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Analysis

Document

55/2015 2 December, 2015

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The management of water resources in the adaptation to Climate Change

This document has been translated by a Translation and Interpreting Degree student doing work experience, MÓNICA VILA ROUCO, under the auspices of the Collaboration Agreement between the Universidad Pontificia Comillas, Madrid, and the Spanish Institute of Strategic Studies.

The management of water resources in the adaptation to Climate Change

Abstract:

Adaptation improves the resilience of populations making them less vulnerable to the consequences of climate change. Water resources protection and management are among the main adaptation measures, as water shortages directly affect human security and can lead to destabilization and conflicts. This paper analyses adaptation measures in relation to water resources included in the INCDs of some of the countries who will present greater water stress in the future.

Keywords:

Climate change, water resources management, water security, adaptation, INDCs.

Climate Change: new commitments

According to the 5th IPCC[1] report, if adequate measures aren't adopted, the earth's temperature could rise 4.8ºC from current level, generating catastrophic consequences. In order to avoid this, experts point out that an emission peak is necessary by 2050, followed by a reduction to preindustrial levels by 2100. The Kyoto Protocol has become obsolete due to its incapacity to provide any commitment of greenhouse gases reduction from some of the most polluting countries. The time has come to take a definitive step in the fight against climate change and there are high expectations for the Paris Summit, COP 21.

Before the Summit, most countries had already presented their commitments to reduce emissions through their INDCs[2] (Intended Nationally Determined Contributions), even those excluded from the Kyoto Protocol for being developing countries, such as China, India and USA.

In 1990, China's emissions accounted for one third of the total. Today, they stand at 55% and by 2030 they will reach 70%. Aware of its significant contribution, China has presented an INDC that targets to reduce its emissions by between 60-65% per unit of GDP by 2030, compared to 2005 levels[3].

India appears as another example of this new global commitment in the fight against climate change. When analysing the growth forecast for 2030, in its INDC, figures are so diverse that development will only be sustainable with a decarbonisation of its economy. To that end, the Indian government has committed to reduce its emissions between 33-35% per unit of GDP by 2030[4].

The last example is the USA, who did not ratify the Kyoto Protocol. However, President Obama has spearheaded the USA to take the lead on the fight against climate change through a commitment of reducing its emissions between 26-28% in 2025, compared to those of 2005[5].

[1] https://www.ipcc.ch/report/ar5/
[2] http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx
[3] http://www4.unfccc.int/submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf
[4] http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf
[5] http://www4.unfccc.int/submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf

India	*2014*	*2030*
Population (billions)	*1.2*	*1.5*
Electricity demand (TW/h)	*776*	*2499*
Urban population (millions)	*377*	*609*

Growth forecast for India contained in its INDC.

The decarbonisation of the world's economy must be based on the modification of all energy models –aiming for clean energies– and on the establishment of a system that regulates carbon emissions, either through trade or through the imposition of a carbon levy.

To face the new reduction commitments, it will be necessary to work towards sustainable development and to approach the fight against climate change as an opportunity to create wealth and employment instead of treating it as an obstacle against economic growth.

In 2007 Ban Ki Moon pointed out that the origin of Darfur's conflict had been the droughts that resulted from climate change[6]. Such a statement demonstrates the gradual transition in the attitudes towards global warming; it is no longer considered an environmental problem, but one with a direct impact on human security. Consequently, this can lead to destabilization and violent conflict. More precisely, this relationship with security is also fostering a final push towards the fight against climate change.

Adaptation and water resources management

The commitments presented through the INDC signify a major advance in the fight against climate change even if these are primarily focused on mitigation. Also, it is recommended to approach adaptation from a sensitive point of view, for example, by establishing objectives and allocating funds to those projects with greater impact on increasing the resilience of populations in the most vulnerable countries. Temperature will continue rising during the next decades due to the inertial factor of climate change

[6]http://www.washingtonpost.com/wp-dyn/content/article/2007/06/15/AR2007061501857.html

itself. For this reason, even if from now on anthropogenic emissions of greenhouse gases ceased to exist, it is urgent to undertake new adaptation measures.

Adaptation improves the resilience of populations by making them less vulnerable to the consequences of climate change. The protection and management of water resources are among the main adaptation priorities, as water scarcity directly affects human security and can create instability and conflicts. According to the data compiled by the World Resource Institute, the following countries will suffer from water stress in 2040.

