

Bhutan Improves Economic Development as a Net Carbon Sink

Sana Munawar

July 2016



A publication of the Climate Institute

1400 16th St. NW, Suite 430, Washington, DC 20036

Table of contents

1.1 Bhutan: land of forests, and gross national happiness	3
1.2 The power of water.....	6
1.3 Bhutan’s low carbon development	7
1.4 Adaptation: equally essential to mitigation.....	9
1.5 Following Bhutan’s example of carbon negative development	10
Case studies	11
1.5.1 Costa Rica	11
1.5.2 Maldives.....	11
1.6 Sustainable Development Mechanism (SDM).....	13
Conclusion	14
References	14

List of figures

Figure 1: Land cover map of Bhutan for 2010	3
Figure 2: Philosophy of Bhutan’s GNH Index	4
Figure 3: Forest management strategy for climate change mitigation and adaptation	5
Figure 4: National climate change adaptation strategies.....	10
Figure 5: Conditions of sustainable development	13

List of tables

Table 1: GHG emission scenario for the year 2000.....	5
Table 2: Low carbon development strategies	8

Abstract

Lying within snow-capped mountains, the small, isolated kingdom of Bhutan shows the world how to foster a growing and carbon negative economy. Bhutan has greatly stepped up its efforts to mitigate climate change, routinely having negative yearly carbon balances. Forest reserves act as mega carbon sinks and gushing rivers provide the country an emission free power source. Bhutan's landscape certainly encourages carbon neutrality, but the nation's commitment to the environment goes beyond playing to its strengths. The kingdom actively forms nationwide action plans and implementation strategies for clean economic growth.

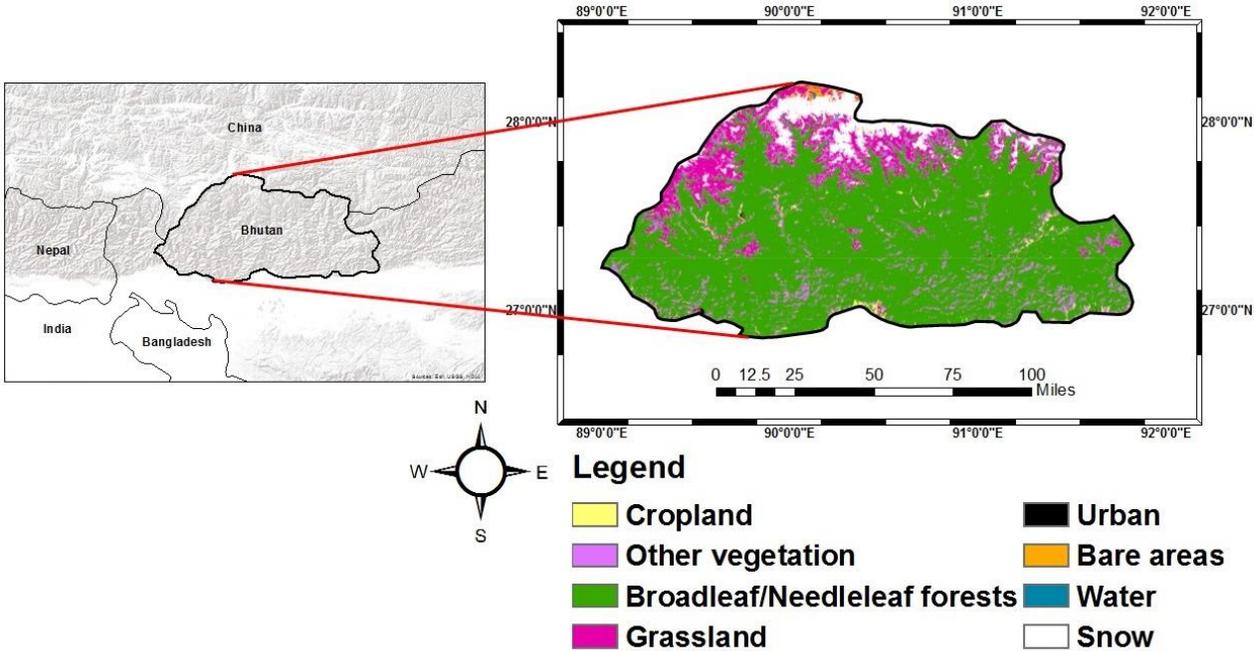


[Photo](#) by [Simon Monk](#)/[CC By 2.0](#)

