ICLEI Local Governments for Sustainability

100% RENEWABLES CITIES & REGIONS ROADMAP

Supported by:

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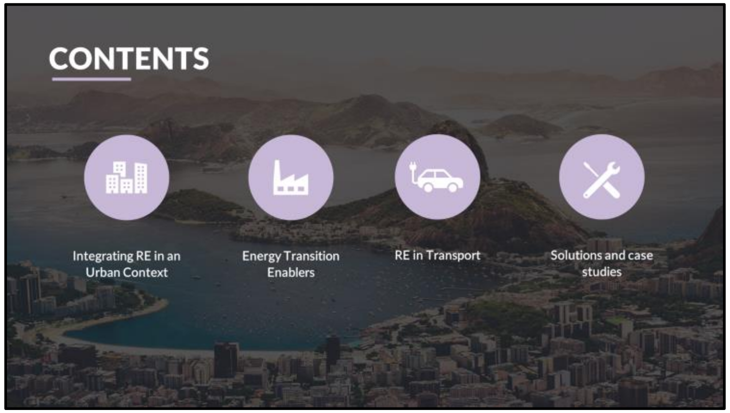
IKI INTERNATIONAL CLIMATE INITIATIVE

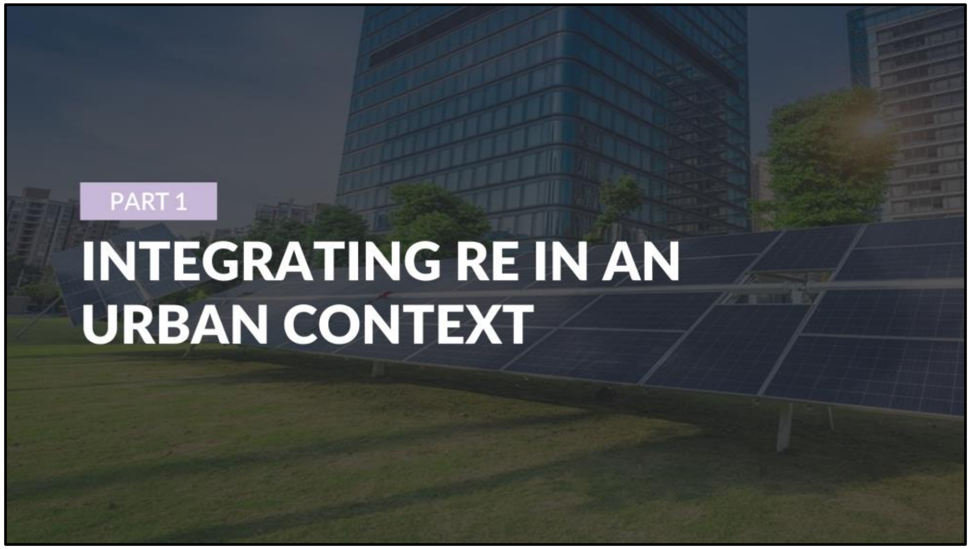
CAPACITY BUILDING MODULE: RENEWABLE ENERGY TECHNOLOGIES

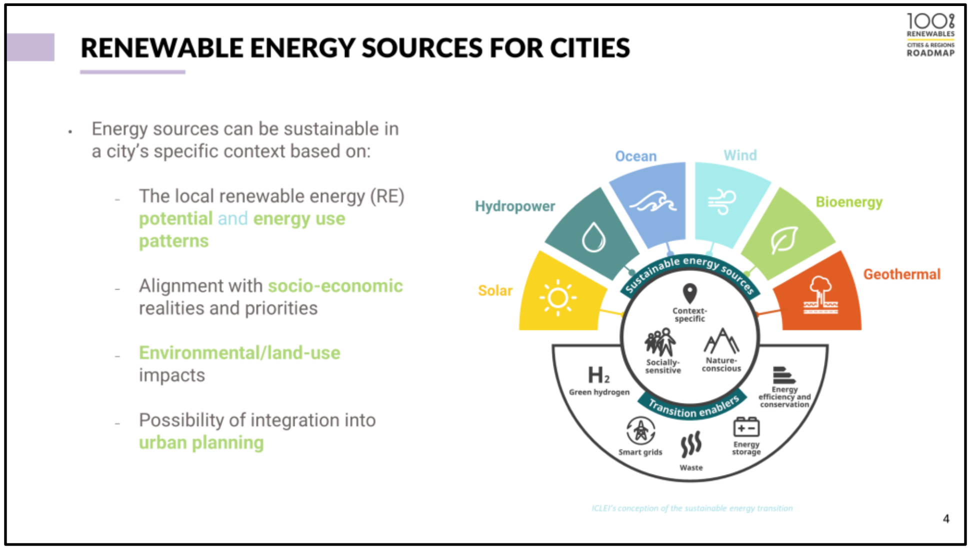


Introduction to 100 % Renewables Cities & Regions, ICLEI's Sustainable energy position
Why renewables, Global status of renewables in power capacity growth & power capacity expansion

Introduction to the solar energy:
Energy from the sun, Solar energy received on earth, sun path geometry, radiation distribution on earth surface, peak sun hours, global horizontal irradiation

Introduction to solar photovoltaic (PV) systems: Solar PV cell operation, key milestones in history of PV technology, Solar PV cell current voltage characteristics, solar cell parameters, solar cell – module – PV panel – PV array, available technologies, linear vs non-linear PV module, area required by technology, technical specifications of PV module, standard test conditions and normal operating cell temperature, working of PV module with varied radiation and temperature.


PART 1
INTEGRATING RE IN AN URBAN CONTEXT



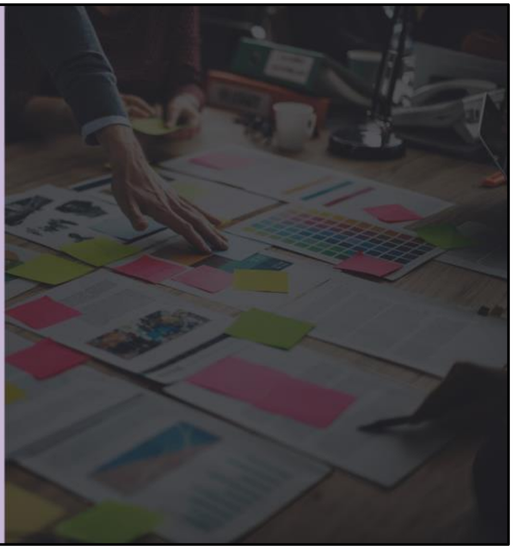
Sustainable energy resources contextualized to the local (city) refers to the idea of identifying and utilizing renewable energy sources in a specific city or urban area in a way that suits its unique characteristics, needs, and resources. Building on the definition of sustainability, a resource is sustainable if its present use does not compromise its use in the future.

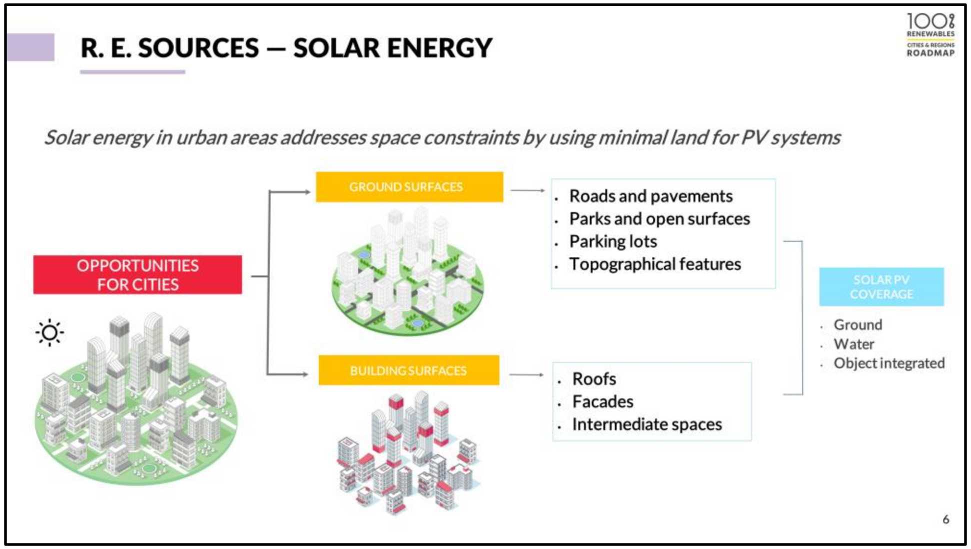
For example, in a water-stressed city, rain-dependent hydropower may not always be sustainable. But wastewater could potentially be. Similarly, not all biomass may be sustainable if its use requires excessive clearing of forests; but agricultural waste could be one such potential resource.

