The Effects of Climate Change on Hydroelectric Power in Iraq

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The aim of this study (part1):

Is to evaluate potential climate change impacts on Dokan hydro electric power plant, and to recommend various options to maintain optimum required water level to ensure full capacity of electricity generation throughout the year.

A simple approach assumes that hydropower systems will reduce generation if water supply reduces, and vice versa. The analysis of the approach was carried out to convert changes in water resource availability to changes in electric hydropower generation.

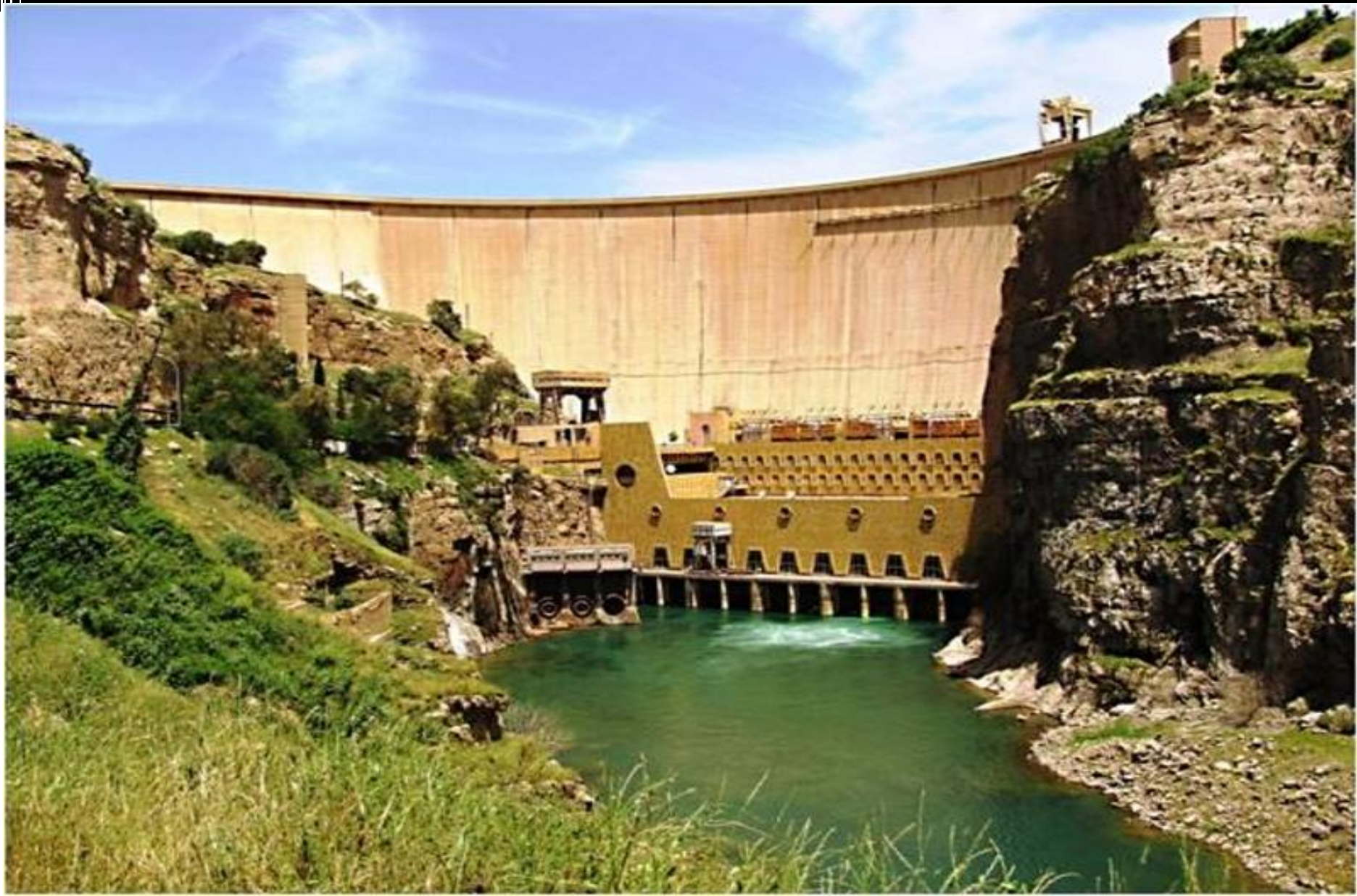
Iraq Electricity Sector Overview:

In Iraq, electricity is supplied by

9.22% from hydro power.
80.49% from fossil fuel power plants.
and 10.29% imported electricity.

