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**The need for research to mitigate the impacts of climate change in electrical  
energy Sector**

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# The need for research to mitigate the impacts of climate change in electrical energy Sector

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As climate change is a global problem, it calls for a global solution taking into consideration the principle agreed upon in the Rio declaration in 1992, namely the principle of “common but differentiated responsibilities.” This implies that developed countries, which are historically responsible for the largest part of the accumulated GHGs in the atmosphere, should take the lead in reducing GHG emissions given their higher technological and financial capabilities. Developing countries, including the Arab countries, are requested to do their best to adopt development activities utilizing less energy, less water, and fewer raw materials, and to produce less waste.

Mitigation refers to efforts to reduce greenhouse gas emissions and to capture greenhouse gases through land use changes such as forestation or carbon capture and storage in deep geological formations. Policies and measures to reduce greenhouse gas emissions include improving energy efficiency to reduce energy consumption per unit of economic output, switching to low or zero carbon fuels such as switching from oil to natural gas, and using renewable energy sources such as solar and wind energy.

# Renewable Energy

The Arab countries have a great potential for renewable energy, including solar and wind, as well as hydro and geothermal in specific locations, which are still underutilized. The share of renewable energy in the total installed generation capacity of the Arab countries remains relatively low, standing at around 7% in 2007, mostly from hydropower in Egypt, Syria, Iraq, Lebanon, Sudan, Algeria, Morocco, Tunisia, and Mauritania. Solar and wind generation of electricity amounts to 257 MW and remains limited to Tunisia, Egypt, Jordan, Morocco, and Palestine (OAPEC, 2008).

# To Solve the Problem Arab Countries Need

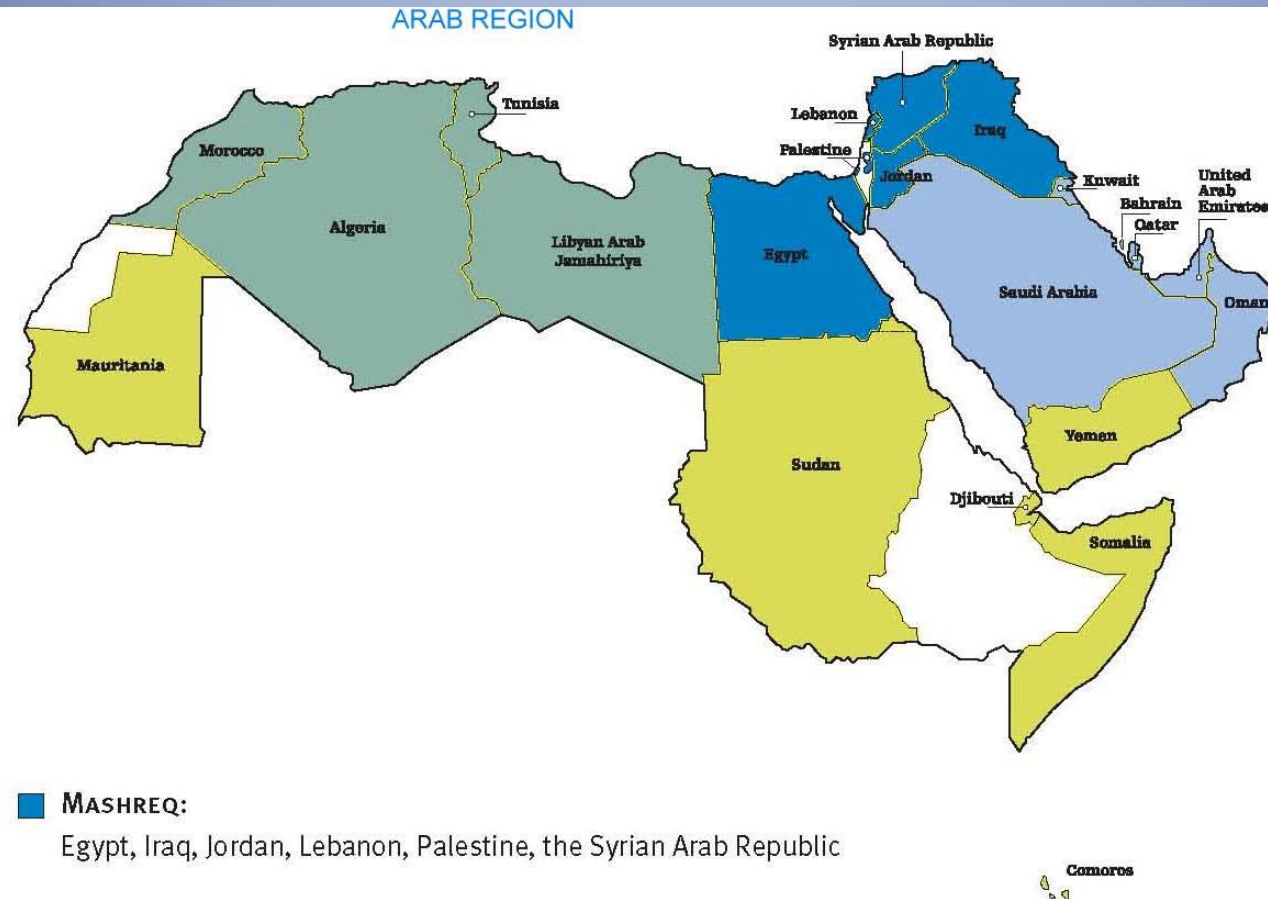
- Researching
- Partnership
- Corporation



