable pavements, and street trees.
- **Procure necessary works, services and equipment** such as runoff modelling software that can aid decision making and water quality assessment equipment.
- **Ensure that all urban runoff facilities are operated and maintained properly**
- **Monitor and evaluate the performance of intervention** in the city and assess if the required objectives are being achieved. If not, realign actions (improve policy, designs, standards, etc.)

To learn more visit Storm water management at city-scale Solution online:
www.solutions-gateway.org/solution?code=15

Case study: Portland, USA

Drastic reduction in capital expenses via SUDS, in "Green Infrastructure Case studies"

Approach:
Portland, Oregon, is often cited as the prime example for Sustainable Drainage Systems (SUDS). The City has taken the initiative, and to some degree, the risk, necessary to implement a citywide SUDS program, and with this has achieved drastic reduction in capital expenses in wastewater drainage and treatment conventional "hard" infrastructure.

The City has a citywide comprehensive and mature strategy for green infrastructure and SUDS, with multiple policies and programs that complement and reinforce each other, resulting in successful implementation over time. The city effectively integrates regulations with incentives, from requiring on-site management for public and private new development to incentive-based programs for homeowners and developers in existing developments. SUDS has been integrates in a range of settings, including parking lots, apartment buildings, schools, private businesses, government offices and in public spaces like parks and riverside esplanades.

Results:
- Drastic reduction in capital expenses: the city invested $9 million in SUDS to save $224 million in hard infrastructure
- 56,000 properties with disconnected downspouts
- Stormwater charge discount program has over 35,000 participants, including both residential and commercial property owners:
  - $4 million in retroactive credits for properties with low impact development (LID) already in place at the program's inception
  - $1.5 million in discounted fees for newly participating properties.
- 4.5 million m^3 of stormwater kept out of the combined sewer system since 1994.

Source: In "Green Infrastructure Case studies", USEPA, 2010

2.5.2 Solution: Storm water in private developments

This Solution offers approaches for the management of surface run-off at the source. This is achieved by collecting, treating and infiltrating or reusing run-off, where possible onsite, or in the near vicinity using Sustainable Urban Drainage Systems (SUDS). Examples include: decoupling of stormwater drains from wastewater, green roofs, rain gardens, living walls, permeable pavements, rainwater retentions and reuse systems, and onsite infiltration systems. It is applicable to new settlements, as well as to existing residential, commercial and institutional buildings and facilities.

This solution is tailored to local governments that have a mandate to approve and enforce municipal building regulations or bylaws that require and/or incentivize the use of SUDS and rain water harvest in private buildings and facilities in the city. To implement this Solution, the local government should undertake: policy enactment, standardization, stakeholder involvement; community sensitization and mobilization, and monitoring and evaluation of interventions, including enforcement of regulations. The benefits and long-term impacts of this Solution are similar to those indicated for the Package.

Exclusive sneak-peek: "reality-check"

This section enables the local government to quickly assess whether the Solution may be of interest for its jurisdiction. It contains key information on applicability, required pre-conditions, success factors, recommended follow-up, barriers and risks.

When is this Solution applicable?

The application of this Solution is particularly relevant for cities where:
- There is frequent water scarcity due to low precipitation or
- There is frequent incidence of flooding in low-lying areas due to heavy rainfall
- Ground water tables are dropping due to over extraction
- The local government finds that cost of wastewater treatment is increasing
- The local government finds it challenging to invest in sewer networks
- The city is largely covered by combined sewer networks
- New settlements are going to be planned

This Solution is **not** applicable where:
- Water tables are already high
- Geological conditions are not favorable for ground water percolations
- Population densities are very high and there is a lack of space to construct SUDS.

Learn how to address risks:
- **Poor solid and hazardous waste management practices amongst the citizens** (discarded motor oil, paint, cement bags, batteries, medicines, etc.) leads to contamination of storm water which will either be reused or infiltrated to the ground. The elimination of the risk of contamination from hazardous substances is of utmost importance and proper guidelines and measures should be taken to avoid incidences.
- **High ground water levels** can harm substructures of buildings such as foundations, basements, underground water tanks, etc. Thereby close monitoring of groundwater levels are important to avoid damage to property in case storm water infiltration happens over a period of years, and depending on the geological conditions.