No.	Project name	Installed capacity (MW)
1	**Dokan Dam (our case study)**	400
2	Darbandikhan Dam	240
3	Mosul Main Dam	750
4	Mosul Dam pump storage plant	200
5	Mosul Regulating Dam	60
6	Haditha Dam	660
7	Samaraa Barrage	80
8	Hemrin Dam	50
9	Adhaim Dam	40
10	Al-Hindiyah Barrage	15
11	Shatt Al-Kuffa Regulator	6

Dokan Dam in the North of Iraq.




Dukan Dam
Syria
Iraq
Lebanon
Jordan
Malatya
Diyarbakir
Batman
Kahramanmaraş
Adıyaman
Gaziantep
Şanlıurfa
Kızıltepe
Adana
Viranşehir
Aleppo
Iskenderun
Latakia
Idlib
Ar Raqqah
Al Hasakah
Deir ez-Zur
Homs
Al Mayadin
Al Qa'im
Beirut
Damascus
Haifa
Irbid
As Suwayda
West Bank
Gaza
Karak
Petra
Ma'an
Aqaba
Turaif
Arar
Sakaka
Al Khanafah
Wildlife Sanctuary
Tabuk
Mosul
Arbil
Al Qamishli
Tabriz
Urmia
Maragheh
Mahabad
Saqqez
Sanandaj
Samarra
Ramadi
Baghdad
Karbala
Kut
Al-Najaf
Nasiriyah
Amarah
Basrah
Abadan
Kuwait
Kuwait City
Hafar Al Batin
Khafji
Rasht
Zanjan
Qazvin
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Chalus
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Kashan
Borujerd
Kuhdasht
Arak
Khoramabad
Dezful
Esfahan
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- **Dokan Dam:** is located in the north of Iraq on the Lesser Zab River.

The Dokan Dam reservoir had a total design of 6,870 Million Cubic Meters.