## **RENEWABLE ENERGY PARTNERSHIP EUROPE - MIDDLE EAST - NORTH AFRICA**

- Renewable Energy (RE) is the best alternative to cover the world's increasing demand for electricity in view of the increasing fossil fuel prices and expected negative climate impact due to increased burning fossil fuels.
- It is more economic to harvest the good resources and convert them to electricity to be transported to the regions where electricity is needed, rather than using poor resources found near the demand.

# Research and Development on Renewable Energies in the Arab Countries



- The Arab Countries AC enjoy a very high availability of indigenous and clean renewable energy (RE) resources, specifically hydro, solar, wind, and biomass.

# Research and development (R&D)

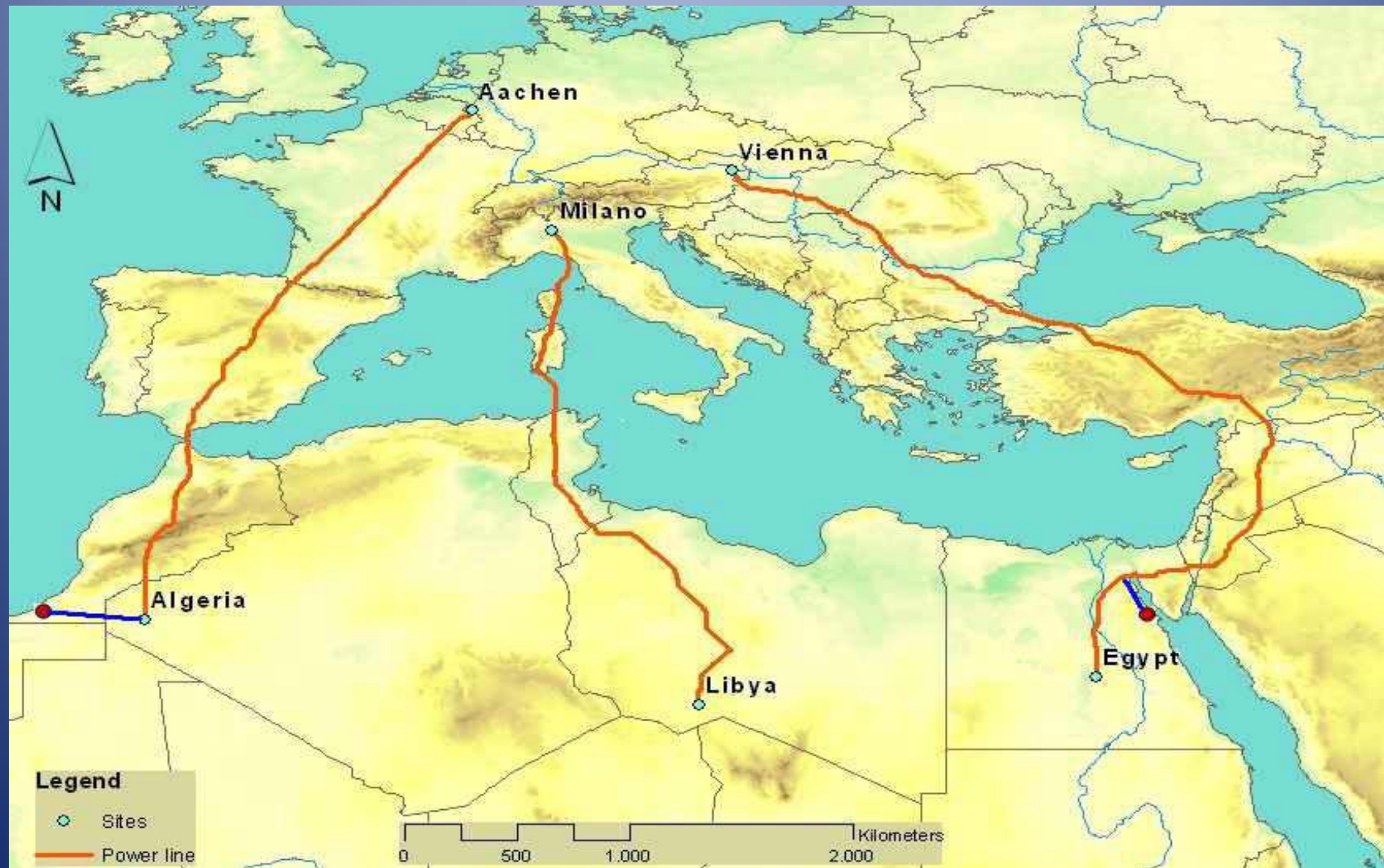
- Solar, wind and biomass resource assessments have been undertaken by most of AC. However, some countries have developed national atlases for them, while:
- in the remaining countries, data are either incomplete or not reliable enough to allow feasibility studies of real projects.
- Since the late 1970s, several universities and research institutions in the region have directed efforts towards investigating RE technologies and applications.

The research work covered both theoretical and experimental investigations on components and systems. Considerable experience, however, has been gained in only a few countries. For example, Egypt has developed serious expertise in the operation, analysis and development of wind-energy systems, especially in large scale, grid connected units. Similar experience has been reported in Jordan, but with regard to stand-alone wind energy systems. Also, important expertise in the operation of PV systems has been developed in Morocco, Tunisia and Saudi Arabia .