This involves finding out which renewable options, like solar or wind power, work best based on factors like local climate and infrastructure. Then, these sources are integrated into city planning and development, considering local challenges and opportunities. The goal is to create environmentally friendly energy systems that meet the city's needs while reducing pollution and adapting to climate change. Urban design that incorporates the characteristics of renewable technologies, as well as finds synergies between planning needs and energy, e.g. use of water features and floating photovoltaics, building-integrated solar PV, etc.

SOLAR ENERGY

*How can **solar energy** be leveraged as a viable and effective option for integrating renewable energy into urban environments?*





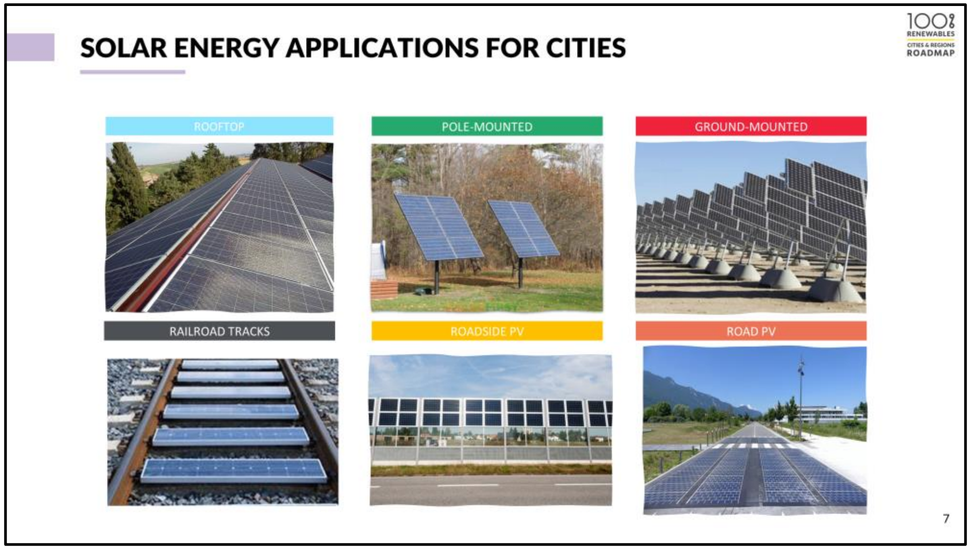
Solar energy in urban areas addresses space constraints by using minimal land for PV systems. It promotes sustainability, reduces emissions and improves energy resilience. However, urban solar planning faces challenges such as the complexity of spatial analysis, regulatory barriers and financial constraints, and requires collaborative efforts for successful implementation and realization of benefits.

Ground surfaces:

1. Roads and pavements: Large, open areas suitable for installing solar panels, especially where shading is minimal.
2. Parks and open spaces: Green areas with fewer obstructions that receive ample sunlight throughout the day.
3. Parking lots: Large, flat areas that are often underutilised and offer opportunities for solar panel installation.
4. Topographical Features: Natural features such as water, hills and open fields that provide unobstructed access to sunlight.

Building Surfaces

1. Roofs: Horizontal surfaces that cover buildings, often used for solar PV deployment due to the amount of space available.
2. Facades (Walls): Vertical surfaces that can be fitted with solar panels, feasibility depends on orientation and shading.
3. Intermediate spaces:Areas within buildings such as balconies, awnings and courtyards that offer additional opportunities for solar energy generation.



Imagine a world where solar panels are seamlessly integrated into our environment, harnessing the sun's energy in ingenious ways. They adorn rooftops, converting sunlight into electricity for homes and businesses, all while reducing our carbon footprint. But the innovation doesn't stop there. Journey further, and you'll find pole-mounted solar arrays, elegantly reaching towards the sun, efficiently generating power in open spaces. Explore ground-mounted installations, spanning vast areas, a testament to our commitment to clean energy, collecting solar power on a larger scale and contributing to our renewable energy goals. Urban architecture takes sustainability to the next level with building-integrated PV systems, turning sun-kissed glass facades into energy generators, reducing our reliance on traditional sources. Now, meet bifacial solar panels, capturing sunlight from above and reflected light from the ground, maximizing energy output in an artful manner. As your exploration continues, prepare to be amazed by floating solar PV, panels atop water surfaces, turning reservoirs, lakes, and the open sea into power-generating platforms, a promise of sustainable energy from unexpected spaces. This diverse range of solar technologies, from rooftops to ground-mounted, building-integrated to bifacial, even floating solar PV, illustrates our commitment to cleaner, greener energy. Each innovation leads us towards a brighter, more sustainable future, where the sun's boundless energy becomes our greatest ally in tackling climate change and powering our world.

SOLAR ENERGY APPLICATIONS FOR CITIES

100% RENEWABLES CITIES & REGIONS ROADMAP

TRANSPARENT

SOLAR ENERGY APPLICATIONS FOR CITIES

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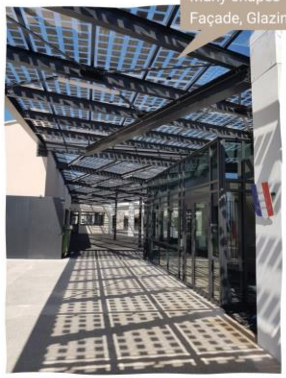
BUILDING INTEGRATED

Many shapes
Façade, Glazing



SOLAR ENERGY APPLICATIONS FOR CITIES

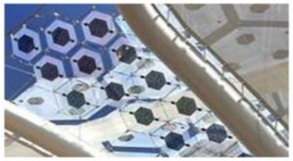
AGRO VOLTAICS

FOLDING/ROLL ON PANELS

CONTAINERIZED

FLOATING PV

ARTISTIC PV ASSET



Key impacts:
Reducing dependence on fossil fuels and greenhouse gas emissions
Promotion of sustainable energy practices and creation of local jobs
Improving air quality and grid reliability

Benefits:
Cost savings, increased building value and reduced environmental impact
Improved thermal comfort conditions and reduced energy production costs

Monitoring indicators:
Reduction in energy expenditure and greenhouse gas emissions
Increase in renewable energy production and local job creation

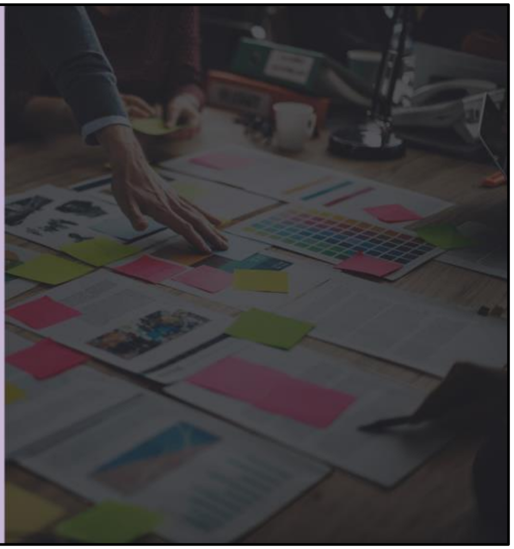
Local government roles:
Data analysis, policy making, facility operation, procurement, stakeholder engagement and provision of technical capacity.