To learn more visit storm water in private developments Solution online:
http://www.solutions-gateway.org/solution?code=16

Case study: Cambourne, UK

Lamb Drove, residential SuDS scheme

Approach:

Lamb Drove is a residential development of 35 affordable homes on a one hectare site which was used by the Cambridgeshire County Council to showcase practical and innovative sustainable water management techniques, demonstrating SUDS as a viable and attractive alternative to more traditional forms of drainage and to deliver practical solutions for new housing areas.

The project demonstrated practical, innovative and cost effective drainage techniques, in both relatively low and high-density developments and received positive reactions from the community, including the residents and developers.

Results:

- Estimated cost savings due to SUDS: £11k, approximately 10% of cost to connect the settlement to a sewer
- Avoids storm water disposal charges: £30/year/household
- Positive reactions from residents and other stakeholders
- Improved quality of water leaving the site compared with traditional drainage systems
- Attractive landscape, increased amenity and social value

Source: In www.susdrain.org

2.6 Solutions Package: Solar hot water

Energy consumption to produce hot water can be significant in different types of facilities such as households, swimming pools, laundries, canteens, hospitals, food industry, etc., – having an impact on their energy bill. As an example, in Sao Paulo (Brazil) water heating is estimated to account for approximately 40% of the city's electricity consumption, including both residential and commercial use. The production of hot water in households represents more than 10% of the final energy consumption in the European Union (13%) and in the USA (18%). Typically, water is heated using fossil fuels and/or electricity. This presents an opportunity for renewable solar energy use, through readily available and proven technologies.

This Package offers an integrated set of measures for the deployment of solar water heating systems in public and private buildings and facilities.

Solutions included in the solar hot water Package

Solar hot water in municipal buildings and facilities

Solar hot water at community-scale

Main benefits and long term impacts:

- Build consumer confidence on solar thermal systems
- Develop the local market for solar water heating systems
- Generate jobs
- Reduce fossil fuel dependency and increase share of renewable energy
- Reduce the energy bill of buildings and facilities
- Enhance the city's profile as green and sustainable
- Improved air quality and reduced GHG emissions where fossil fuels are replaced

The Solutions highlighted in orange will be briefly described below.
To learn more visit solar hot water Solutions Package online:
www.solutions-gateway.org/package?code=2

2.6.1 Solution: Solar hot water in municipal buildings

In this Solution, the local government takes leadership by implementing solar hot water (SHW) systems in its own buildings and facilities, also acting as role model for the community. This includes conducting an assessment of the potential for solar hot water use in municipal buildings and facilities, a procurement process to select a technology provider, and implementation, operation and maintenance of the systems to ensure high levels of performance throughout. Communication of the results is also important for demonstration and awareness-raising purposes.

Exclusive sneak-peek: "science and technology insights"

Did you know?

- **Solar water heating systems are typically sized to meet 70% of the hot water demands**, to avoid having excess capacity during summer months which would lead to higher payback time. Therefore, a back-up system is necessary to provide the remainder of the necessary thermal energy, for example using pellets or natural gas.
- **If not properly installed and maintained, solar water heating systems lose efficiency** over time preventing them from delivering the full expected results and pay-back period.
- **The techno-economic assessment of a solar water heating system** for a building is influenced factors such as: hot water consumption patterns, rooftop solar exposure and available area, technology costs, costs of alternative energy source to heat water, etc. ...

To learn more visit Solar hot water in municipal buildings Solution online: http://www.solutions-gateway.org/solution?code=1

Case study: Bhubaneswar, India

Pioneering renewable energy and energy efficiency application in India's municipal health sector

Approach:
The installation of solar water heating in a Municipal Hospital demonstrated energy savings, which drove further investments in renewable energy and energy efficiency. This step towards energy independency was very important to the quality of the hospital services since, in the past, the hospital services were frequently interrupted due to the erratic power supply.

Results:
- After three months, hospital's energy consumption was reduced by 15%
- Energy independence: solar-powered equipment allowed the hospital to function independently of the public grid for its critical energy needs.
- Improved health care services.