- **Assessing climate change impacts on hydropower generation systems.**

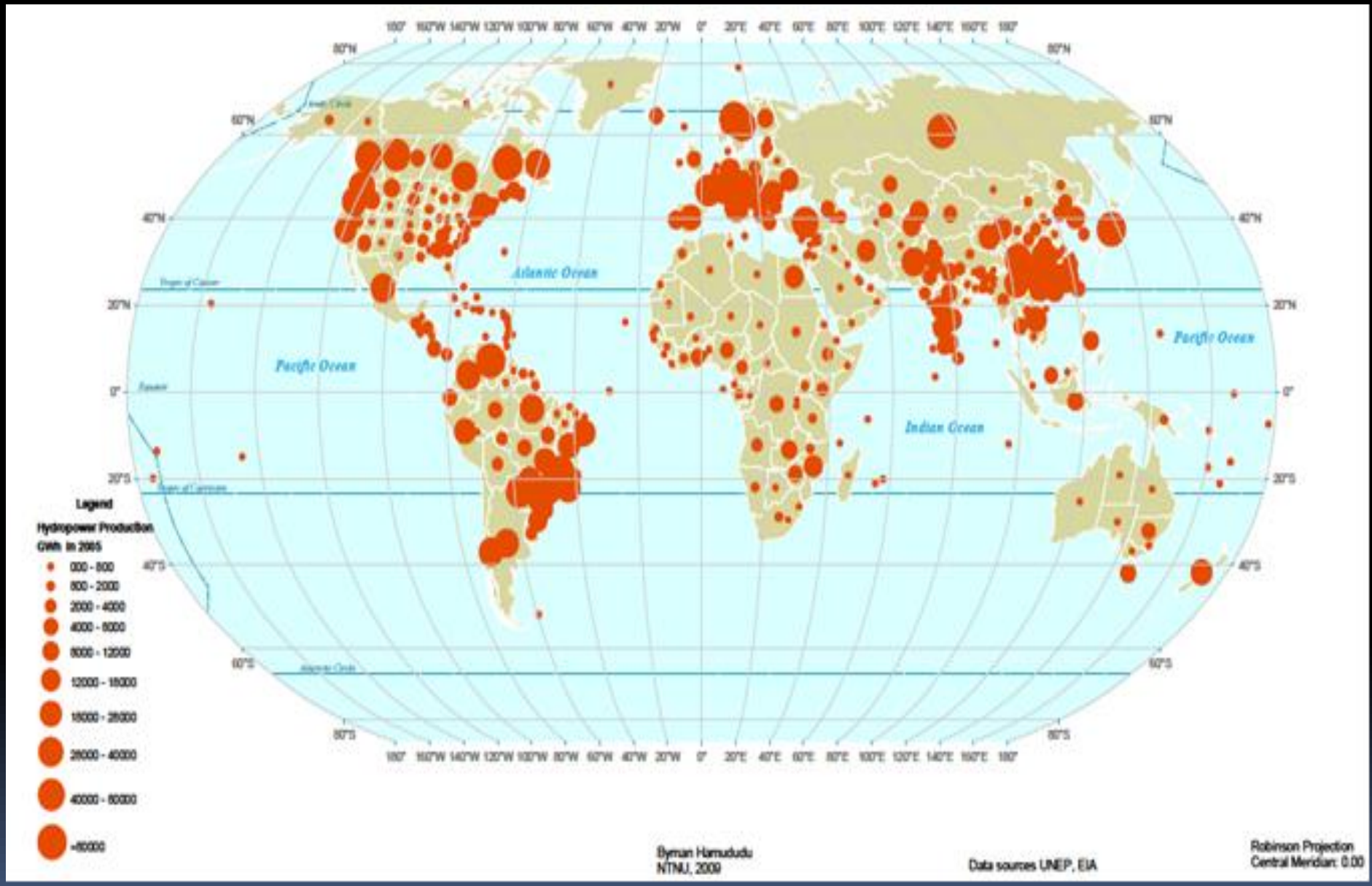
Hydropower generation with our approach changes in annual mean flows. To simulate observed regional patterns of the twentieth century, multi-decadal changes in stream flow, an ensemble of 12 climate models was used with statistically and significant skill.


Chwarqurna
چوارقورنة
Qalat Dizah
قلعدزة
Dukan Lake
بحيرة دوكان
Dokan
دوكان
Google

