

UNEP/UNDP program of capacity development
for the CDM in MENA region



Baseline methodology applied to :

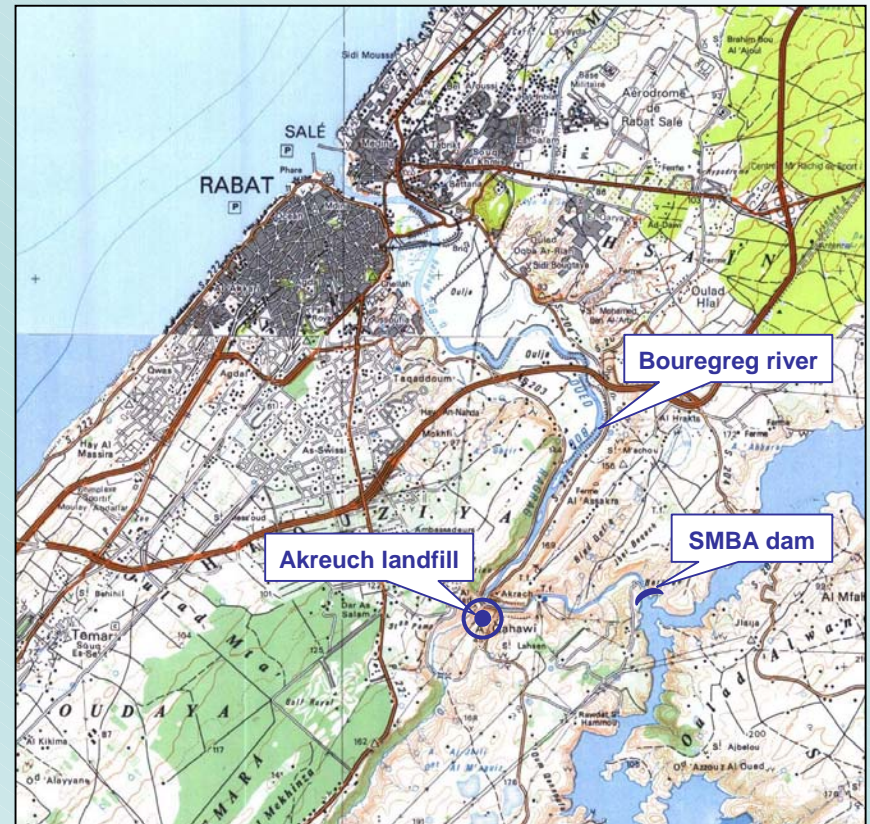
Akreuch Landfill gas project

Hammamet, March 18-20, 2004

Presented by : M'hammed EL MERINI - Morocco

Akreuch landfill

- Located 12 km south west of Rabat;
- Opened in 1984;
- Saturation is expected in 2004;
- Receiving at present about 510 tons a day of waste;
- Expected to gather more than 3 million tons at closing.
- Landfill area : 4.3 Ha
- Waste structured as a layer from 25 to 45 m deep.