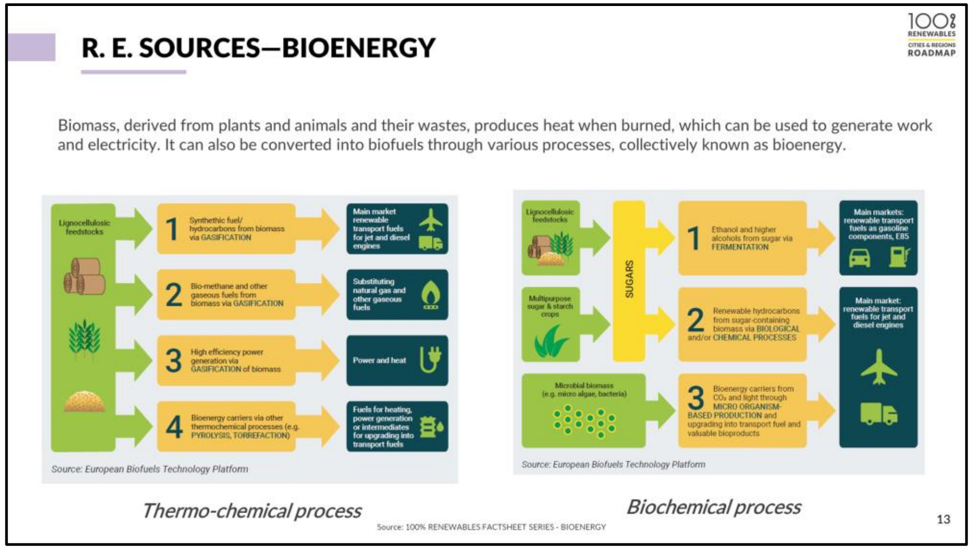
Workflow/Process Phases:
Preparation, approval, procurement, implementation and monitoring
Includes steps such as data assessment, project scoping, system installation and performance evaluation.

Case studies and additional resources for estimating solar potential and analyzing solar energy in public buildings.

BIOENERGY

What are the main applications of bioenergy as carbon neutral solutions?





WHAT IS BIOENERGY?

The organic material from plants and animals, including their waste and residue, is called biomass. Combustion of biomass releases heat. This heat can be used to generate work and electricity. Biomass can be transformed into liquid and gaseous form of fuels by various chemical and biological processes, known as biofuels. The term bioenergy is used to cover biomass and biofuels together.

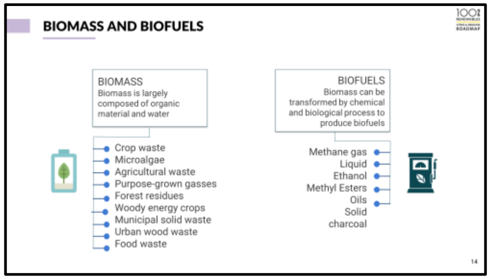
Bioenergy can be classified based on the the biological methods and the chemical processes in order to produce the fuel.

The thermo-chemical process consists of direct combustion, pyrolysis, and gasification methodologies. The figures show the flow of the process from raw material (biomass) to the end products.

The bio-chemical process consists of aerobic and anaerobic digestion, and alcoholic fermentation processes.

This technology eliminates the use of fossil fuels, helping to reduce the carbon footprint. It creates jobs and growth in rural areas, reuses resources from other operations that result in recycling and waste disposal, decreases external reliance on fuel supply, and is an efficient technology available at a reasonable price.

However, the topic of ‘carbon neutrality‘ has been addressed in recent years with regard to the products of bioenergy produced from forest biomass. Scientific opinions diverge regarding the classification of biomass as carbon neutral.



BIOMASS
Biomass is largely composed of organic material and water. It is essential that biomass is clearly assessed as either wet or dry matter mass, and the exact moisture content should be known.

-Bioenergy is a source of energy from the **organic** material that makes up **plants**, known as biomass, which originates from different sources such as agriculture, forests and waste

-These include **firewood**, cattle **dung** etc.

-Biomass contains carbon absorbed by plants through photosynthesis, and through burning, releases energy (heat) that can be used to generate work and electricity.

--Traditional biomass is useful and critical, BUT it burns **inefficiently**. Processing and upgrading it can help create a more **efficient and cleaner fuel.**

Various sources of biomass:
Crop waste, Wood energy crops, Microalgae, Municipal solid waste, Agricultural waste, Urban wood waste, Purpose-grown gasses, Food waste, Forest residues

BIOFUELS
Biomass can be transformed by chemical and biological processes to produce biofuels, i.e. biomass processed into a more convenient form, particularly liquid fuels for transport. Examples of biofuels include: Methane gas, Liquid ethanol, Methyl esters, Oils, Solid charcoal

REDUCTION IN CO_2 Emissions
Plants and trees i.e. bioenergy sources also function as a carbon sink by removing cumulative CO_2 from the atmosphere. Compared to natural forms of carbon sinks, Bioenergy Carbon Capture and Storage (BECCS) can store CO_2 for a longer time and in a stabler way if sequestered in geological formations

REPLACING FOSSIL FUELS
Bioenergy can meet the needs of transport and industry as fuel and feedstock. The potentials of bioenergy can be further harnessed through advancements in biofuel technologies to be deployed in heavy freight, shipping and aviation. Future trajectory: Heating of space and water for industrial and residential purposes,

as well as cooking

BIOGAS
This fuel can be used in cooking or to power gas lamps for lighting

Cooking and Lighting:
The biogas, once connected to a house by pipes, can be used as a clean cooking fuel
It burns more efficiently than traditional biomass, and so creates less pollution. Less fuel is required for the same amount of cooking. Less time is spent gathering traditional fuelwood.
If piped into the house, it can also be connected to gas lamps for lighting, replacing traditional lamps and kerosene
However, the appropriate stove and lamps must be purchased

INDIRECT USE
Upgrading/Purification: The methane quantity can be increased
Vehicle fuel: This biomethane can be used in natural gas vehicle.
Electricity generation: Biogas can be burned in an engine to generate electricity; biomethane could potentially be used in turbines (very large-scale operation)

UPGRADATION
Purification involves removing any impurities from the biogas, such as sulfur compounds, which can be harmful and corrosive to materials
Upgradation involves removing carbon dioxide from the biogas (usually around 25–45% of its composition), to increase the methane content to over 90%
This process can be physical, chemical, cryogenic etc.
However, all these processes are costly and energy-intensive, so may not be applicable to all biodigester setups

VEHICLE FUEL
Upgraded biogas or biomethane can be used in natural gas vehicles directly, without modifications
Gasoline vehicles can also be converted to operate on biomethane, by installing a second fuel supply system. However, this can be costly.