- To achieve that, a renewable energy partnership shall be established between countries having good RE resources and countries with high electric energy consumption.
- For example Europe and the countries of North Africa and the Middle East, whereas transportation lines with high voltage direct current would enable the transfer at reasonable costs.
- Benefits as clean environment, prosperity, employment and availability of desalted water are expected for the participants of the partnership.



# HVDC lines connecting Europe with MENA



# WHAT ARE THE WIN OBJECTIVES ?

- Europe wins:
  - ○ Clean and cheaper electricity
  - (price goes down instead of climbing fossil fuel prices).
  - ○ Employment due to machinery exportation.
  - ○ Investing capital instead of burning fossil fuel.
  - ○ Diversification of energy supplies.



## MENA wins:

- ○ Water in considerable amount.
- ○ Sells electricity for a reasonable price.
- ○ Social and economic development.
- ○ Employment and winning technology knowledge.

# Environment wins:

- o Less CO2 emission.
- o This system encourages developing of low cost equipment and
- extending the solar share to 100% using heat storage,
- a technology that is not yet commercially available for large scale.

# **Academic Research Case Studies Achieved in Kirkuk Technical college**

- 1) Kirkuk Municipal Waste to Electric Energy
- 2) Carbon Dioxide Free Power Plants in Iraq
- 3) The Effect of Using Concentrated Solar Power Systems (CSP) in Iraq to Mitigate Climate Change Impact**

# 1st Case Study: Kirkuk Municipal Waste to Electrical Energy

For years Kirkuk residents have been dumping their garbage into unregulated areas or merely unloading it in open fields outside the city.