Source: ICLEI Case Study series n. 108

2.6.2 Solution: Solar hot water at community-scale

In this Solution the local government implements a set of integrated measures to deploy solar hot water in private buildings and facilities in the community, using its regulatory powers as the main leverage to approve, or amend, a municipal building code which requires (new) buildings to use solar hot water (SHW) systems.

Exclusive sneak-peek: "multiplier actions"

Below the main actions a local government can take are outlines to increase the impact, also through synergies and cooperation with external stakeholders.

Regulation
- Incentives for installation of solar water heating systems in private buildings and facilities

Governance
- Counteract against non-compliance: ensure that enforcement structures are operational

Capacity Building
- Promote training of active building designer professionals on solar water heating systems
- Promote training and certification of installers
- Integrate solar thermal systems into curricula of relevant technical-scientific training programs

Stakeholder engagement
- Create a helpdesk for Solar Hot Water technical, financial and legal issues
- Conduct a survey to verify benefits of the Solar Ordinance in terms of energy and cost savings to end users

Technology
- Support creation of solar-collectors homologation entities
- Promote the warranty of installations by the suppliers/ installers (typically 1 to 6 years)
- Make energy audit mandatory before major refurbishment activities / roof works

Finance
- Partner with financing institutions for co-financing or lower interest rates to private sector

Awareness Raising and Publicity
- Encourage inclusion of solar thermal energy in the school curricula
- Promote school activities and festivities on solar energy
- Communicate the approval of renewable energy policy and regulation
- Communicate results (e.g.: results of survey on savings)

To learn more visit Solar hot water at community-scale Solution online
To learn more visit solar hot water at community-scale Solution online:
http://www.solutions-gateway.org/solution?code=3

Case study: Betim, Brazil

Solar water heaters in low income housing: energy and financial savings

Approach:
Through an initiative of the City of Betim, 1,356 Solar water heaters were installed in low income housing (2004-2007). Although other similar initiatives can be found throughout the world, it is not often that the results and benefits are monitored and evaluated. The city conducted a survey on these households 2-5 years after equipment installation, which confirmed the social and environmental benefits of the use of solar hot water in residential buildings.

Results:

- For average family of 3–4 members:
  - household electricity consumption was reduced up to −20%
  - electricity bill was reduced up to −57% by qualifying to tax exemptions (available to households that consume <90 kWh/month).

Source: ICLEI Case Study series n. 112

2.7 Solution: Natural refrigerants in municipal buildings' cooling

Air conditioning (AC) units and refrigerators consume 20% of the electrical energy world-wide and the trend is increasing. The energy requirement for air conditioning in developing countries is expected to grow at an average of 7% annually until the year 2050. The use of natural refrigerants in AC to replace currently applied refrigerant fluids offers a way to reduce energy consumption while contributing to climate mitigation and ozone layer protection. Natural refrigerants include substances such as carbon dioxide (CO_2), ammonia, propane, and other hydrocarbons. They replace ozone depleting hydrochlorofluorocarbons (HCFCs) and high global warming potential hydrofluorocarbons (HFCs).

This Solution consists of a set of measures to convert conventional central air-conditioning systems in municipal buildings and facilities to use natural refrigerants. Local governments can contribute to the safe use and promotion of natural refrigerants by creating demonstration sites in their own buildings, developing local capacities for the installation, maintenance and servicing of these devices.

Exclusive sneak-peek: "benefits of national-subnational integration"

This section shows how national-subnational cooperation and coordination can facilitate the implementation of the Solution, also sharing benefits between different levels of government.

Benefits for the local government:
- **Increase visibility of successful local climate change mitigation initiatives.**
- **Removal of barriers to the use of natural refrigerants embedded in the national framework**
- **Preferential access to funding programs.**

Benefits for other levels of government:
- **Pilot testing and demonstration of Solution at local level, facilitating the replication of the initiative throughout the national territory.**
- **Local contribution to reach national mitigation targets, and targets set forward in national technology roadmaps.**

To learn more visit natural refrigerants in municipal buildings Solution online:
www.solutions-gateway.org/solution?code=10

ENERGY

Energy efficiency and renewable energy are cross-sectoral principles applicable to all low emission development strategies. Energy efficiency at the consumption level and the use of decentralized renewable energy are addressed within the corresponding sectors. For example: measures to promote energy efficient vehicles are addressed under Transport, and production and use of renewable energy in buildings is included under Buildings. The current section focuses only on energy at the utility scale.

