

## Climate Resilient City and Urban Environmental Sustainability

[Bhutan]

# Location



## Country profile

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- Population: 807,610 people (2017)
- 4 major cities
- Bhutan is not only carbon neutral, but also the first carbon negative Country.
- Bhutan generates only 2.2 million tonnes of carbon dioxide (CO<sub>2</sub>), but the forest sequesters more than three times that amount which is about 6 million tonnes of CO<sub>2</sub>.
- In Bhutan, mean annual temperatures are predicted to increase by 0.8°C - 1°C by 2039.



# Cities



River system



Thimphu City



Phuntsholing City





## Profile

**Country's Population:** 807,610

Thimphu city= 126,000

Gelephu City= 41,000

Phuntsholing City= 65,000

Samdrup Jongkhar City= 37000

**Area:** 38,394 km<sup>2</sup>

**Demographic density:**

21 people per square kilometer of land area

**Height above sea level :** 210 m and above

**Human Development Index:** 132

**GDP of the country:** 2.237 billion USD \$

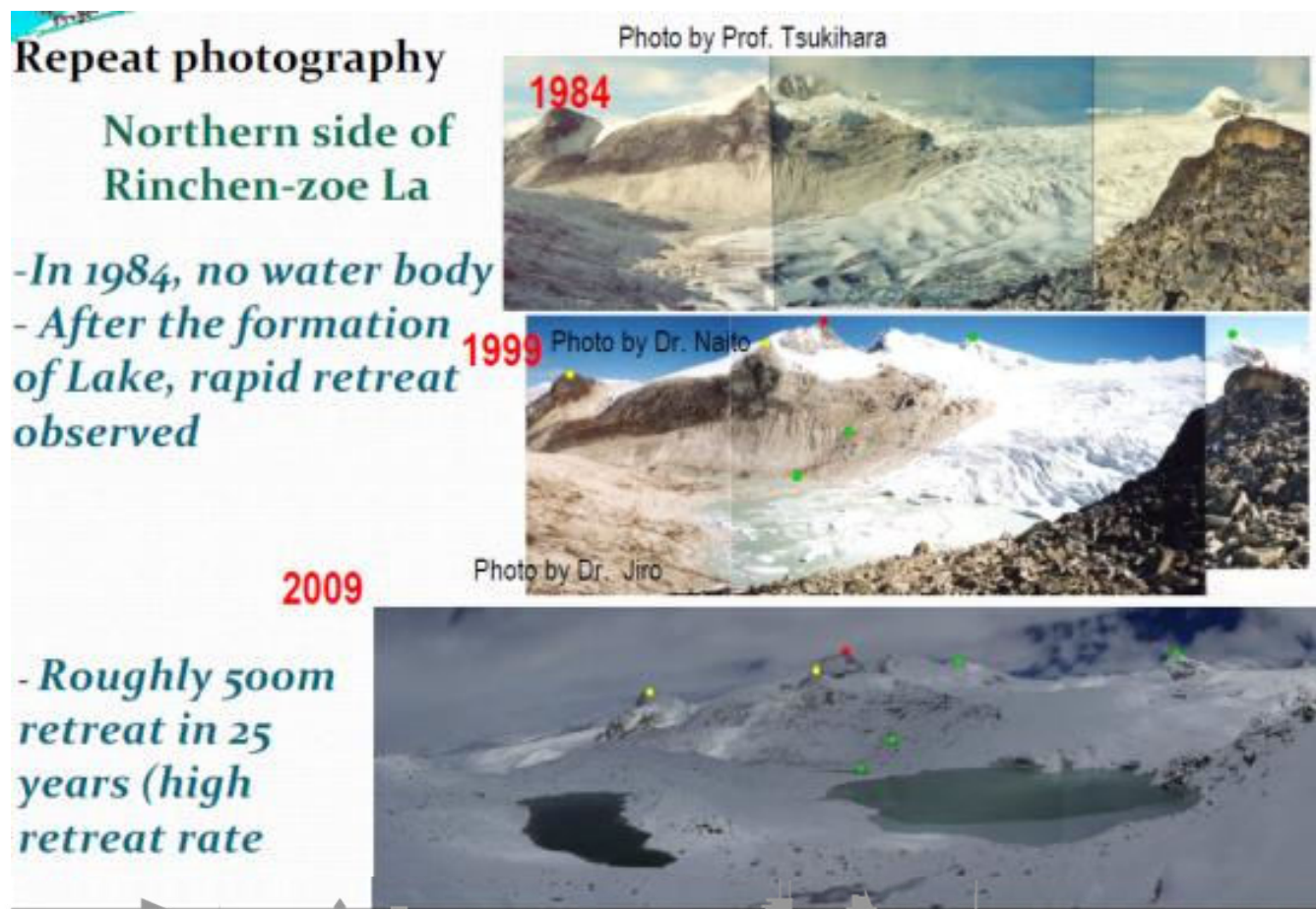
**GDP per capita:** 2804 USD \$



## Specific CCA/M and urban environment issues faced by Cities in Bhutan

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### 1. Accelerated melting of glaciers, formation of Glacial Lakes and GLOF



# Specific CCA/M and urban environment issues faced by Cities in Bhutan

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## 2. Flooding



## Specific CCA/M and urban environment issues faced by Cities in Bhutan

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### 3. Drying up of fresh water resources





# Specific CCA/M and urban environment issues faced by Cities in Bhutan

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## 4. Heat Island Effect



## Goals and Objectives

Sl. no	Issues/ Problems	goals	Objectives
1.	Accelerated melting of glaciers leading to formation of Glacial Lakes and GLOF	✓ Assess GLOF risk in Bhutan and attempt to implement adaptation and prevention measures to curb both existing and future GLOF-related risks	<ul style="list-style-type: none"> <li>✓ To reduce the emission of GHGs</li> <li>✓ To prepare for the impact of GLOF</li> <li>✓ To enhance awareness raising, mobilize effective commitment and actions through bringing together policy makers, academicians and practicing stakeholder with the aim of effectively mainstreaming glacial lake out burst.</li> </ul>