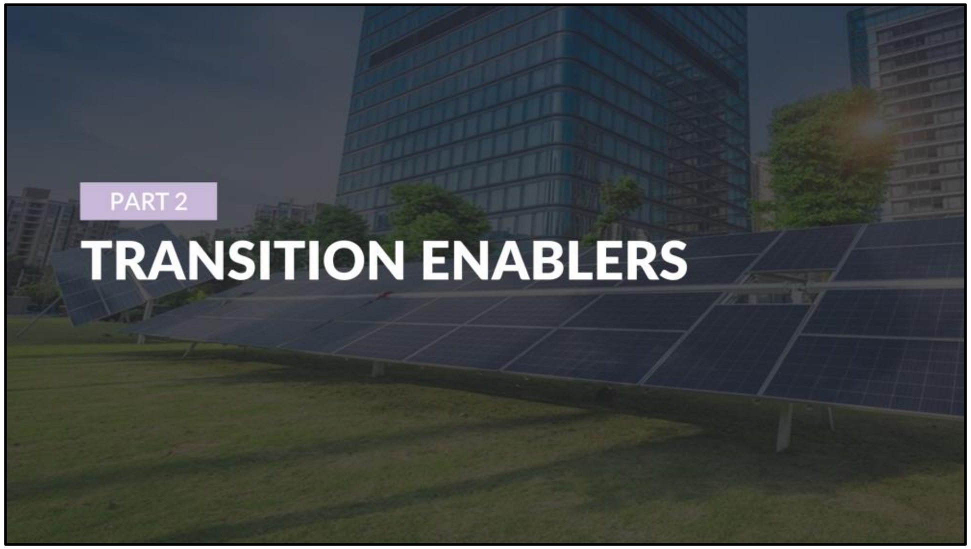
ELECTRICITY GENERATION
Biogas can be used in engines to generate electricity for small-scale operations
If upgraded to biomethane, it could potentially be used to power even larger operations
The needs of the farm can be met with this electricity, or it can be sold to the grid for additional revenue—but this can be a complicated process

Definition of co-processing
- A sustainable waste management technique that integrates municipal solid waste into industrial processes

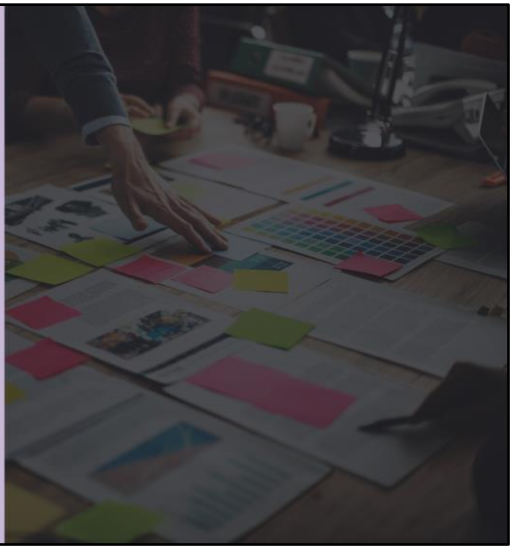
Benefits and opportunities for cities
- Environmental benefits:
  - Reduces reliance on landfill, minimises methane emissions
  - Reduces greenhouse gas emissions through resource recovery
- Economic benefits:
  - Cost-effective waste management solution
  - Generates revenue through resource utilisation
- Social benefits:
  - Improves public health by reducing pollution and promoting cleanliness
  - Creates employment opportunities in the waste management and recycling sectors

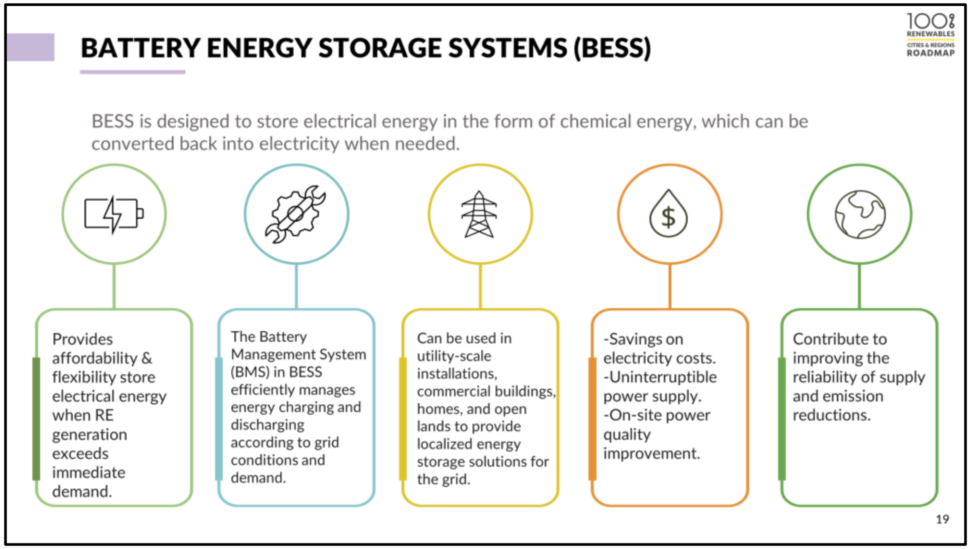
Role of local governments
- Policy development:
  - Formulate regulations that promote co-processing as a sustainable waste management practice
  - Provide incentives for industries to adopt co-processing techniques
- Infrastructure development:
  - Establish infrastructure for waste segregation, collection and transport
  - Facilitate partnerships between municipalities and industry for co-processing facilities
- Awareness and education:
  - Educate citizens about waste segregation and the importance of co-processing
  - Conduct awareness campaigns highlighting the benefits of co-processing for sustainable urban development.

Case studies
- Highlighting successful implementation of co-processing initiatives in cities
- Present the environmental, economic and social benefits achieved
- Discuss lessons learned and best practices for replication in other urban settings


PART 2
TRANSITION ENABLERS

ENABLERS:
ENERGY STORAGE





Renewable Energy is intermittent and variable, Load Management is crucial. BESS is designed to store electrical energy in the form of chemical energy, which can be converted back into electricity when needed. Purpose: Storing excess energy generated from renewable energy (RE) during periods of low demand & release it during peak demand when RE generation is low.

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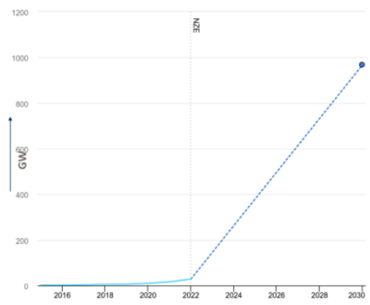
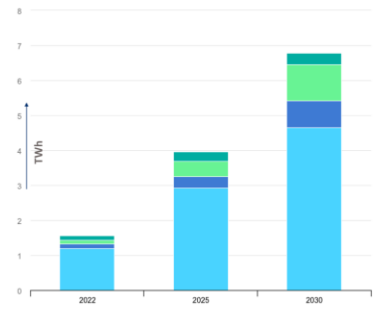
GLOBAL STATUS OF BESS



Source: IEA, 2023



Source: IEA, 2023

Global installed grid-scale battery storage capacity is expected to reach up to 967 GW by 2030 under the net zero scenario

A significant and progressive increase in Lithium-ion battery production. It is expected to increase from 1.57 TWh in 2022 in 2030.

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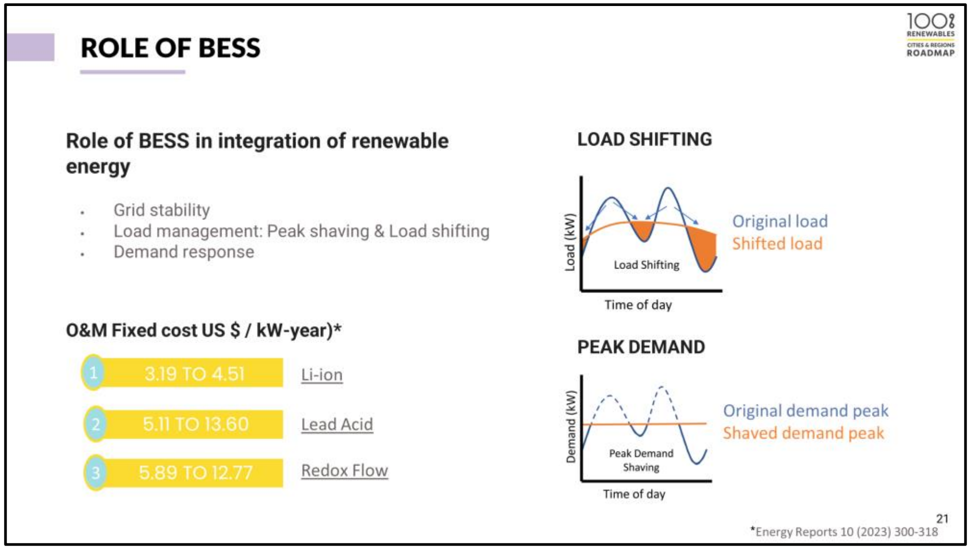

Purpose: Storing excess energy generated from renewable energy (RE) during periods of low demand & release it during peak demand when RE generation is low.