- Solutions Package: Turning waste into energy (see above)
- Solutions Package: District heating
- Solutions Package: District Cooling

2.8 Solutions Package: District heating (preview)

The development of modern district energy is one of the least-cost and most efficient ways to reduce emissions and primary energy demand in cities, by enhancing energy efficiency both on the supply and on the demand side and by enabling the large-scale use of renewable energy. Local governments have a key role to play in this transformation.

District energy relies on mixed-use zoning and high heat demand density to be economical. The Solutions Package aims to support local governments in taking an integrated systems approach which contributes to reliability and affordability of district heating. Considering that cities have varying district energy needs and urban development circumstances, and can be in an initial or more advanced stage of the development of district energy systems, this Package integrates several complementary Solutions to address the specifics in terms of framework, market development, heat demand and local availability of energy resources.

Solutions included in the District heating Package

Planning for district heating

Implementing district heating in new developments

Implementing district heating in existing developments

Consolidating the district heating market

Retrofitting district heating systems

District heating with waste heat

District heating with cogeneration

District heating with renewable energy

Interconnected energy networks

Main benefits and long term impacts:

- Energy efficiency improvement
- Reduced fossil fuels consumption
- More reliable energy supply
- Reduced socio-economic impacts of fossil fuels' price volatility
- Increase use of local renewable resources
- Local wealth retention and economic development
- More affordable energy and consumer protection
- Additional income opportunities for the local government
- "Future-proofed" network (allows easy adoption of renewable energy and new technologies
- Air quality improvement
- Green local jobs
- Climate change mitigation

2.9 Solutions Package: District Cooling (preview)

The energy requirement for air conditioning is expected to grow an average of 7% annually in developing countries until the year 2050. In Dubai, for example, cooling represents 70% of electricity consumption. The use of district cooling enables both a smoother demand profile and tapping into energy sources which might not be viable at the scale of a single building.

The Solutions Package aims to support local governments in taking an integrated systems approach to ensure reliability and affordability of district cooling, exploring the different roles which local governments can engage in to support modern district cooling.

Solutions included in the Distict cooling Package

Planning for district cooling

Implementing district cooling in new developments

Implementing district cooling in existing developments

Consolidating the district cooling market

District heating with renewable energy

District cooling with waste heat

Interconnected energy networks

Main benefits and long term impacts:

- Lower strain on the power grid and reduced black-outs
- Reduced electricity peak demand
- Postponing the need to invest in additional capacity of the power grid to satisfy peak demand
- Decreased heat loss into the atmosphere, minimizing the urban heat-island effect
- Contribution to meeting GHG reduction targets, by reducing direct and indirect emissions

LAND USE

2.10 Solution: Urban infill development

Urban infill development is a type of urban intensification addressing construction and land development within a built-up area or existing community. This includes building on vacant or underutilized spots, and the reuse of old or blighted sites and buildings. Urban infill development approaches are motivated by the need to counteract urban sprawl and the underutilization of existing sites and buildings which include the following associated negative impacts:

- Social exclusion: poor access to services and amenities, abandoned or vacant sites cause safety, aesthetic and walkability concerns, and pose harm to well-being and health.
- Economic losses: an insufficient tax base, coupled with the high cost of spreading out infrastructure, increases resource consumption and longer traveling distances.
- Environmental degradation and poor resource efficiency: increased pollution, CO_2 emissions and reliance on fossil fuels, loss of agricultural land or green space, loss of natural habitat and ecological communities, etc.