Akreuch landfill gas project

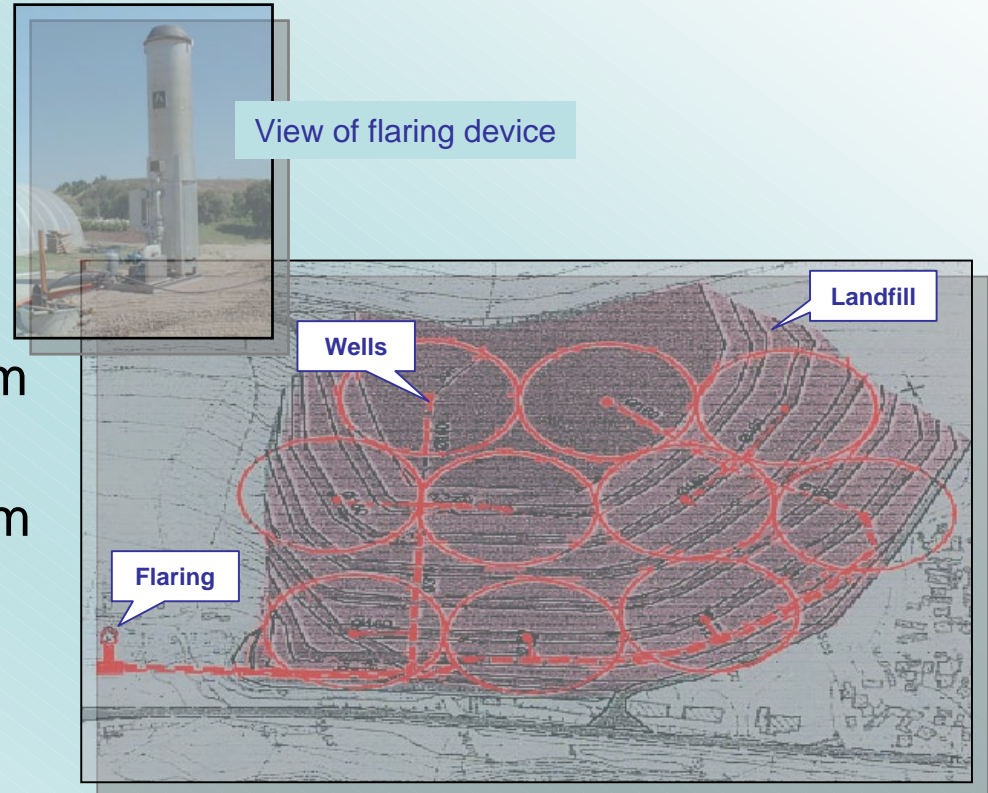
Opportunity

- The Rabat City Council has decided to rehabilitate Akreuch landfill;
- According to present regulation, landfill rehabilitation projects are to cover the area by a vegetal soil with modeling and planting of slopes;
- The Akreuch landfill gas project is aimed to introduce, within the initial rehabilitation project, the option of methane collecting and flaring;

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Technical issues

- The gas flaring system includes:
 - Draining network as central wells with gas from 20 to 30 m around;
 - Collecting network at 25 m depth taking gas from wells to the drying, suction, flaring system.



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Financial issues

- The initial investment cost of the project is estimated to US \$ 850,000 with operating and maintenance annual charges of US \$ 55,000.
 - As there can be no direct profit from the gas flaring, the project is not viable from the financial point of view.
 - Even with considering the electrical energy producing and sale, which is facing several institutional constraints, the project remains not attractive (IRR 3.5%).
- ➔ The Sale of Gas Emissions Reduction Units seems to be the one option to make the project more attractive.

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Baseline methodology

- The Baseline methodology is « Simplified financial analysis of the investment project where « Business As Usual » is the one possible option ». *This methodology has been approved in the 11th meeting of the EB (AM0003).*
- Two options are then of concern “Investment project” and “Business as Usual”;
- The emissions reduction is calculated as follows:
 - Evaluation of the total amount of waste at the closing of the landfill;
 - Calculation of methane emissions for both the two options;
 - Calculation of emission reduction between the two options.

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Baseline calculations

- **Amount of waste at the closing of the landfill :**

3.1 millions of tons

This is an average rate of 146,200 tons a year during the operating period from 1984 to 2004.

- **Calculation of biogas emissions:**

Biogas emissions are calculated within the EPA formula:

$$\text{LFG (cf)} = 2 \text{ Lo R (e}^{-kc} - \text{e}^{-kt})$$

where: Lo and k are constants Lo = 2.565 (cf/lb) and k = 0.1 (1/an)
R is the annual average amount of waste
t is the duration since the deposit of the waste in the landfill
c is the duration since the closing of the landfill

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Baseline calculations

- **Conversion to methane emissions:**

Methane emissions are calculated by conversion of the former formula into the following:

$$\text{CH}_4 \text{ (ton)} = 2 A d L_o R (e^{-kc} - e^{-kt})$$

where:

- A is the part of methane in biogas (60%)
- d is density of methane ($679 \cdot 10^{-6}$ ton/m³)
- L_o and k are constants L_o = 160.13 (m³/ton) and k = 0.1 (1/an)
- R is the annual average amount of waste
- t is the duration since the deposit of the waste in the landfill
- c is the duration since the closing of the landfill