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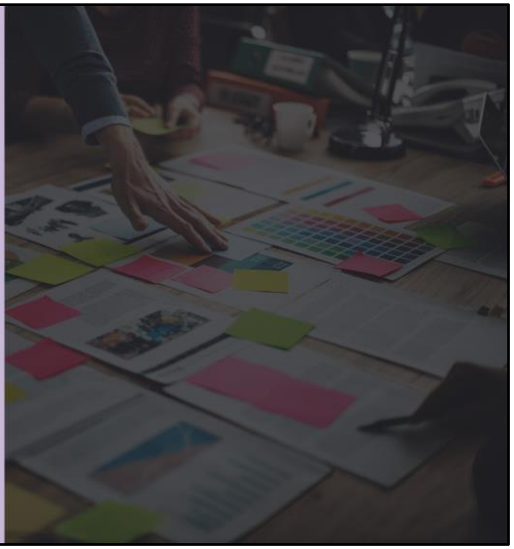
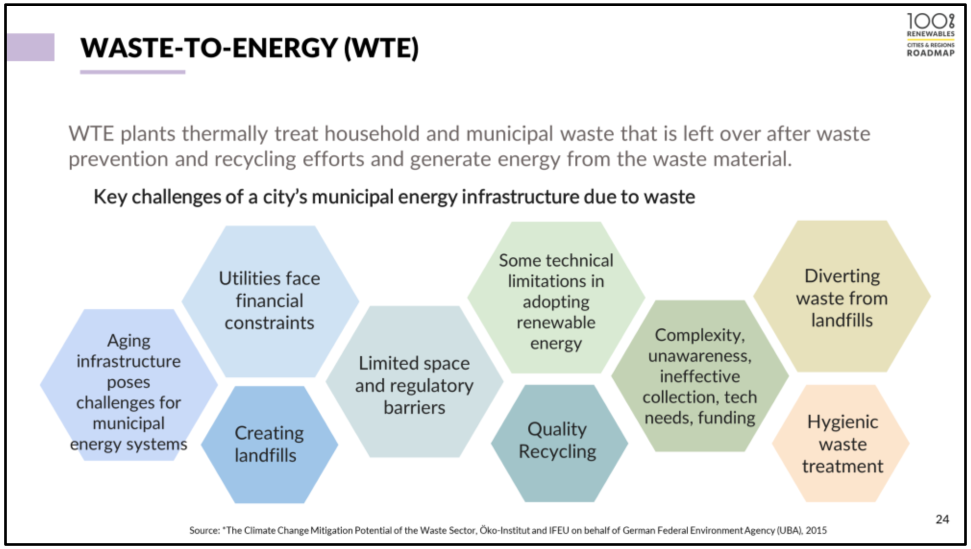
Grid stability: BESS enhances grid stability by providing fast-response energy storage capabilities that help regulate voltage and frequency fluctuations, maintain grid balance and support system reliability. They serve as flexible assets that can quickly inject or absorb power to mitigate imbalances caused by sudden changes in renewable energy output or unexpected spikes in demand.

BESS APPLICATIONS

ENABLERS: WASTE





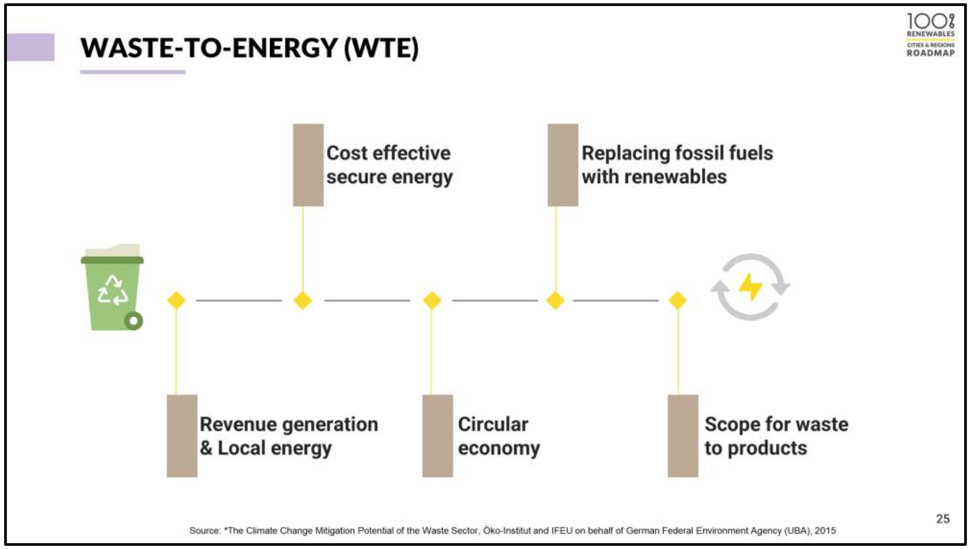
Diversion from landfill is the main contributor to GHG mitigation in the waste management sector* Waste is a useful resource, most of which goes into landfills, Municipal waste from landfills need to be addressed in order to:

-protect soil and groundwater from contamination

-prevent micro-plastics from being blown into seas and rivers

-avoid the creation of methane – a potent greenhouse gas

-harness the material and energy content of residual waste



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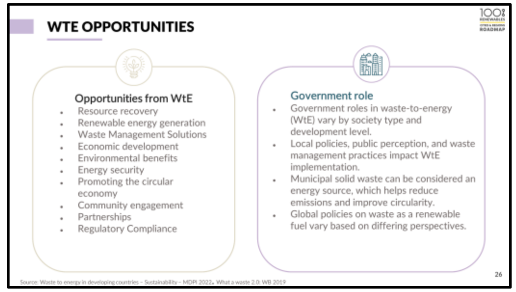


Daily per capita waste generation will increase by 40% for developing countries by 2050 [WB]

Total waste generation by 2050 in SSA 3X and SA 2X. About three-fourths of waste in SA is openly dumped. Significant portion is organic (51.6%), offering potential for energy conversion.

Need to increase the share of renewable energy sources. Global waste crisis due to untreated and unsafe disposal, exacerbated by inefficient waste collection.

Population growth and urbanization are major contributors to escalating waste generation.

Waste management operations are complex and costly, consuming significant municipal budgets.

Link to Sustainable Development Goals (SDGs):

Waste generation and management is directly linked to SDG-12 (responsible consumption and production) and SDG-13 (climate action).

Untreated waste leads to air pollution, health problems and adverse climate impacts, impacting SDG-3 (health and well-being) and SDG-7 (affordable and clean energy).

Waste-to-energy (WtE) technology offers a promising solution to the waste crisis.

Various WtE methods, including incineration and anaerobic digestion, can generate electricity and reduce greenhouse gas emissions.

The benefits of WtE include job creation, efficient waste management and a contribution to sustainable development.

However, the uptake of WtE is limited in developing countries, where untreated waste is a major source of air pollution.

Opportunities:

Resource recovery: Extracting valuable resources from waste streams.

Renewable energy generation: Producing electricity, heat or biofuels in a sustainable way.

Waste Management Solutions: Effectively divert waste and reduce pollution.

Economic development: Job creation and infrastructure investment.

Environmental benefits: Reducing emissions and promoting sustainability.

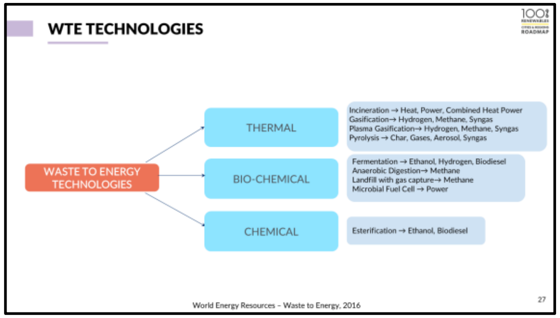
Energy security: Diversifying energy sources and increasing resilience.