3	Drying up of fresh water resources	✓ Integrated plan to sustain the fresh water sources	<ul style="list-style-type: none"> <li>✓ To provide measures to prevent the drying of water sources</li> <li>✓ To create awareness among the people</li> </ul>
4	Heat island effect	✓ To make Bhutan cities climate resilient by increasing its adaptive capacity via Climate SMART Land Use Planning (LUP); and to promote climate resilient urban services and infrastructure	<ul style="list-style-type: none"> <li>✓ To review the Urban Development Plan for stocktaking and identifying entry points for the incorporation of land use planning components that are climate SMART (Sustainable Mitigation &amp; Adaptation Risk Toolkit);</li> <li>✓ To carry out a detailed inventory of existing urban critical infrastructure and services that would be improved for climate resilient measures.</li> <li>✓ To enhance the capacity of local Governments to plan and implement Climate SMART Cities.</li> </ul>

## Action plan

Sl. no	Issues/ Problems	Mitigation	Adaptation
1.	Accelerated melting of glaciers leading to formation of Glacial Lakes and GLOF	<ul style="list-style-type: none"> <li>✓ Bring the world together to reduce the emission of GHGs.</li> <li>✓ Encourage to go green.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Create awareness about the chances of GLOf.</li> <li>✓ Identifying the possible area which will be affected and implement measures to prevent the disaster</li> <li>✓ Comprehensive inventory of Glacier lakes.</li> <li>✓ Reduce the natural flow regulating capacity of the glaciers with serious consequences on our water resources.</li> </ul>
3	Drying up of fresh water resources	<ul style="list-style-type: none"> <li>✓ Drip irrigation/Plantation</li> <li>✓ Effective watershed management for conservation and sustainable utilization.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Sensitize on minimizing the wastage of water.</li> <li>✓ Reduce, reuse and recycle.</li> <li>✓ Rainwater harvesting</li> <li>✓ Source conservation</li> <li>✓ Ecological sanitation</li> <li>✓ Water policy</li> </ul>
4	Heat island effect	<ul style="list-style-type: none"> <li>✓ Create Parks and Open Green Spaces</li> <li>✓ Urban Forest</li> <li>✓ Promote Urban Garden</li> </ul>	<ul style="list-style-type: none"> <li>✓ Energy efficient infrastructure</li> <li>✓ Integrated Green Transportation</li> <li>✓ Green Building Codes</li> <li>✓ Smart city Planning</li> <li>✓ Install green roof or roof top garden.</li> <li>✓ Construct permeable pavements instead of concrete surfaces.</li> <li>✓ Use energy efficient appliances and equipment's.</li> </ul>