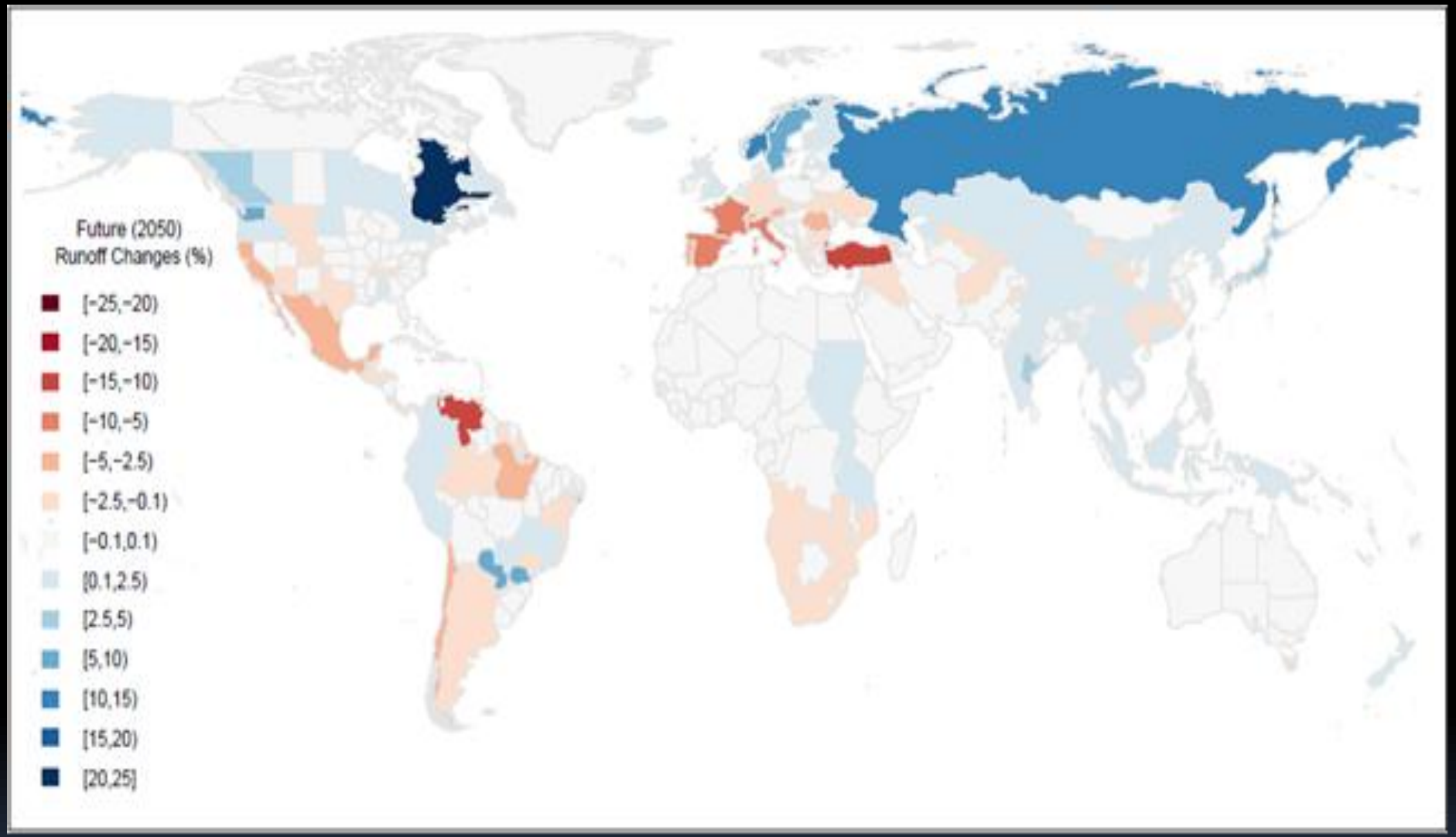
Why we apply Models?

The main reason to apply models is their ability to explore different scenarios. These scenarios can capture aspects that cannot directly be influenced, such as population growth and climate change.

Given suitable climate and river flow data, a simple hydrological model would be able to derive suitable input-response relationships. After calibration and using the suitable technical data and operational parameters, the model will convert input climate data into estimates of river flows. These results would be processed by the hydropower component and compute the electrical power generated