Main benefits and long-term impacts of this Solution include:

- Compact, strengthened and more vibrant urban fabric
- Reduced need for building new infrastructure and optimized efficiency of existing infrastructure
- Potential for regeneration of neglected neighborhoods for increased safety and services assess
- Improved local economic growth opportunities and access to jobs
- Increased tax base
- Potential for demand-driven development of mass transit prompted by critical density
- Improved walkability and accessibility
- More efficient use of existing urban land and conservation of agricultural land and green space
- Reduced energy consumption and GHG emissions due to a more compact urban built environment
- Conservation of green field land

Exclusive sneal-peek: "reality-check" – success factors

Success Factors

- **Implement policies to remove barriers to urban infill** such as streamlining of the development approval process via fast-track permitting, negotiating with and incentivizing developers to engage in urban infill projects, and promotion of participatory planning and design processes.
- **Meaningfully engage stakeholders and community members** to ensure the project design and function are sensitive to community needs, secure community buy-in and prevent opposition.
- **Target and guide meaningful urban infill development,** such as in abandoned, underutilized or run-down lots and buildings in neighbourhoods in need of enhanced community services, increased density, mixed-use building typologies, and more vibrancy.
- **Balance community needs and market dynamics.** Exercise a balanced and strategic approach to urban infill projects.

To learn more visit Urban Infill development Solution online:
http://www.solutions-gateway.org/solution?code=9

Case study: San Diego, California

Transportation and environmental impacts of infill versus greenfield development: a comparative study

Approach:
The benefits of urban infill development by comparison with green field development are demonstrated and quantified in a comparative case study analysis developed by the United States Environmental Protection Agency and the Urban and Economic Development Division, using scenarios and modeling.

Results:

- Travel would be more convenient and cheaper with the infill site:
  - Average drive-alone trip times: −48%
  - Congestion within one mile of the infill site: −75%
  - Average travel costs: −42%
  - Per capita vehicle miles traveled: −48%
  - Auto use as a percentage of all trips: − 11%
- Public infrastructure expenditures would be lower for the infill site:
  - Infrastructure costs per dwelling: −90%
  - Travel externality costs: −48%
- Environmental impacts would be lower with the infill site:
  - Saving 160 acres of open space compared to the greenfield site
  - Greenhouse gas emissions with the infill site: −48%
  - Ozone (smog) precursor emissions: NO_x −51% and VOC −43%.

Source: In www.epa.gov

CROSS SECTORAL

2.11 Solution: Sustainable Public Procurement (SPP)

Government and utility related expenditures have a significant influence on the economy. In the European Union (EU) every year approximately 20% of GDP is spent on public procurement by different levels of government (national and sub-national). Procurement can stimulate sustainable development by increasing the demand for more sustainable goods, works and services available on the market. It can also help achieve financial savings by considering not just the acquisition costs, but also the running costs of equipment and projects. Sustainable public procurement (SPP) is the act of purchasing products, services and works with the lowest environmental and highest positive social impacts throughout their life-cycle.

SPP measures can be adopted at different levels. For example, by minimizing the need to purchase, by targeting one specific product type or service, or by going as far as setting a comprehensive sustainable procurement policy that requires integrating environmental and social aspects into all procurement of goods, works and services. This Solution seeks to support local governments on their path towards putting in place a comprehensive sustainable procurement policy.

The main benefits and long-term impacts of this Solution are:
- Increased effectiveness and financial sustainability of local government operations
- Stimulated green economy
- Driving innovation
- Reduction of environmental impacts of products and services throughout their life cycle
- Reduced negative impacts of unsustainable consumption
- More efficient use of natural resources
- Reduction of waste production
- Enhanced social responsibility
- Increased transparency and improved public image
- Reduction of greenhouse gas emissions.

Take an inside look at the "resources" section!

The resources section of each Solution contains elements that further support the implementation of the Solution including selected case studies, references and further reading, as well as other resources such as calculators, guides and standards.

Examples of recommended resources:
- **Sustainable Procurement Resource Center (SPRC) – operated by ICLEI European Secretariat, the SPRC has a variety of online resources:**
  - **Tools and guidance**
  - **Good practice cases**
  - **Projects and initiatives**
  - **Studies and Reports**
  - **Policies and Strategies**
  - **Procurement criteria**
- **The Procura+ Manual – Provides clear guidance on how to implement sustainable procurement in practice, regardless of the size or level of experience of the public authority. It contains general information on management, cost and legal factors, as well as key criteria for product groups with high sustainability impact. Available in several languages.**
- **Local Authority Environmental Management and Procurement (LEAP) toolkit – developed under the LEAP project funded by the European Commission (2003–2006).**
- **Guidance for the verification of green claims – A useful guide for assessing when green claims are genuine: Green Claims Guidance – Department for Environment, Food and Rural Affairs, UK.**

To learn more visit Sustainable Public Procurement Solution online:
http://www.solutions-gateway.org/solution?code=11

Case study: Vienna, Austria

Vienna's sustainable new hospital

Approach:
The Vienna Hospital Association's new North Hospital Project was developed following green public procurement principles. The City Sustainability Charter was developed for the project, detailing criteria for each stage of the hospital's planning (2006–2010) and construction (started in 2012).