# Needs of the cities in Bhutan for urban environment sustainability

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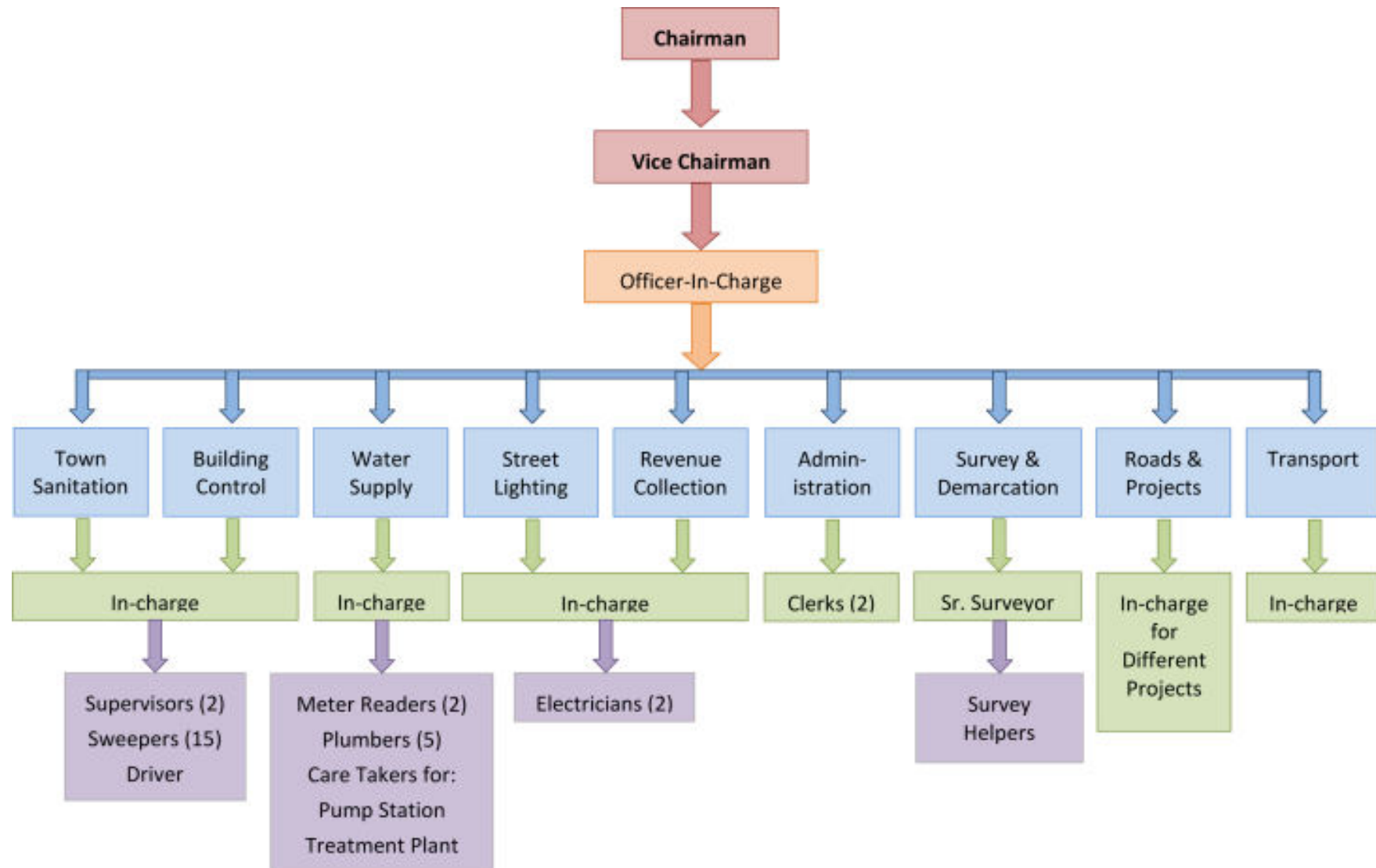
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- ✓ An ecosystem approach (Biodiversity)
- ✓ Reduced carbon footprint
- ✓ Efficient use of resources
- ✓ Green Building
- ✓ Clean air (quality) and human Health
- ✓ Sustainable Communities ( group of people, well informed, share common interest, consensual decision making)
- ✓ Economic opportunity
- ✓ Conserve green urban forests