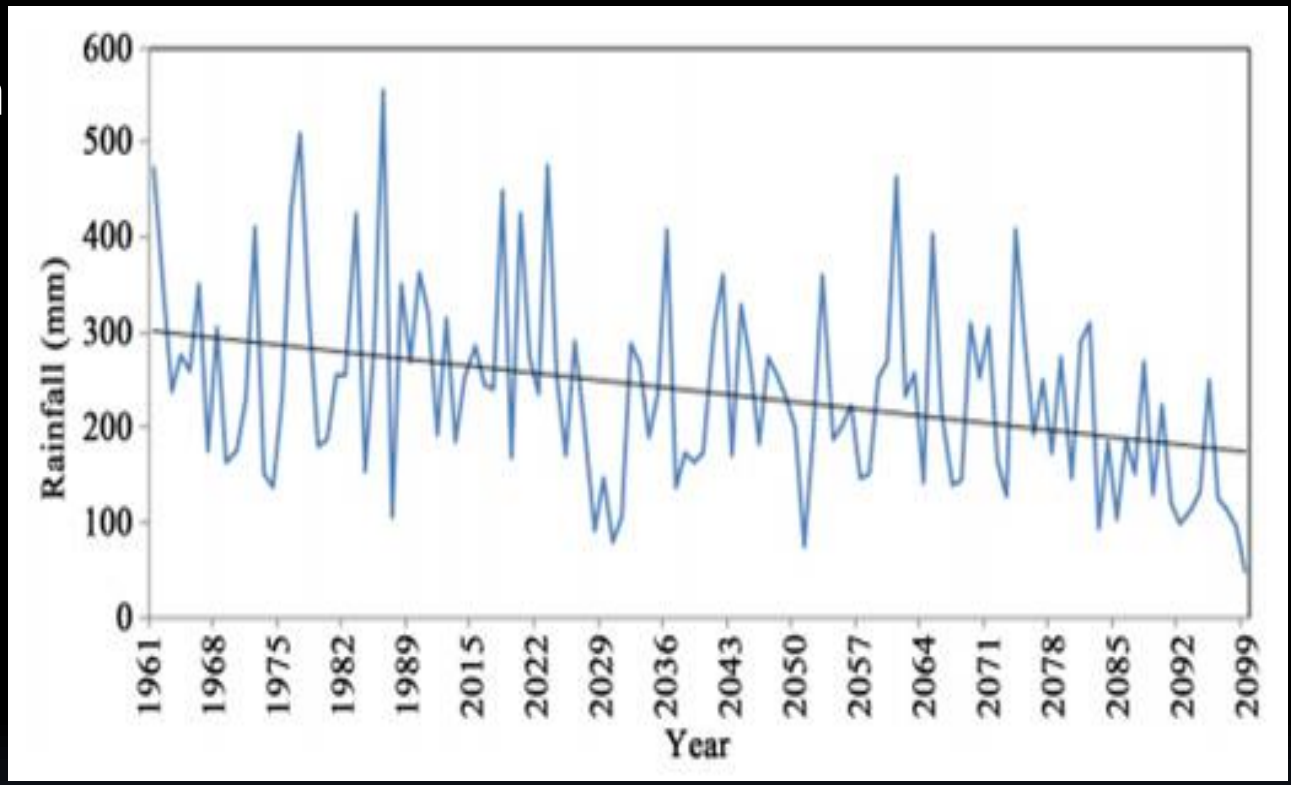
Hydropower generation (GWh) in 2005



it can be seen that by year 2050, Runoff changes (decrease or increase) based on 12 GCMs under A1B scenario. In Iraq runoff decreases by 5 to 10 % which will have negative effects on energy sector and the future production of electricity in Iraq.

Average annual rainfall in the north of Iraq

According to recorded data a comparison shows a decrease in inflow and outflow of Dokan Lake during (2002 – 2012) and the average annual rainfall has been reduced in the north of Iraq.



Results and Discussion.

From the analysis, based on 2005 global hydropower generation, it can be seen that by year 2050, the hydropower generation have totally decreased by **5-10%**. Runoff changes in Iraq based on 12 GCMs under A1B scenario, decreases by **5 to 10 %** which will have negative effects on energy sector and the future production of electricity in Iraq.

Accordingly hydropower generation reduces by: **5 – 10%** and the electric power generation in Dokan power plant decreases by **20-40 MW.**