Water Stress by Country: 2040

RANK	NAME	ALL SECTORS
1	Bahrain	5.00
1	Kuwait	5.00
1	Qatar	5.00
1	San Marino	5.00
1	Singapore	5.00
1	United Arab Emirates	5.00
1	Palestine	5.00
8	Israel	5.00
9	Saudi Arabia	4.99
10	Oman	4.97
11	Lebanon	4.97
12	Kyrgyzstan	4.93
13	Iran	4.91
14	Jordan	4.86
15	Libya	4.77
16	Yemen	4.74
17	Macedonia	4.70

RANK	NAME	ALL SECTORS
18	Azerbaijan	4.69
19	Morocco	4.68
20	Kazakhstan	4.66
21	Iraq	4.66
22	Armenia	4.60
23	Pakistan	4.48
24	Chile	4.45
25	Syria	4.44
26	Turkmenistan	4.30
27	Turkey	4.27
28	Greece	4.23
29	Uzbekistan	4.19
30	Algeria	4.17
31	Afghanistan	4.12
32	Spain	4.07
33	Tunisia	4.06

Source: http://www.wri.org/sites/default/files/uploads/water_stress_table_large.jpg

The management of water resources is one of the main topics on the COP 21 agenda. As a result, some countries have signalled they will include adaptation measures in their INDC, specifically water resources management and conservation. The suggested options are diverse and range from water saving and guaranteeing its provision to the introduction of improvements on its location and distribution.

Using this data as a basis and just as presented in the INDC of some countries, following, adaptation measures and, specifically, the management of water resources will be explained in detail.

Bahrain

In its INDC[7], Bahrain views water scarcity and conservation as a significant problem and considers "imperative" to develop a water resource strategy, integral and resistant to climate change, focused towards sustainable management. To tackle this challenge, in 2009 the government set up the National Water Resources Council. Currently, the Ministry of Electricity and Water is carrying out a project "Water Conservation Initiative" that aims to update the water distribution network in order to minimize leaks. These measures will result in a reduction of water consumption and in a decrease of the amount of energy required for desalination. Also, it encourages a reduction of emissions, which is a clear example of adaptation that also contributes to mitigation.

Kuwait

This country also mentions the management of water resources in its INDC. The development of its water resource management program stands out, as well as the population's education on environmental-related topics does.

Qatar

Qatar also includes the management of water resources in its INDC[8]. As outlined in the document "Qatar National Vision 2030", the country wants to achieve sustainable exploitation of its resources. In terms of water, one of the actions that is currently underway is the improvement of the processes for the treatment of aqueous wastes, with the purpose of producing better quality water for agricultural use, thereby, reducing the consumption of potable water. Also, envisaged in the document is the adoption of a National Water Act and the improvement of the desalination processes, including the development of new technologies and the use of renewable energies.

San Marino

San Marino does not include any measure in terms of water resources management in its INDC.[9] However, it is important to point out that, even if only contributing 0.00052% of total global emissions, it has presented a reduction objective of 20% by 2030, compared to 2005 levels.

[7]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Bahrain/1/INDC_Kingdom_of_Bahrain.pdf
[8]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Qatar/1/Qatar%20INDCs%20Report%20-English.pdf
[9]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Qatar/1/Qatar%20INDCs%20Report%20-English.pdf

Singapore

In its INDC[10], Singapore commits to the improvement of its water security. For this purpose, it has developed a diversified and safe supply system based on "four National Taps"[11]: water capture, water import (from Malaysia), desalination and reuse. Three reservoirs have been built in urban areas and the area of water capture has been enlarged to include up to two-thirds of the country's area.

In order to avoid dependence on rain, Singapore commits to use desalinated water, as well as recycled water, as a supplementary provision in times of drought. Singapore's objective is to achieve water security through these two methods. In terms of water capture, it is willing to achieve 90% of its territory extension through variable salinity techniques applied in the rivers of the coastal zones.

Arab Emirates

As observed in its INDC[12], the most worrying impact of climate change has occurred on its water resources; for this reason, the government aims to establish a strategic federal framework for the management of water resources. As in neighboring countries, water desalination and reuse are the main ways to guarantee water availability. Water conservation is one of the major challenges for the Arab Emirates. Desalination, more efficient technologies and the employment of renewable energies are still under investigation.