Promoting the circular economy: Closing the waste management loop.

Community engagement: Educating residents about sustainable practices.

Partnerships: Work together for innovation and investment.

Regulatory Compliance: Effectively comply with waste and energy regulations.

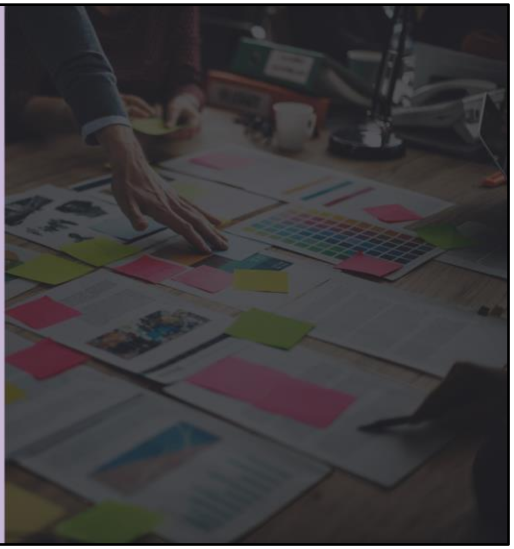


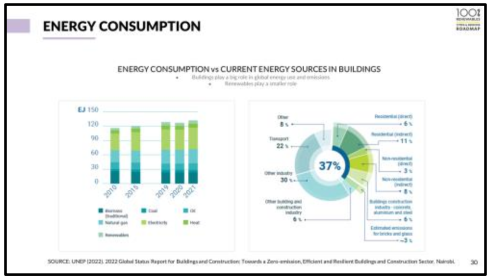
1. Digestion (AD):Converts organic waste into biogas and fertilizer through microbial breakdown in an oxygen-free environment.
2. Gasification: Heat-driven process that converts carbonaceous materials into synthetic gas (syngas) for electricity or biofuel production.
3. Pyrolysis: Thermal decomposition of organic materials at high temperatures in the absence of oxygen, yielding bio-oil, gas, and char.
4. Plasma Gasification: Uses high-temperature plasma arc to convert waste into syngas and slag, offering high efficiency and minimal emissions.
5. Mechanical Biological Treatment (MBT): Integrates mechanical and biological processes to separate, recycle, and stabilize organic waste.
6. Thermal Depolymerization: Breaks down organic materials under high heat and pressure to produce synthetic crude oil, methane, and other valuable byproducts.
7. Chemical Recycling: Converts plastic waste into chemical feedstocks or fuels through depolymerization or pyrolysis.
8. Hydrothermal Processing: Utilizes high-temperature, high-pressure water to convert organic waste into biocrude, biochar, and gas.
9. Microbial Fuel Cells (MFCs): Generates electricity by harnessing the metabolic activities of microorganisms in organic waste.
10. Advanced Incineration Technologies: Incorporates advanced flue gas cleaning systems, energy recovery mechanisms, and emission controls for cleaner and more efficient incineration.

- Zero Waste Energy Development, led by local companies GreenWaste Recovery and Zanker Resource Recovery, is working with the City of San Jose.
- The project aims to establish the first of its kind dry fermentation anaerobic digestion and in-vessel composting facility.
- The facility will use advanced KompoFerm© technology, which is exclusively licensed to ZWE USA.
- San Jose awarded Zero Waste Energy Development a 15-year contract to process all commercial organics.
- The facility is expected to process more than 270,000 tones of organic waste per year, diverting it from landfills.
- Goals include contributing to economic development and reducing per capita energy consumption in San Jose and surrounding areas.
- High-quality compost produced enriches the soil, while renewable biogas powers local facilities and the utility grid.
- Two state-of-the-art 2G avus 800 biogas CHP systems will be deployed, each with an annual capacity of 13,300 MW/h.
- These fully containerized systems integrate advanced MWM core engines and comprehensive gas treatment technology.

- Designed to meet stringent emission limits, the systems feature an ultra-low emission configuration and integrated SCR systems.

ENABLERS:
ENERGY EFFICIENCY AND CONSERVATION





-Energy Efficiency: It is the use of less energy to perform the same task or produce the same result. It often entails using technology that requires less energy to perform the same function.

Energy Conservation: Using less energy by adjusting your behaviors and habits

-Energy Intensity: Reveals how much energy is used to produce one unit of economic output. It is calculated by dividing total primary energy supply by the GDP.

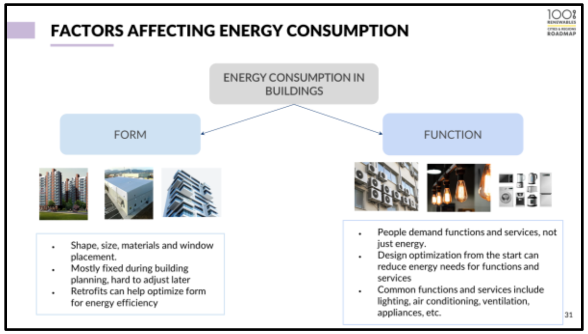
-Renewable Energy: Energy produced from sources that are naturally replenished and do not run out.

-Energy Management: It is the efficient and effective use of energy to maximize profits (minimize costs) and enhance competitive positions. The control of energy use and cost while maintaining indoor environmental conditions to provide comfort and fully meet functional needs (ASHRAE)

REF: Capehart, B.L., Turner, W.C. and Kennedy, W.J. (2012) Guide to Energy Management, Energy Management. 7th Edition, The Fairmont Press, Lilburn.

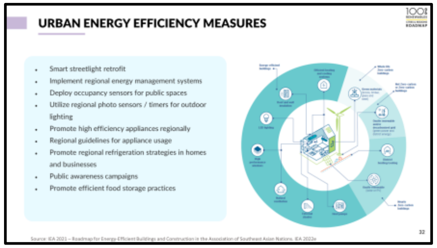
-Building energy use plays a large role in the global energy system and emissions footprint of the energy sector. The building sector, both commercial and residential consume up to 34% of the global energy produced. This energy consumption is spread across the entire life cycle of buildings from construction, to use and deconstruction. On the right chat, we can see the distribution of energy consumption in the building sector, with residential buildings taking the leading edge and non-residential buildings following – the main use of energy being electrification and heating.

Unfortunately, the energy use in the building sector is far from sustainable, looking at the sources of energy on the chat to the left. Over the past decade to date, natural gas, oil, and coal have been the most dominant sources of energy, with renewables playing a small part in supplying building energy needs. Let us see what the implications of this proportions are in the next slide.



There are mainly two key drivers of building energy consumption – i.e., form, and functions and services. Let us take a quick look at form:
Form causes energy use through shape, size, materials, window placement – it is mostly fixed (determined at the planning of the building construction) and hard to adjust at later stages, though retrofits can help in adjusting form for building energy efficiency optimization. Form enablers energy efficiency: including thermal mass, passive solar and natural ventilation.
Here we see different forms of buildings which have different energy needs, consumption and efficiency rates

Functions and services also significantly contribute to building energy consumption – and they are rather operational lasting through the operational stages of the building lifecycle. It is important to remember that people don't demand energy, they demand functions and service that are driven by energy. Building design can be optimized from the start of building design construction to ensure that some of the functions and services can run with less or no energy.
Some of the common functions and services include lighting, air conditioning and ventilation, appliance use among others.
Besides optimizing building design, providing information/awareness, and fostering behavior change practices towards sustainability can be a key strategy for reducing energy consumption through building functions and services.



- Buildings account for a significant portion of energy consumption in communities.
- Up to 30% of energy in commercial buildings is often wasted due to inefficiencies.