Conclusions & Recommendations

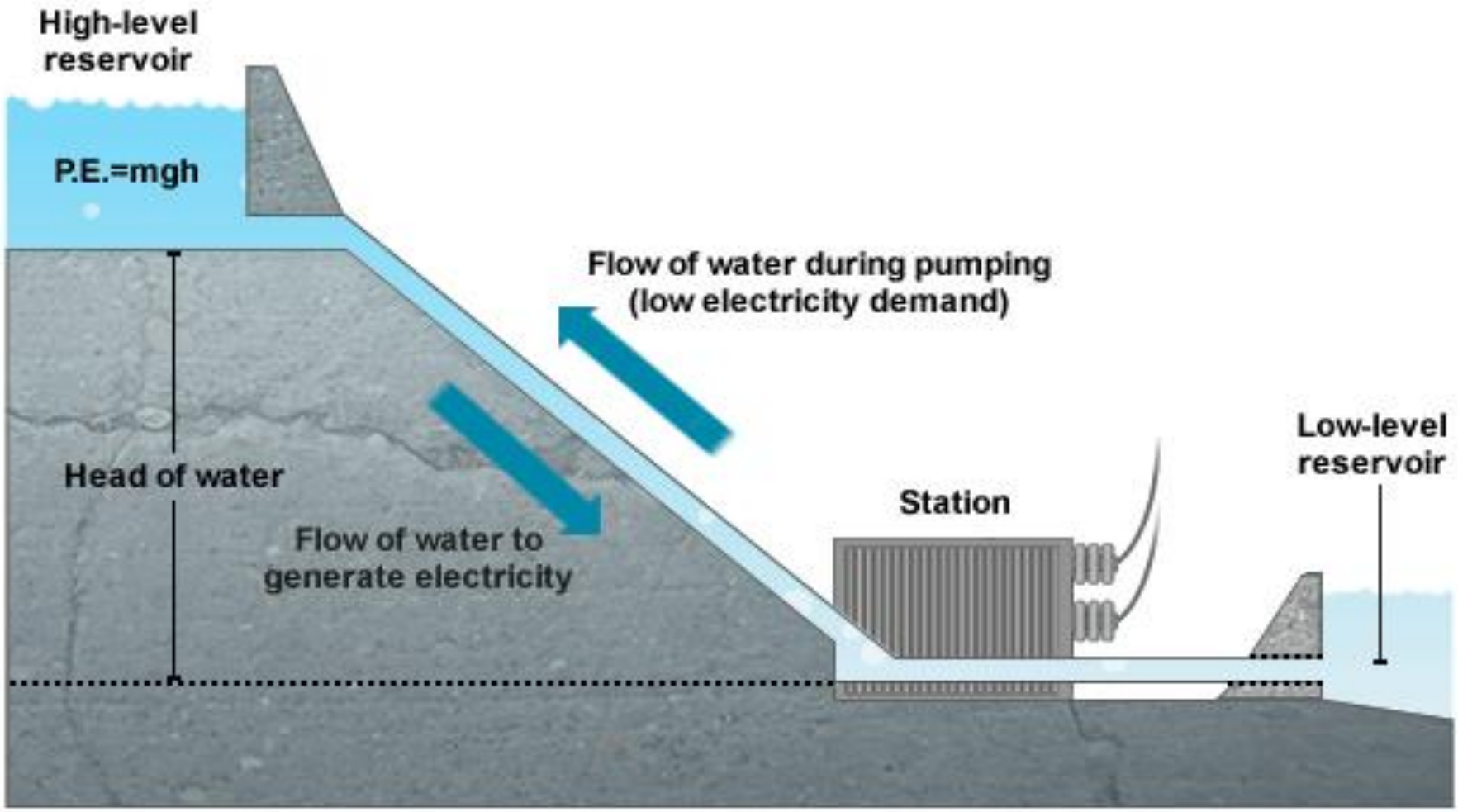
Based on this study part1 we conclude that:

1. **Some countries will experience decreases in climate potential while others increases, but with a great degree of risks in both cases.**
2. **It can be concluded that one of the most environmental and social sensitive power generation technologies is hydropower technology.**
3. **In some countries, careful planning and design are required due to the occurrences of extreme weather events caused by climate change, so as to come up with sustainable hydropower projects.**
4. **A need for national adaptation strategies to water supply shortages is so important**

Conclusions & Recommendations

5. To mitigate the effects of climate change on hydropower plants, improvements in the present hydro-power resources for water recycling and/or development of micro-dams for storage of excess water need exploration.
6. Finally, construction of new plants with better technology (e.g., high efficiencies) in the hydropower sector could help to reduce the gap that may be created by the effects of climate change on electric power generation.

pump storage hydroelectric power plant



Thank You
For Your Attention...