Israel

In the INDC presented[13], Israel mentions the National Adaptation Plan, currently under consultation process. It also mentions the Climate Change Information Center (ICCIC), in charge of collecting scientific data to evaluate the impact of climate change in sectors such as water resources, biodiversity, public health and urbanization plan.

Saudi Arabia

Saudi Arabia[14] approaches adaptation by generating collateral benefits for mitigation. Among its objectives is the integrated water management charged with the development of new sources of fresh water, and the construction of new dams to

[10]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Singapore/1/Singapore%20INDC.pdf
[11] https://www.chijournal.org/C375
[12]http://www4.unfccc.int/submissions/INDC/Published%20Documents/United%20Arab%20Emirates/1/UAE%20INDC%20-%2022%20October.pdf
[13] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Israel/1/Israel%20INDC.pdf
[14] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Saudi%20Arabia/1/KSA-INDCs%20English.pdf

collect drinking water and groundwater recharge. It will also promote the reduction of water consumption and the reuse of wastewater at a local, industrial and commercial level, in order to reduce energy consumption, production of desalinated water and underground leaks.

Oman

In its INDC[15], Oman states that adaptation measures are conditioned by funding availability and technology transfer, delivered under the UNFCC framework. Among others, water scarcity and desertification are highlighted as possible destinations for future funding.

Lebanon

Adaptation to climate change is a priority for this nation due to its arid/semi-arid climate, water resources scarcity and high population density in coastal areas[16]. 70% of available water is deployed on harvest irrigation, and the state estimates that decreasing rainfall will have a significant impact on water and food security. To minimize the impact, Lebanon is considering developing dams, optimizing existent resources in line with the "National Water Sector" strategy of 2012 and improving water employment efficiency, including irrigation activities. As in Oman's case, Lebanon expresses the need for more financial and technical aid, as well as technology transfer.

Iran

Iran[17] acknowledges that it is a country vulnerable to climate change effects according to the criteria of the UNFCCC[18]. It is estimated that in the next fifteen years the surface runoff will decrease around 25% and the average temperature will increase by approximately 1.5ºC. Consequently, there will be a loss of available water, estimated at 20-25 billion cubic meters, with a subsequent estimate of USD 3700 million annual losses. However, the INDC does not include any specific adaptation measures related

[15] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Oman/1/OMAN%20INDCs.pdf
[16]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Lebanon/1/Republic%20of%20Lebanon%20-%20INDC%20-%20September%202015.pdf
[17] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Iran/1/INDC%20Iran%20Final%20Text.pdf
[18] Among the criteria gathered in Articles 4.8 and 4.10 in order to be considered a vulnerable country the following point out:

- To present on third of global average rainfall.
- Three times more evaporation than global average.
- Three times more desserts per capita than global average.
- One third of global average forests.
- Desert areas of 7.7 million hectares.

to the management of water resources.

Jordan

Jordan is one of the countries that has paid most attention to adaptation actions in the water sector in its INDC[19]. The scarcity of water resources is one of the greatest barriers that stand in the way of sustainable development. Jordan's Ministry for Water and Irrigation presented a strategy for water management in the report "Water for Life: Jordan Water Strategy – 2008-2022"[20].

Economic and population growth as well as the inflow of Syrian refugees have resulted in a decrease per capita of water availability. Facing a possible problem of water insecurity, adaptation measures suggested by Jordan in its INDC are divided into sections: underground water protection, surface water development and demand management.

Yemen

The INDC[21] presented by Yemen mentions the problem of water scarcity as it could pose a threat to its economy and directly affect food security. The decrease in rainfall along with the operating speed of aquifers, which have been reduced by approximately 2-7 meters annually, point to a serious problem in the future as it has been estimated that underground reserves will run dry between 2025-2030.

Morocco

Water resources management is fundamental for Morocco[22] in order to achieve sustainable development. To make a comprehensive water management solution Morocco has developed a "National Water Strategy". On top of the commitments to mitigation, the INDC presents specific objectives related to water management for 2020 and for 2030. In the medium term, Morocco aims to replace the exploitation of its aquifers (about 85 million m3 / year) for surface water and increase drip irrigation from 154,000 hectares today to 555,000 in 2020 and 920,000 hectares in 2030.