1.1 Bhutan: land of forests, and gross national happiness

This landlocked country in the pocket of the Himalayas is a small, but tree-dense carbon sink (Figure 1). The rugged mountain terrain ranges from an elevation of 160 to 7000 meters above sea level. More than half (56.3%) of the population, a projected 745,000, works in the nation’s agricultural and forestry sector. Rural inhabitants compose a robust 69% of the population, but urban immigration is on the rise. The country’s second national GHG (Greenhouse Gas) inventory reports that Bhutan is a net sink for greenhouse gases. Per capita emissions total only 0.8 annual metric tons. ¹

Figure 1: Land cover map of Bhutan for 2010 extracted from Land Cover Project of Climate Change Initiative by ESA ²



Despite its economic challenges, Bhutan committed to going carbon neutral at the 2009 Copenhagen climate conference and has, to date, kept its promise. This is largely due to its vast

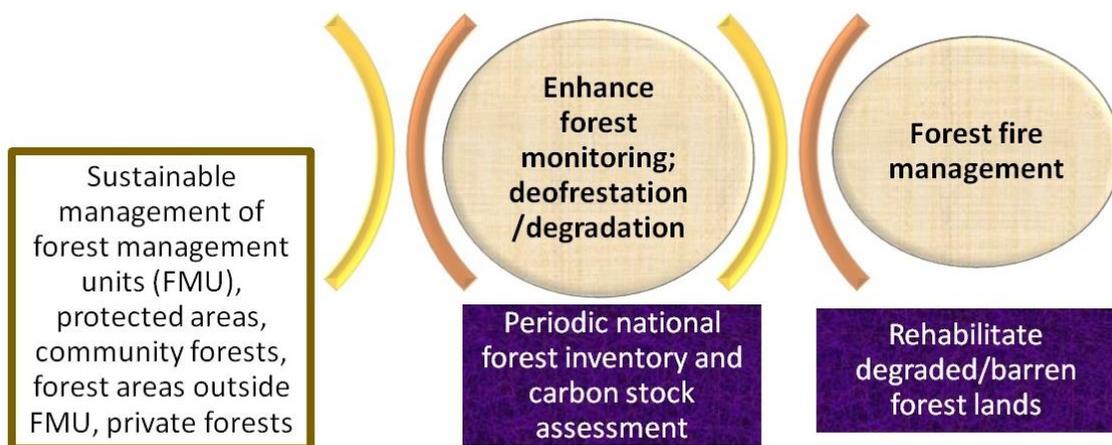
forest reserves that have the potential to sequester 6.3 million tons (Mt) of CO₂ annually, easily eclipsing the country's estimated year 2013 emission total of 2.2 Mt of CO₂ equivalent.

Figure 2: Philosophy of Bhutan's GNH Index ³



The Bhutanese believe that their national progress is tangible in terms of Gross National Happiness (figure 2), a policy that exemplifies its goal to implement a fine balance between economic growth and environmental preservation. Bhutan's constitution reflects this ideal as it requires forest area to be maintained above 60% of its original cover. As such, export logging has been banned and the government is heavily involved in reforestation and protecting existing forest cover (Figure 3).⁴

Figure 3: Forest management strategy for climate change mitigation and adaptation



The Energy and Climate Intelligence Unit’s Carbon Comparator Tool has declared Bhutan to be an “unparalleled carbon sink, absorbing three times the amount of CO₂ than its population emits” (table 1). Bhutan maintains carbon net negativity due to:⁵

- Low levels of industrial activity.
- 100% electricity generation through hydropower.
- 70.5% of land being covered by forests.