This unrestricted dumping has the potential to cause serious health, environmental and public safety concerns.











To find an environmentally safe solution to the city's garbage collection and disposal, a sustained Solid Waste. Management Program for Kirkuk was initiated in 2005. This site represents the first environmentally engineered and constructed landfill in Iraq.

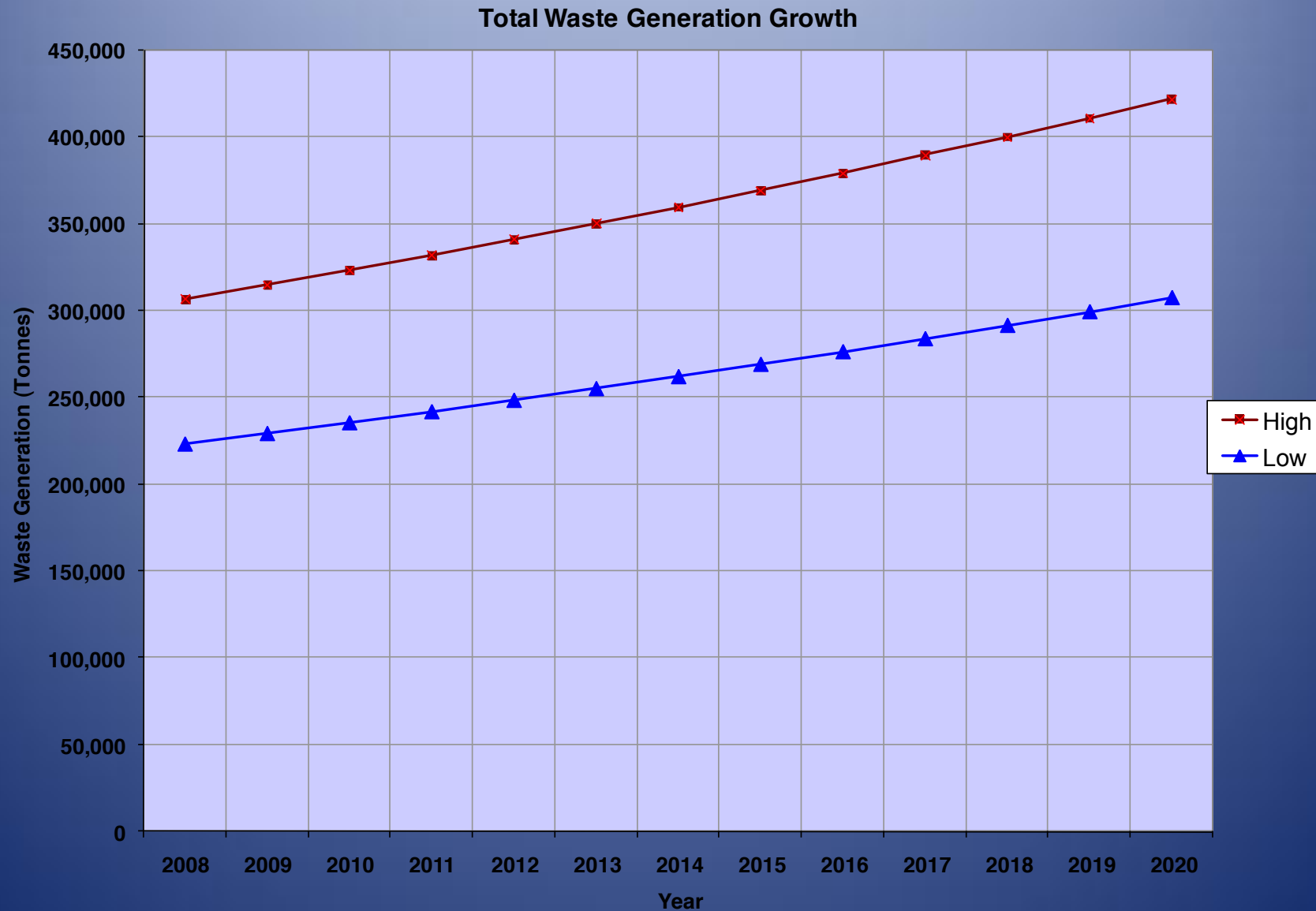


The generation of waste is expected to grow in the future with the rise of city population.