Low-Cost Measures

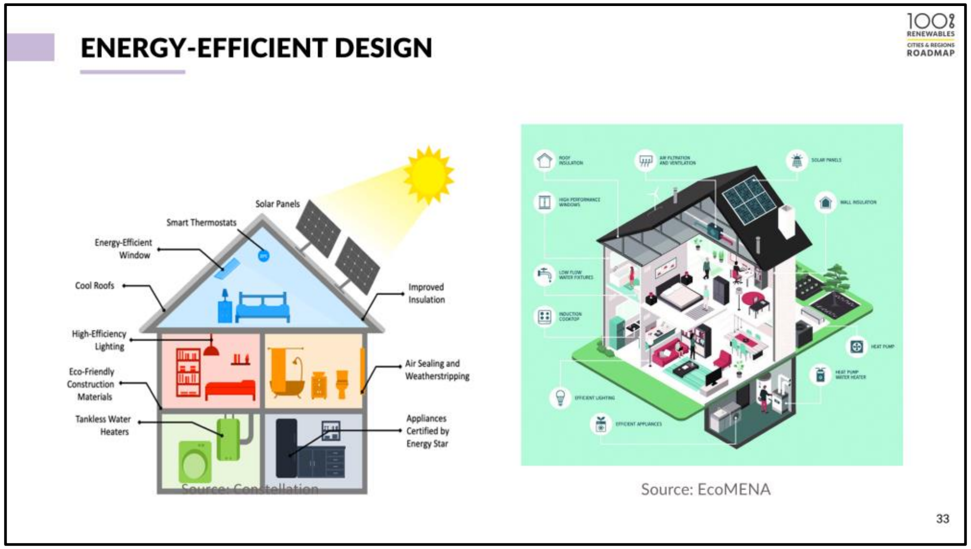
- Measure and track energy performance.
- Turn off lights when not in use or utilize natural daylight.
- Set back thermostats during unoccupied periods.
- Perform regular maintenance on heating and cooling equipment.
- Educate staff on energy-saving behaviors.

Cost-Effective Investments

- Install energy-efficient lighting systems and controls.
- Upgrade and maintain heating and cooling equipment.
- Utilize performance contracts for guaranteed energy savings.
- Collaborate with energy services providers.
- Purchase ENERGY STAR qualified office equipment.
- Implement window films and insulation to reduce energy consumption.

At Building level:

- Lighting Retrofit
- Install building management systems
- Install occupancy sensors for offices
- Photo sensors/Timers for security lights
- Check energy rating on appliances_ choose high star rating
- Position refrigerators away from cookers and direct sunlight
- Avoid frequent opening & closing of refrigerators
- Cool the food first before putting in the refrigerator and set the correct temperature



This is a demonstrative model of an energy efficient building design that demonstrates opportunities for optimizing energy efficiency in both the form and functions and services of the building. Firstly, we can see that the building generates its own energy in form of renewable energy. The we see that energy wastage is minimized and consumption reduction is highly maximized and integrated in several aspects of the building. The emphasis on eco-friendly materials also highlights and opportunity to reduce the embodied carbon in the building design. From the building sector, let us now dive a little deeper into specific aspects of building such as HVAC and Lighting, which are some of the key drivers of building sector energy consumption.

SOLUTION: ENERGY EFFICIENCY LABELING FOR BUILDINGS

Energy efficiency labeling for buildings informs homeowners, tenants, and developers about a building's energy performance to guide decisions toward energy efficiency.

Importance:

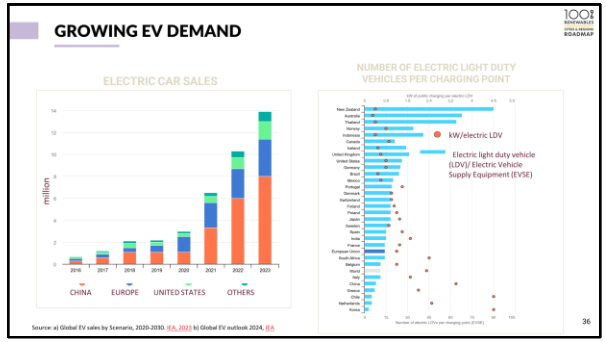
- Governments are implementing regulations to achieve energy savings in buildings to combat climate change.
- Energy efficiency labelling raises awareness and promotes adoption of efficient buildings, reducing energy consumption and emissions.

Environmental impact:

- Buildings consume a significant portion of total energy, with residential buildings alone accounting for over 20%.
- Population growth and construction demand contribute to rising energy needs.

Source: 100 % Renewables solutions package: Energy Efficiency labelling for buildings


PART 3
RE IN TRANSPORT



Importance of adopting Electric vehicles - Energy demand

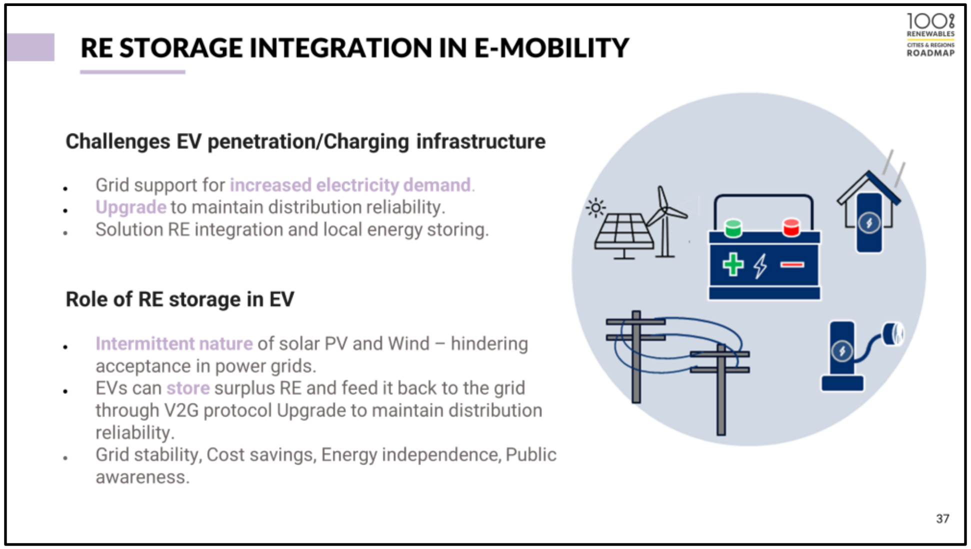
- The surge in electric vehicles is expected to eliminate the need for 5 million barrels of oil per day by 2030, reducing global oil demand by about 5%.
- This would reduce emissions by 700 million tones of carbon dioxide equivalent (MtCO2e) by the end of the decade.
- If governments meet their targets for electric vehicles and clean power generation, 770 MtCO2e of emissions would be avoided.
- This scenario would put countries two-thirds of the way towards the IEA's net zero emissions (NZE) scenario by 2050, which is in line with the Paris Agreement's 1.5°C warming target.