Table 1: GHG emission scenario for the year 2000 ¹

GHG sources/sinks	Total emissions (Gg)
Energy	270
Industrial processes	237
Solvents /product use	0
Agriculture	1,005
Waste	46
LULUCF	-6, 309
Total GHG Emissions, excluding LUCF	1,559.56
Total GHG Emissions, including LUCF	-4,750.04

**LULUCF: land use land use change forestry*

Despite its low level of economic production Bhutan envisions to develop organic agriculture by 2020 and zero-waste agriculture by 2030. It is easy to conceptualize organic farming in Bhutan because of its already minimal use of agrochemicals and high use of natural fertilizers such as forest litter and livestock manure. Under the National Organic Program, launched in 2011, the state offers free training sessions to farmers on organic farming practices, encouraging low waste farming and use of compost. It aims to reduce the country's dependence on imported food (only 4% of the total land is being used to grow crops). Moreover, local organic food has to be marketed at competitive prices compared to imports.⁶

1.2 The power of water

Besides huge expanses of forests, some of nature's other gifts to Bhutan include its glaciers and rivers. With the potential to generate 30,000 MW, of which only 5% is currently utilized, hydropower dominates the mix of the country's major sources of renewable energy and wealth. The government now plans to generate 10,000 MW from hydroelectric dams by 2020 and export 80% of this production to India. Bhutanese hydropower offsets 4.4 Mt worth of CO_{2eq} with the possibility to offset 22 Mt per year by 2025, most of which will be achieved through the exporting power. This is partly due to high costs of grid extension that makes it economically unfeasible to provide electricity to 40% of the population within the kingdoms borders.³⁴

While hydropower is renewable and carbon neutral, it is worth noting that it is not completely environmentally friendly. Bhutan's mass exploitation plan of hydropower raises concerns of the ecological damages caused by dam construction. Although Bhutan claims that rivers are located deep in valleys near minimum human populations and will lower environmental and social impacts, it remains questionable that Bhutan's ecological footprint can be minimized like its carbon footprint. The future of Bhutan's hydroelectricity is also unclear because climate change is frequently projected to alter rainfall and glacial melt in the Himalayas. Hedging the risk of losing its hydro resources is not only a matter of environmentalism but also economics as the country could lose its energy exports and source of affordable power. Therefore, the mountain economy must diversify its energy portfolio.¹

1.3 Bhutan's low carbon development

In the face of increased economic development, Bhutan has created action plans for various economic sectors. Table 2 gives an overview of Bhutan's national strategy towards a more prosperous and low carbon future. Although emissions from industrial and transport sector are low, they have started to increase in recent years. Therefore, it is necessary to go beyond relying on forests for sequestration by lowering emissions from prominent sources. The following provides an overview of how Bhutan controls vehicular emissions:⁷

- Raising vehicle and fuel price to lower the number of vehicles on the road.
- Applying fees and time limits for parking private cars in urban areas.
- Regulating taxis through efficiency standards.
- Encouraging the use of private electrical vehicles.
- Improving public transport by making the bus service system time efficient.
- Applying tax waivers to eco-friendly and fuel efficient buses and taxis.
- Altering narrow two-way streets to one-way streets within the cities in order to:
 - Reduce heavy traffic congestions especially during peak hour periods.
 - Improve traffic flow that will result in lower point source emissions from standing vehicles.
- Providing electric trains in cities.
- Discouraging farmers from using fire wood for household activities.
- Improving facilities for pedestrians by:
 - Observing pedestrian day.
 - Cycling and walking to the work areas.