The daily waste generation is projected to 1000 tone in 2011.

By 2021, the daily waste will amount to 1200 tones. Potential power for a plant sourcing from the MSW mass to be fed into the national grid was estimated at 5 MW.

# Waste Growth



Kirkuk high and low estimation waste growth

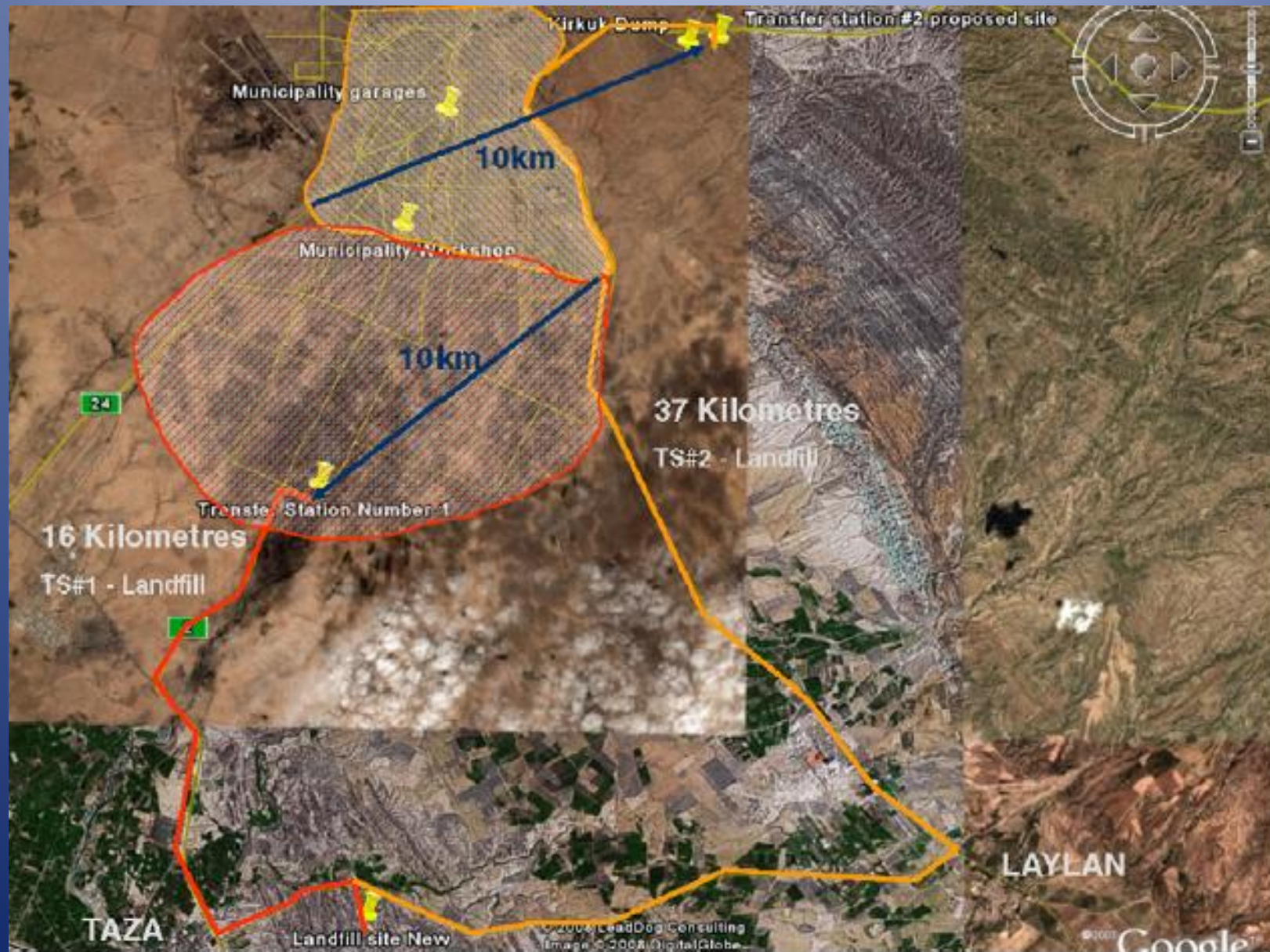
Landfill gas extraction system proposed for installation during landfill operation is aimed to comply with USA Environmental Protection Agency(EPA) guidelines for a Class 1 sanitary landfill site, as well as with the European Union Landfill Directive active landfill site construction requirements.