Among the targets set for 2030, Morocco aims to desalinate 285 million m3 per year, reuse 325 million m3 of wastewater, build 30 new dams and make an inventory of sites

[19]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Jordan/1/Jordan%20INDCs%20Final.pdf
[20] http://www.emwis.org/documents/database/water-life-jordans-water-strategy-2008-2022
[21]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Yemen/1/Yemen%20INDC%2021%20Nov.%202015.pdf
[22]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Morocco/1/Morocco%20INDC%20submitted%20to%20UNFCCC%20-%205%20june%202015.pdf

vulnerable to flooding.

Chile

According to its INDC[23], Chile has a National Climate Change Adaptation Plan divided in sectors. One of these plans, currently under development, addresses the issue of water resources.

Algeria

Algeria presents problems of desertification and land degradation. Most of its territory is arid or semi-arid, and, as a result, the impact of climate change has had serious repercussions[24]. For example, the rainfall average dropped around 30% in the last decade. Among the objectives presented by Algeria, the development of a National Adaptation Plan to climate change appears to improve the resilience of ecosystems against floods and droughts, prevent erosion and land degradation, and integrate climate change impacts at a sectorial level, such as agriculture, water management, public health and transport. This plan will also integrate climate change at a national security level.

Tunisia

Water scarcity is already a reality in this country and estimates show that this problem will deteriorate in the future as forecasts point to a 28% decrease of conventional water sources in 2030 and a further decrease of surface water of approximately 5%[25]. Additionally, sea level rise will cause the salinization of nearly half of the aquifers, which represent approximately 150 million m3 water volume.

Afghanistan

Afghanistan is among the most vulnerable countries to climate change impact[26]. The country is attempting to promote sustainable development; many policies have been developed to target the problem of food security, water security, and the reduction of natural disaster risks, and biodiversity conservation. Among these policies, two stand out: the Afghanistan National Renewable Energy Policy (ANREP) and the National Water and the Natural Resource Man**a**gement Priority Programme.

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[23]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Chile/1/Chile%20INDC%20FINAL.pdf
[24] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Algeria/1/Algeria%20-%20INDC%20(English%20unofficial%20translation)%20September%2003,2015.pdf
[25] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Tunisia/1/INDC-Tunisia-English%20Version.pdf
[26]http://www4.unfccc.int/submissions/INDC/Published%20Documents/Afghanistan/1/INDC_AFG_Paper_En_20150927_.docx%20FINAL.pdf

Spain and Greece

To end this analysis, it is important to mention that both Spain and Greece are part of the World Resources Institute but have not submitted their INDC individually. The European Union has presented its commitment globally and focused mainly on mitigation.

Conclusions

Bearing in mind the new direction that the fight against climate change is taking with the presentation of major pollutant countries' INDC, it is necessary to show interest for adaptation and mitigation. Global warming is an unstoppable phenomena and it is essential to adopt policies aimed at increasing the resilience of populations and economic systems.

Climate change impact is higher in the most fragile and economically poor countries. Among its consequences, the following stand out: increased migration[27] movement, land degradation and shortages of water and food resources that could lead to the emergence of conflicts over resources and the promotion of radicalism and extremism. Climate change has become a safety issue for the international community.

Within adaptation, water security is a priority, especially for the most vulnerable countries to climate change impacts, and for this reason it has been included in their INDCs. The types of actions are varied and range from the construction of dams to the use of renewable energy in desalination plants. The latter approach has been highlighted by several countries as an example of synergies between adaptation and mitigation.

Water scarcity is considered a source of conflicts and destabilization. Adequate water management should be viewed as a matter of national security. Some countries have already developed water management strategies and it is likely that as happened with the emergence of national security strategies, the same will happen with water sources strategies.

[27] It is estimated that by 2050 there will be 200 million displaced people. http://edition.cnn.com/2009/TECH/06/10/climate.change.refugees/index.html?eref=rssus

Finally, a change of mindset is also taking place vis-a-vis global warming. Decarbonization of the economy should not be seen as a cost but rather as an opportunity to create economic benefits. With this mindset, it is also necessary to address adaptation. The measures suggested by some countries in their INDCs welcome new projects and investments in the affected countries, especially in relation to water resources management.

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