The mountainous country funds these strategies through several methods. Bhutan for Life, a proactive plan to sustainably improve the economy, raises funds for climate initiatives by establishing a funding mechanism for individual or corporate donors to support environmentally sustainable and carbon sequestration projects. Bhutan has also integrated conservation in its tourism industry. As one of the region's most bio diverse hotspots and serene environments, it has seen

increased revenue from tourism that has helped fund the mitigation strategies mentioned in this section. Under the ‘High value and low impact’ policy, it is a compulsorily for tourists to pay \$200 per day. The green revenue brought in by tourism in 2008 amounted to \$38 million.⁵

Table 2: Low carbon development

Waste management	Green economy	Renewable energy	Agriculture
Zero waste concept through strict application of reduce, reuse and recycle and transforming waste material to other types of valuable resources	Improve manufacturing processes in industries	Developing mass hydropower capacity by having support from CDM and other international climate markets to reduce emissions within Bhutan and across borders by exporting surplus electricity	Climate smart livestock farming practices to contribute towards poverty
Improve current infrastructure for waste management	Enhance environmental compliance monitoring system		Organic livestock farming and eco-friendly farm designs
	Promote clean green industry development		Improve various livestock breeds, especially the conservation of native gene pool
	Integrate emission cutback schemes in urban and rural establishments by constructing green/sustainable buildings, making existing buildings more efficient and building climate smart cities		Expand the production of biogas with more stall feeding
			Agro-forestry or agro-silvo pastoral systems for fodder production
			Sustainable soil/land management technologies

Bhutan's dedication to curbing GHG emissions extends to other climate smart and resilient developmental plans. For instance, the Department of Forests, with the help from the U.N., has devised a REDD (Reducing Emissions from Deforestation and Forest Degradation) Readiness proposal which includes mechanisms that generate carbon payments by sustainably harvesting forest products and a strategy to establish forest reference levels, assessing carbon stocks and forest biomass.

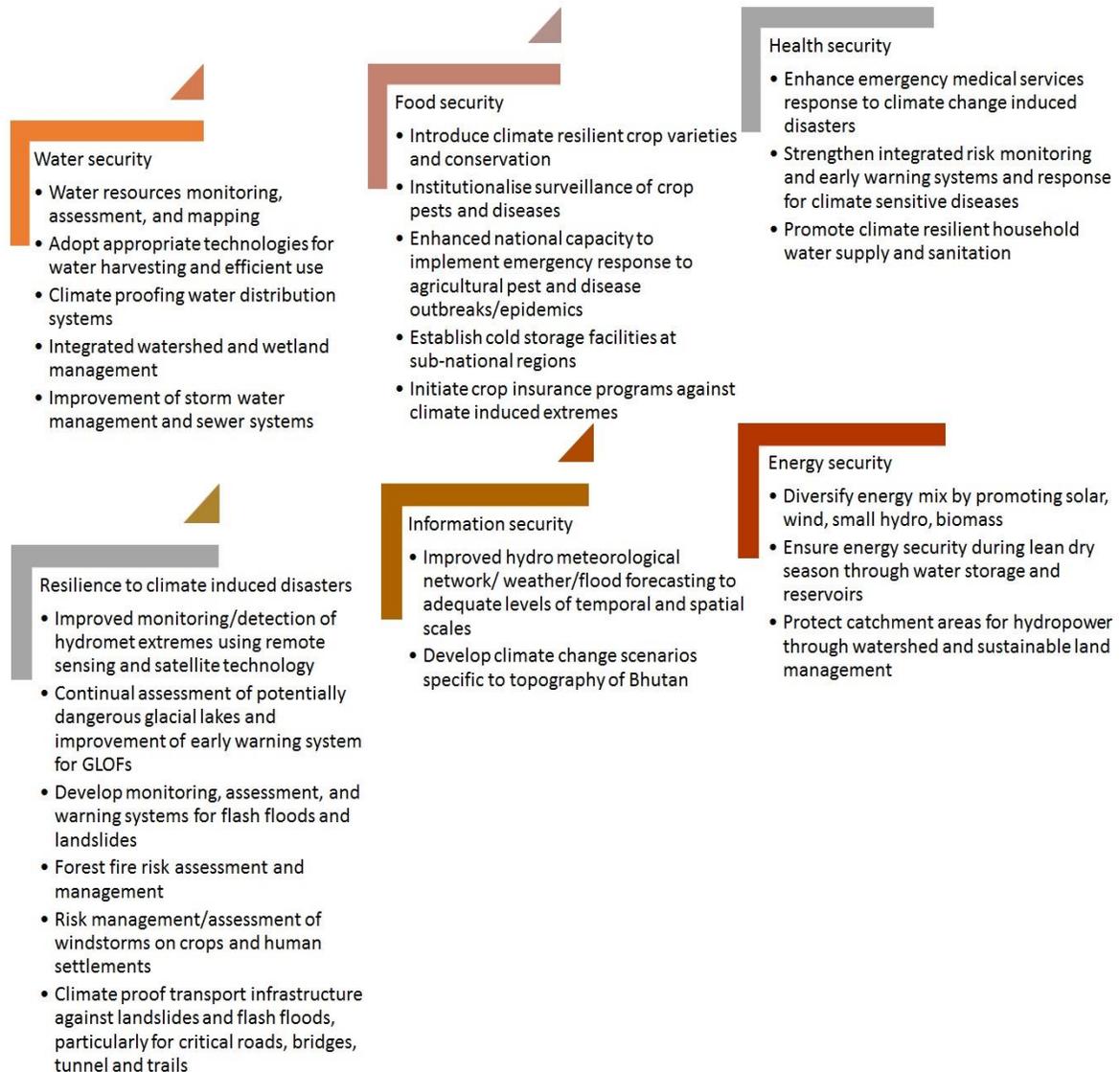
The National Environmental Commission (NEC) of Bhutan has implemented the Low Emission Capacity Building (LECB) which will address energy efficiency in key areas such as transportation, housing, and waste management. Additionally, a partnership with Norway is underway to help Bhutan invest in cleaner home appliances like efficient cooking stoves in rural areas.⁸