# The new Landfill in Kirkuk City





# Kirkuk space image landfill site



- Equivalent CO<sub>2</sub> emission in the absence of waste to electrical energy project and the emission by proposed
- project were calculated.
- The reduction in CO<sub>2</sub> emission is 87.4%.

# Results and benefits

1. Local air quality will be improved.
2. The project will deliver more electricity to the grid, reducing one of the people problems in load shedding in Iraq.
3. The project will help to solve waste disposal problem.
4. Creation of jobs and improving the quality of life of people live in areas adjacent to the project site .
5. Leading to further emission reduction.
6. The new technology, however, still needs to prove the capability to supply energy for a sustainable world.
7. Waste to energy (WTE) is a proven, environmentally sound process that provides reliable electricity generation.





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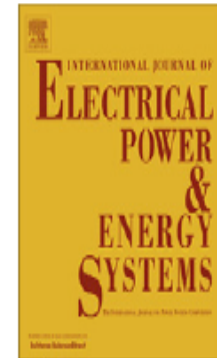




Contents lists available at SciVerse ScienceDirect

## Electrical Power and Energy Systems

journal homepage: [www.elsevier.com/locate/ijepes](http://www.elsevier.com/locate/ijepes)



### Kirkuk municipal waste to electrical energy

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## 2<sup>nd</sup> Case Study

# Carbon Dioxide Free Power Plants in Iraq

The aim of this work is to mitigate the impact of climate change by reducing the amount of CO<sub>2</sub> techniques, and to calculate the cost of the system components.

CO<sub>2</sub> capture & storage (CCS) is a process comprised of three steps. The **first** is CO<sub>2</sub> capture from CO<sub>2</sub> point sources such as power plants, industrial facilities, and natural gas wells with high CO<sub>2</sub> content emissions. The **second** step is transportation via pipelines to the storage site; and the **third** step is geological storage in deep geological formations including saline formations, depleted oil/gas fields, coal seams, and enhanced oil or gas recovery sites.