Results:
- Energy demand was reduced below current minimum legal requirements:
  - energy demand for heating was reduced by 25%
  - energy for cooling was reduced by 20%.

Source: In case study available at www.ec.europa.eu

Case study: Cascais, Portugal

Purchasing energy-efficient outdoor lighting in Cascais

Approach:
In 2005, energy consumption for public lighting in the municipality of Cascais represented 79% of total electricity consumed by the local government. In preparation of a purchase tender for energy-efficient outdoor lighting, the Municipality of Cascais undertook a market engagement and consultation process of suppliers of light emitting diodes (LEDs) with one-to-one meetings. This contributed to defining selection criteria, technical specifications and economic criteria for awarding the contract.

Results:
- Cascais' new energy efficient lighting system is expected to reduce emissions by 34,600 kg of CO_2 / year.

Source: In case study available at www.ec.europa.eu

LOCAL GOVERNMENT OPERATIONS

While all the Solutions and Packages included in the Solutions Gateway have a direct relation to usual roles and mandates of a local government, some action areas are highlighted that are typically part of local government operations, such as:

- Sustainable Public Procurement (SPP)
- Water-loss reduction in the urban water supply
- Energy-efficient urban water supply
- Storm water management at city-scale
- Integrated solid waste management
- Urban transport performance measurement
- Solar hot water for municipal building
- Natural refrigerants in municipal building cooling system

Case study: City of Saint John, Canada

Municipal Energy Efficiency Program (MEEP)

Approach:

Comprehensive energy audit on corporate buildings Municipal Energy Efficiency Program (MEEP) initiated in 1996:

- Performing energy audits and feasibility studies
- Energy retrofit projects, e.g.: lighting and Heating, Ventilation and Air Conditioning (HVAC) systems
- Energy Management Control System (EMCS) tools for monitoring
- Staff training and awareness programs

Results:

- As of 2011:
  - energy retrofit projects implemented in 90 corporate buildings and facilities
  - energy savings in buildings and facilities: 16%, 15 million kWh
  - cost savings: over $1.8 million
  - GHG emissions reduced: −6,300 tonnes annually
- MEEP is recognized as a provincial and national best practice