1.4 Adaptation: equally essential to mitigation

Although Bhutan has made a relatively insignificant contribution toward global GHG emissions, it is one of the more vulnerable countries to climate change. Its mountain landscape and limited spatial and temporal data make it difficult and expensive to carry out adaptation measures. Bhutan's regenerative water supply, while particularly vulnerable to global warming, is also pivotal to the country's economy.

Climate Change impacts can potentially derail Bhutan from the path of sustainable development. Key resources, like agricultural and forested lands, will face threats that are unique to mountain environments; GLOF (Glacial Lakes Outburst Floods), flash floods, windstorms, forest fires, and glacial retreat. The National Adaptation Program of Action (NAPA) aims at building resilience to these threats, among other commendable adaptation measures (Figure 4).

Figure 4: National climate change adaptation strategies ³



1.5 Following Bhutan's example of carbon negative development

While replicating all of Bhutan's climate mitigation and adaptation measures in other countries is unrealistic, its environmental sustainability programs exemplify how less developed countries can improve their economies without increasing GHG emissions. Using forests as a reliable carbon sink, the country has a high probability of remaining carbon neutral, if not negative, for many years to

come. The following case studies shed some light on how developing countries with similar circumstances are working toward carbon neutrality.

Case studies

1.5.1 Costa Rica

Costa Rica has committed to decarbonizing their economy, setting a goal of producing all electricity from renewable resources by 2021. Currently, fossil fuel fired power plants provide only 4% of its electricity, with the rest coming from hydro and wind resources at 78% and 18%, respectively. Its heavy dependence on hydropower is insecure, much like that of Bhutan, since water resources will be highly questionable under many climate change scenarios. Moreover, with large-scale utilization of hydropower causing detrimental impacts on the environment and local communities, Costa Rica plans to strongly expand their power mix while continuing to limit power sector GHG emissions.⁹