1 :MOLAABDULLAH ELECTRIC POWER STATION  
2 :TAZEH ELECTRIC POWER STATION  
3 :GAS WELL K23



**MOLAABDULLAH  
ELECTRIC POWER**

**TAZEH ELECTRIC  
POWER STATION**

**INJECTION WELL**

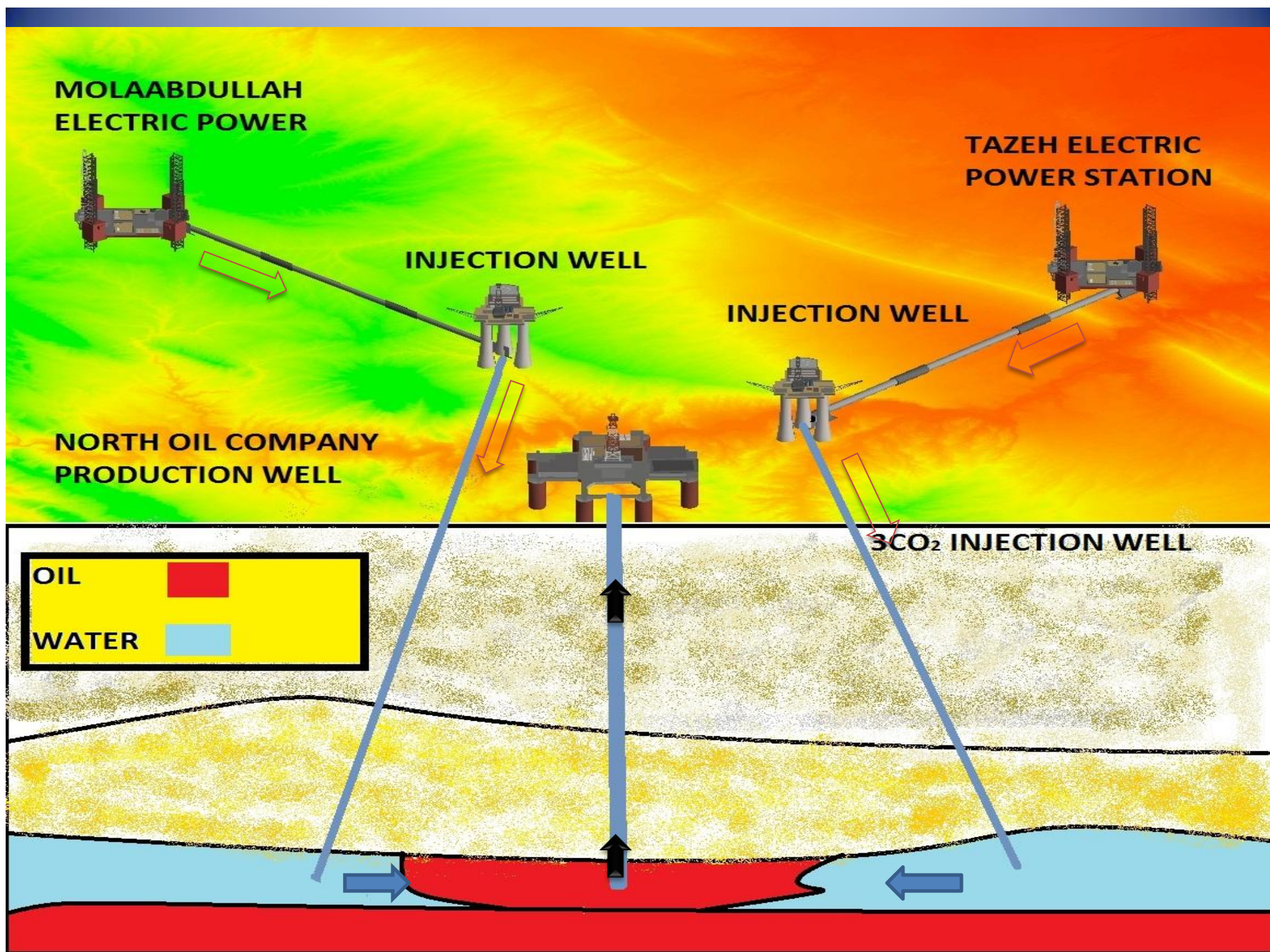
**INJECTION WELL**

**NORTH OIL COMPANY  
PRODUCTION WELL**

**SCO<sub>2</sub> INJECTION WELL**

**OIL**

**WATER**



# The Conclusions:

- CCS technology is not expected to be commercially available for use in power generation before 2020.
- CCS predicts a good reduction in CO<sub>2</sub> emissions.
- This analysis confirms that CCS is an important potential response to climate change throughout the 21st century and a technology that can help control the cost of addressing climate change.



# The 3<sup>rd</sup> Case Study

## The Effect of Using Concentrated Solar Power Systems (CSP) in Iraq to Mitigate Climate Change Impact



Parabolic Trough



Parabolic Dish-Engine



Power Tower



Concentrating Photovoltaic

Our individual project is to study the effect of using solar power system to reduce the lack in electricity and to reduce CO<sub>2</sub> emissions.

The case study in our individual project is Kirkuk city which has two gas electrical power plants, (Mulla Abdullah & Taza).

CO<sub>2</sub> emissions from these two power plants were calculated and a suggested **Concentrated Solar Power CSP** was designed.

Proposed project in Kirkuk city reduce CO<sub>2</sub> emission by 100760 tones CO<sub>2</sub>/year. The reduction in CO<sub>2</sub> emission= **15.47%**

# Thank You