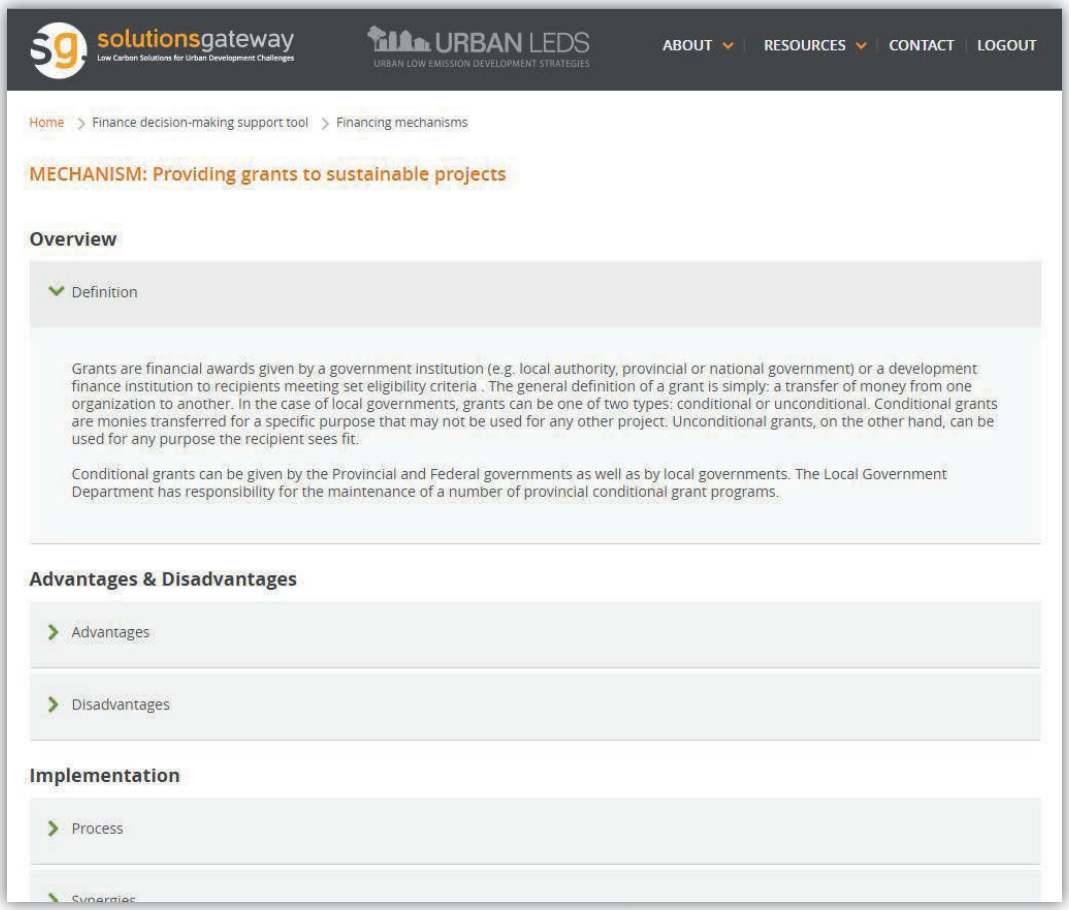
Source: In PCP 2012 report, ICLEI Canada

3. Finance Decision-making Support Tool

In addition to the funding and finance guidance included online in each Solution, to support the local government in the earlier stages of identifying, screening and prioritizing projects, the Solutions Gateway also provides a **Finance Decision-making Support Tool**.

This tool helps local governments identify possible financing options to implement selected projects and realize their Low Emission Development Strategy, considering the local circumstances and replies provided by the user.

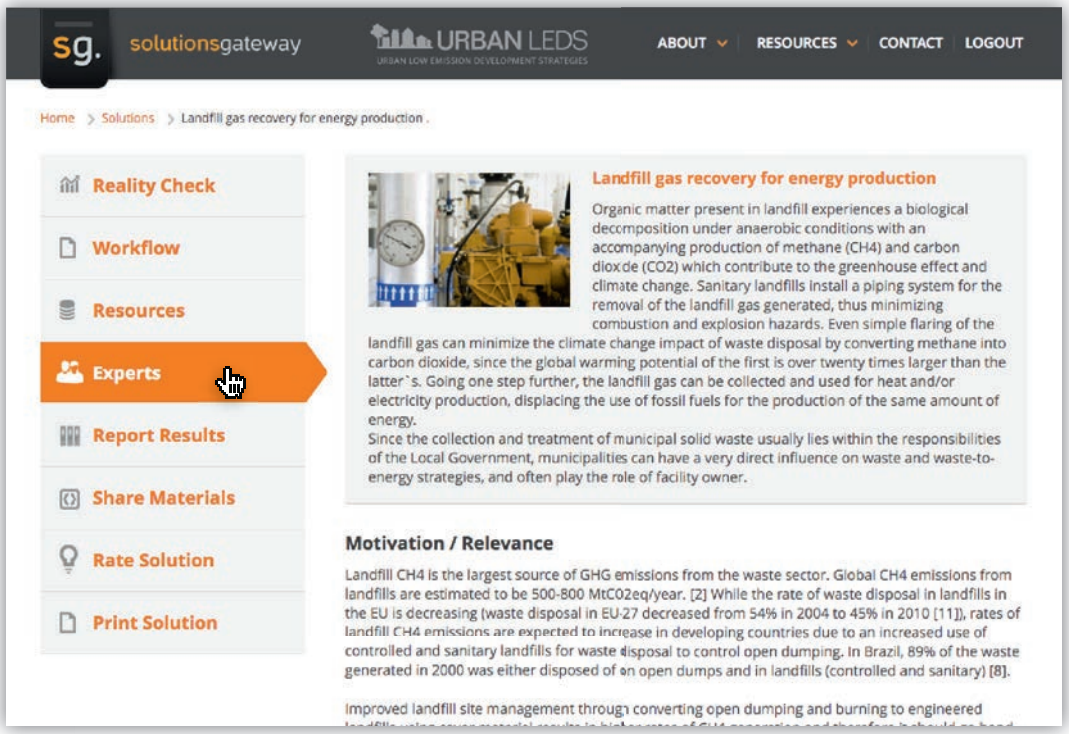
To gain access, register and login for free.