Land use change will be essential to achieve their emission reduction target making continual REDD+ implementation a likely part of the nation's mission to achieve carbon neutrality. During the 1980s, Costa Rica was only left with 20% of its original forest cover, but has since expanded it back to over 50% through various programs. In 1997, for example, the government encouraged landowners to plant trees for carbon sequestration and other ecosystem services in return for payments funded by a gas tax. To promote REDD+ carbon sequestration and payments, Costa Rica created a domestic carbon market and a carbon bank (BankCO₂) that will link these markets to the international community to make it easier to buy and sell carbon credits.¹⁰ One of their key innovations in their national action plan includes introducing “C-Neutral” label, certifying the mitigation of emissions from tourism and industrial activities.

1.5.2 Maldives

As one of the world's lowest lying countries (most of the island at only two meters above sea level), the small island population of the Maldives (341,256) is in extreme danger of being completely inundated due to sea level rise by the end of the century. They are also faced with economic hurdles as climate change will jeopardize their tourism industry and fisheries, even in the short term. The

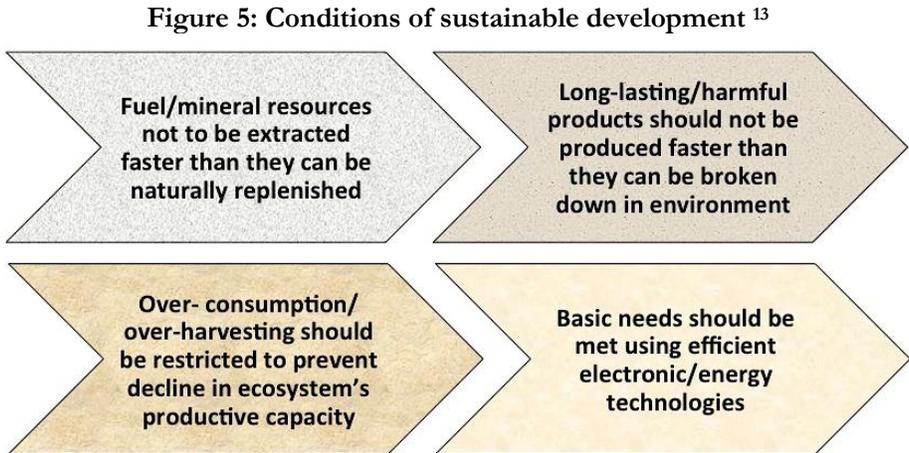
Maldives have pledged to go carbon neutral by 2020, an admirable commitment from a country with a slow economy and precarious future.

The government started by ridding the country of imported diesel as it is a major power source for electricity (The Maldives' total GHG emissions was 1.3 Mt in 2009, of which the energy sector contributed 1.03 Mt) and ferry transport between islands. Relying on foreign fuel is in itself a danger to the Maldivian economy, as it is highly vulnerable to fluctuating oil prices. Thus, officials are highly motivated to cure their oil addiction immediately and shift to renewable energy, a particularly challenging task due to high corrosion of solar panels by high air salt content, low wind availability, and a geographically scattered population.¹¹ Nonetheless, the Maldives's strategy is to compensate for the higher prices of renewable energy by eliminating ineffective investments from importing fossil fuels. The Maldives's plan for carbon neutrality includes:¹²

- Building wind turbines.
- Installing roof-top solar panels using
 - Feed in tariff schemes.
 - Net metering for residential PV applications.
- Using hybrid diesel solar PV systems.
- Installing PV battery banks as back storage up.
- Setting up biomass burning plants with coconut husks as a major fuel source.
- Promoting eco-tourism.
- Limiting import of second hand goods and vehicles.
- Designing walkable cities.

1.6 Sustainable Development Mechanism (SDM)

Stabilizing GHGs in the atmosphere requires an international framework that simultaneously ensures global emission reductions and economic development, especially for developing countries. In particular, achieving low carbon economic growth is a key point in climate policy and climate change governance. Establishing a framework to achieve these goals was one of the principal objectives of the Kyoto Protocol’s Clean Development Mechanism (CDM). Over time, the CDM has become not only a means to steer development towards a sustainable track, but has also addressed economic and social inequity (Figure 5).