- Source: IEA

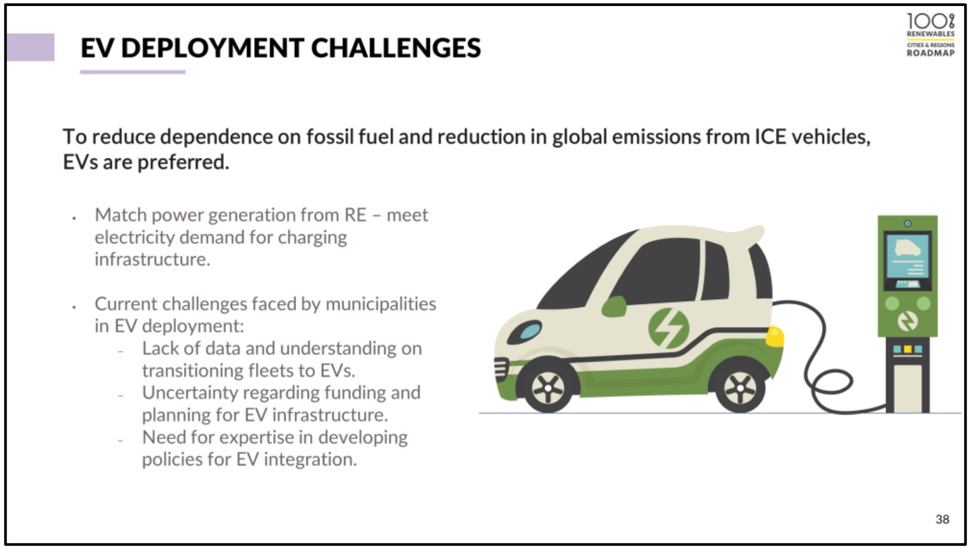
Global rise in electric vehicle adoption

- Image: Graph showing the rise in global electric vehicle sales
- More than 10 million electric cars were sold in 2022, reducing global emissions by 80 million tones of CO2 equivalent (MtCO2e), according to the IEA.
  - Sales are forecast to reach 14 million by the end of 2023accounting for 18% of global car sales in 2023.
  - China dominates the market with around 60% of global sales in 2022, followed by the US and the EU.
  - Electric car sales are expected to double to 36% of the market by 2030, according to the IEA's Stated Policies Scenario (STEPS).
- Source: IEA, Carbon Brief

PHEV = plug-in hybrid electric vehicle.
EV sales share = share of EVs (BEV+PHEV) out of total vehicles sales.
PHEV share in EVs = share of PHEV sales out of EV (BEV+PHEV) sales.
The regional breakdown of these figures by vehicle type can be interactively explored via the IEA’s Global EV Data Explorer.



Coordinating and optimizing operation of various components through control unit in the integration of Renewables – electric charging, energy storage, solar PV/wind, smart buildings, utility grid



Waste is a useful resource, most of which goes into landfills, Municipal waste from landfills need to be addressed in order to:

-protect soil and groundwater from contamination

-prevent micro-plastics from being blown into seas and rivers

-avoid the creation of methane – a potent greenhouse gas

-harness the material and energy content of residual waste

SOLUTION: RE-BASED EV CHARGING STATIONS

RE-based smart charging stations for EVs, using solar, wind, or hydro power:

- Cut GHG emissions
- Enhance energy independence
- Save costs
- Incentivize EV adoption.

Solar Energy Charging: Fastned

Role of Local Governments

- Formulating and implementing policies - support - charging stations.
- Identify suitable sites and invest in infrastructure.
- Provide financial incentives and working with the private sector.
- Educating the public and stakeholders about Evs and RE.
- Aligning efforts with broader sustainability goals and monitoring impact.

Renewable Energy Charging: EnBw

Source: 100% RE Solutions Package – RE Based EV Charging station

Growing GHG emissions– Charging infrastructure
Rapid advancements in infrastructure, transport, technology – exacerbating climate change with transport sector – major contributor
Fossil fuel dependency
Limited EV infrastructure
RE-based smart charging stations for EVs. SDG Impact: Contributes to SDGs 7, 8, 9, 11, 13 by promoting clean energy, economic growth, resilient infrastructure, sustainable cities, and climate action

Relevance

With the transport sector responsible for over 33% of global CO_2 emissions, the promotion of EMVs is crucial to reducing emissions.
EMVs contribute to achieving net zero carbon emissions by 2030, which is essential for sustainable urban development.
In terms of air pollution, EMVs support healthier lifestyles and meet WHO air quality standards.

Key impacts: Economic

EMVs offer affordability, enabling savings on education and healthcare.
They facilitate e-commerce and sustainable tourism, creating economic opportunities.
EMVs drive job creation, particularly in green sectors, and promote economic growth and resilience.

Key impacts: Social

EMVs provide accessible and comfortable transport for a wide range of people.
They increase safety, reduce accidents and improve social well-being.
EMVs provide access to services, supporting community development and inclusivity.
Key impacts: Environment and climate

EMVs reduce traffic congestion, noise pollution and CO_2 emissions, promoting sustainable urban living.
Integration with renewable energy sources enhances their low carbon footprint.
EMVs contribute to climate action and sustainable city initiatives, in line with the SDGs.

Benefits

Economic benefits include savings, income generation and market access for farmers.
Social benefits include improved health, accessibility and partnership development.
Environmental benefits include emissions reduction, climate resilience and sustainable mobility.

RE-BASED EV CHARGING STATIONS

Transport Challenges:
- Rapid technology advancements increase GHG emissions.
- Heavy reliance on fossil fuels in transport leads to CO_2 emissions.

Shift to Greener Transport:
- Global promotion of EVs for climate mitigation.
- EVs are crucial for achieving zero-emission transport.

EV Charging Challenges:
- Fossil fuel dependence persists despite EV adoption.
- Renewable energy-based charging stations (solar, wind, hydro) support cleaner energy for EVs.

Source: 100 % Renewables solutions package: RE Based EV Charging Station

Solutions.

- Total Cost of Ownership (TCO) Analysis: Implemented a comprehensive TCO analysis that highlights the long-term savings of EVs over traditional vehicles, driving procurement decisions.
- Innovative Policy: Developed and implemented the "EV first" Sustainable and Resilient Fleet Policy, setting a gold standard for green fleet policy and emphasising the procurement of electric vehicles.
- Telematics Integration: Used telematics data to inform procurement decisions, identify suitable EV replacements and optimise fleet utilisation, resulting in cost savings and efficient fleet management.
- Collaborative Procurement: Leveraged the Climate Mayors Electric Vehicle Purchasing Collaborative to streamline procurement processes, access a variety of EV options, and accelerate fleet electrification efforts.
- Strategic Infrastructure Planning: Identified prime locations for EV charging stations, executed installations with foresight and flexibility, and established a citywide charging network to support the growing electric vehicle fleet.

Results:

Cost savings: Realised significant cost savings through reduced fuel and maintenance costs associated with electric vehicles, resulting in long-term financial benefits.

Environmental Impact: Reduced carbon emissions and promoted cleaner air by transitioning to electric fleets, in line with the city's sustainability goals.

Efficiency and Innovation: Improved fleet management efficiency through telematics integration and forward-thinking policies, positioning Charlotte as a leader in sustainable transportation practices.

Equity and Inclusion: Demonstrated a commitment to equity and inclusion by prioritising policies that benefit both the environment and taxpayers, ensuring a more resilient and efficient future for all residents.


PART 4
OTHER SOLUTIONS AND CASE STUDIES

Benefits

Greater grid flexibility, Increased grid resilience, Increased deployment of distributed renewable generation, Improved access to energy, Lower energy costs for the community

Role of Local government

Policy maker, Role model, Regulator, Financial supporter, Advocator, Co-Ordinator, Planner, Service provider

100% RENEWABLES CITIES & REGIONS ROADMAP

GREEN HYDROGEN

Green Hydrogen, made through renewable energy electrolysis, is a clean and versatile energy carrier used in transport, industry, and power generation to reduce carbon emissions.

Key impacts:

- Reduced dependence on fossil fuels.
- System integration of renewable energy.
- Attracting investment.

Benefits:

- Reduced energy expenditure
- Innovation hub creation
- Decarbonization in transport and industry
- Job creation and economic development energy sector.
- Enhanced energy security

Source: 100 % Renewables solutions package: Local Strategies for Green Hydrogen

- Green hydrogen is produced by electrolysis using renewable energy sources such as wind, solar or hydroelectric power. - It's called "green" because it's produced from sustainable and clean energy, resulting in minimal or no greenhouse gas emissions. - Electrolysis splits water molecules into hydrogen (H_2) and oxygen (O_2), providing a clean energy carrier for various sectors.


ICLEI
Local Governments for Sustainability
100% RENEWABLES
CITIES & REGIONS ROADMAP
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IKI INTERNATIONAL CLIMATE INITIATIVE
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