# Institutional structure of the local Governments



# Governments initiatives

Sl. no	Issues/ Problems	Specific actions
1.	Accelerated melting of glaciers leading to formation of Glacial Lakes and GLOF	<ul style="list-style-type: none"> <li>✓ In its NDC, Bhutan reaffirmed its goal to remain carbon neutral, by ensuring that GHG emissions will not exceed the sink capacity of its forests.</li> <li>✓ Ensuring at least 70% forest cover.</li> <li>✓ Set up early warning systems for GLOF.</li> <li>✓ Flood Simulation and Hazard map</li> <li>✓ Training on Glaciological survey, Satellite data analyses, Geotec laboratory, etc...</li> </ul>
3	Drying up of fresh water resources	<ul style="list-style-type: none"> <li>✓ Proposal for the Integrated Water Resources Management (IWRM) (2016)</li> <li>✓ Integrating IWRM plans in sectoral priorities through the government's planning, budgeting, implementing, and monitoring processes</li> <li>✓ Management Plan for a priority basin, the National Irrigation Master Plan (NIMP), and to strengthen water resources governance.</li> </ul>
4	Heat island effect	<ul style="list-style-type: none"> <li>✓ Development Control Regulations.</li> <li>✓ Encouraging Vernacular approach</li> <li>✓ Giving importance for urban greens and pedestrian walkways. Eg. Transforming the exiting road way to pedestrian (Norzin lam) in the core area of the Capital.</li> <li>✓ Structure plans for different cities for urban environment management</li> </ul>



# Initiatives



Flood depth simulation



Wind mill- Energy generated 1.5 Mw



# Stakeholder Analysis

Stake Holder	Impact How much?	What is important to Stake holder?	Contribution of the Stakeholder to the Project?
National Environment Commission Secretariat	High	Prevent environmental degradation	Providing environmental information's, clearance, etc.
Ministry of Works and Human Settlement	High	Minimize risks to the urban infrastructure and human settlement	Mobilize Technical capacity and ICT based support
Ministry of Finance	High	Cost and value evaluation	Acquire Budget from within and global CCA/M organizations.
Natural Resources Development corporation Limited	High	Maintaining sustainable resources for the present and future	Supplier of natural resources as construction materials at the most affordable rates and in sustainable manner.



# Stakeholder Analysis

Stake Holder	Impact How much?	What is important to Stake holder?	Contribution of the Stakeholder to the Project?
Department of Disaster Management	Medium	Safety through disaster risk reduction	Coordinate disaster risk management at the national and local levels in coordination with relevant agencies
Local Governments	Medium	Sustainable urban environment management	Implantation and monitoring
Public	Low	Healthy environment	Active participation and community vitality

# Challenges and Opportunities

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## Challenges

- ✓ Human resources
- ✓ Technical
- ✓ Financial
- ✓ Topography

## Opportunities

- Increase the renewable energy production.
- Minimal GHGs emission- Role model
- Clean and green city
- Enhanced air quality

## Important topics for training

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- Glaciological surveys
- Land and lake surveys
- Satellite data analyses
- Flood analyses with GIS
- Soil testing in geotech Laboratory
- Flood analyses and planning
  
- Groundwater exploration
- Smart technology for water management
- Green building/ green city
- Smart city
- Environment conservation and preservation techniques





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# SWOT analysis

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Sl. no	Issues	Strengths	Opportunities	Weakness	Threats
1.	Accelerated melting of glaciers leading to formation of Glacial Lakes and GLOF	1. Torrential River Flow enabling renewable Hydropower generation	1. Capacity to produce more renewable energy. 2. Reduction in GHGs emissions	1. Shortage of water sources 2. Variation in seasonal water flow	1. GLOF 2. Drying up of Water source due to Global warming
2.	Flooding and drought	Nil			
3	Drying up of fresh water resources				
4	Heat island effect				