Market mechanisms such as SDMs lead to international partnerships and encourage policy makers and stakeholders to practice sustainable development. Moreover, the benefits of these mechanisms are more pronounced for developing countries, like Bhutan, as they act as a bridge to transfer technology, expertise, investments, and carbon payments that can help developing countries improve their economies and achieve national emissions reduction targets. Apart from initiating clean development projects, SDMs encourage countries to institutionalize sustainable development by including it in their national policies across all sectors. Developing countries, pledging to go carbon neutral, have a daunting task to grow their economies and cap GHG emissions. Market Mechanisms for Sustainable Development can play a significant role in making the task easier because they draw foreign investments, stakeholder interest, and affiliated parties seeking to reduce their emissions and transition to carbon neutral energy.¹⁴

Conclusion

Bhutan's unique attitude towards nature holds the key to sustainable prosperity. For them, it is not an abstract goal, but a way of life. Despite struggling with economic development, the Bhutanese take pride in preserving their environment and unique culture. In doing so, the humble nation has achieved global recognition for combatting climate change. Bhutan's efforts have certainly made the kingdom a shining example of environmental stewardship, encouraging the rest of the world to take the responsible path to economic development.

Sana Munawar is a Graduate Research Fellow at the Climate Institute. She holds Bachelor's and Master's degrees in Environmental Science from Fatima Jinnah Women University and the National University of Sciences and Technology respectively.

References

¹ Thinley Namgyel, Sonam Dagay,CCU, Tshering Tashi, Sonam Lhaden Khandu & Karma Tshering. 2011. Second National Communication from Bhutan to the UNFCCC. National Environment Commission. Royal Government of Bhutan

² LAND_COVER_CCI partnership. 2014. UCL-Geomatics. Belgium

³ Bhutan: In Pursuit of Sustainable Development. 2012. National Environmental Commission. National Report for the United Nations Conference on Sustainable Development

⁴ Yeshey Dorji. 2015. Intended Nationally Determined Contribution. Kingdom of Bhutan. National Environment Commission. Ministry of Agriculture and Forests

⁵ Arthur Neslon. 2015. Bhutan has 'most ambitious pledge' at the Paris climate summit. <https://www.theguardian.com/environment/2015/dec/03/bhutan-has-most-ambitious-pledge-at-paris-climate-summit>

⁶ Ea Energy Analyses. 2012. A national strategy and action plan for low carbon development

⁷ Dorji Wangdi. Measurement of inland transport CO₂ emission and mitigation policies. Department of roads, Bhutan

⁸ European Commission & UNDP. Low Emission Capacity Building Program. National Environmental Commission. Bhutan

⁹ San Jose. 2015. Intended Nationally Determined Contribution. Government of Costa Rica Ministry of Environment and Energy

¹⁰ Milagros Salazar. 2014. Costa Rica Aims For Carbon Neutrality With Payments For Ecosystem Services. <http://www.ecosystemmarketplace.com/articles/costa-rica-aims-for-carbon-neutrality-with-payments-for-ecosystem-services/>

¹¹ Jorgen Villey Fenhann & Marianne Ramlau. 2014. Maldives Low Carbon Development Strategy. UNEP Risø Centre, Technical University of Denmark

¹² Maldives Intended Nationally Determined Contribution. 2015. Ministry of Environment and Energy. Government of Maldives

¹³ Karem Holm Olsen. The Clean Development Mechanisms contribution to sustainable development. A review of literature. UNEP Riso Centre

¹⁴ Karen Holm Olsen & Jorgen Fenhann. 2008. A reformed CDM- including new mechanism for sustainable development. Perspectives series. Capacity Development for CDM (CD4CDM) project. UNEP Riso Centre