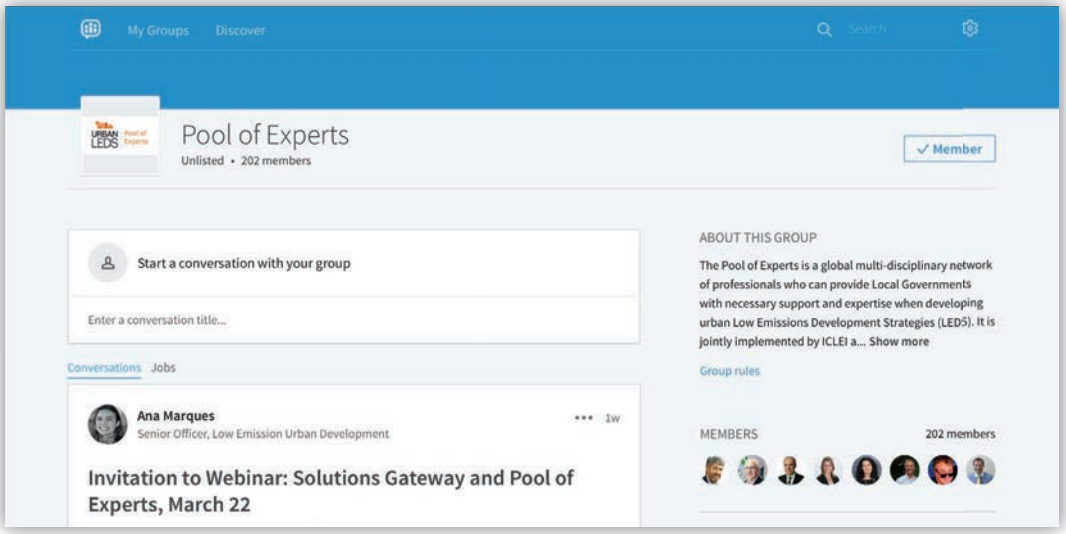


4. Pool of Experts

The Pool of Experts (www.linkedin.com/groups/6731874) is a global multi-disciplinary network of professionals, who can offer expertise in LED to local governments – from strategies to technical sectoral support, from financing projects to capacity building.

Joining the Pool of Experts **is free and open to experts** from business, industry, non-governmental organizations, research and academia, as well as experts from local, subnational and national governments. The Pool of Experts has been established as a closed LinkedIn group (use your existing profile or create one).





URBAN LEDS
URBAN LOW EMISSION DEVELOPMENT STRATEGIES

solutionsgateway
Low Carbon Solutions for Urban Development Challenges

Solutions Gateway:
low emission solutions for urban development challenges

- Advanced guidance on urban low emission development
- Aligned with local government mandates
- Based on proven practices and technologies
- Developed by experts and peer-reviewed
- Integrated approach to maximize results, including enabler and multiplier actions
- Centralized resources to support implementation at local level
- Linked to Finance Decision-making Support Tool
- Connected to the Pool of Experts

Register for the Solutions Gateway today

If you work for a local government, register now to gain full access to the Solutions Gateway's wealth of information and guidance. We also invite you to share your city's best practices and add experts to the Pool of Experts. To gain full access to contents and functionalities, register and login here: www.solutions-gateway.org/login.

Start exploring!
www.solutions-gateway.org

Contact Us:

ICLEI World Secretariat

Kaiser-Friedrich-Str. 7
53113 Bonn
Germany

E: urban-leds(at)iclei.org
W: www.urban-leds.org