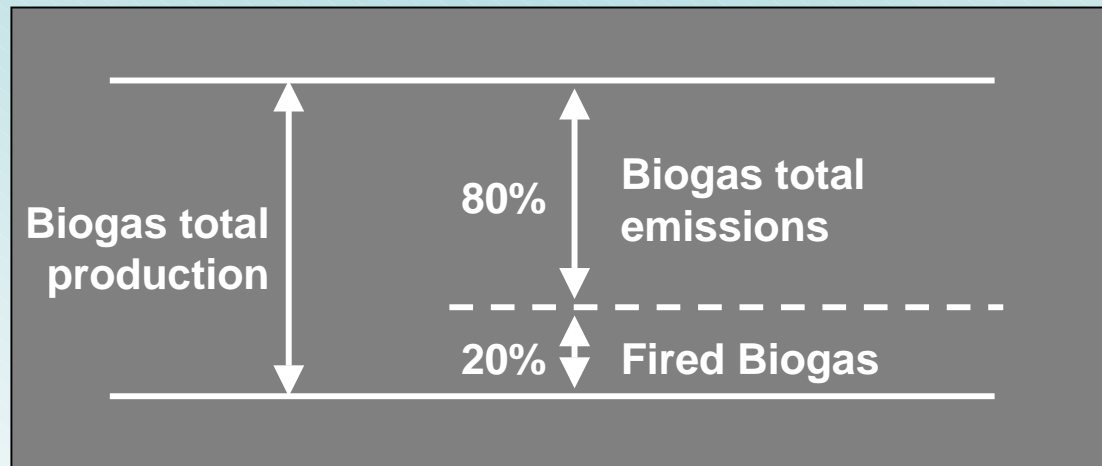
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Baseline calculations

- **Amount of NET biogas emissions (BAU option) :**

In the BAU option, the amount of net biogas emissions is estimated to **80%** of the total biogas emissions.

20% are granted to be already fired in different ways.



*NB: More conservative approaches (Moroccan baseline guidelines) consider the biogas total emissions to be only **75%** of the biogas total production (instead of 80%).*

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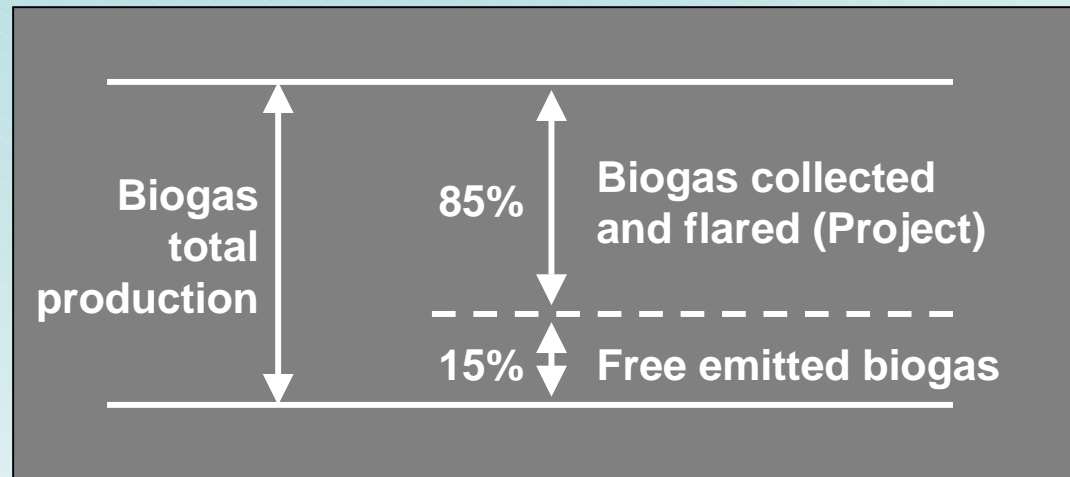
Baseline calculations

- **Amount of NET biogas emissions (Project option) :**

In the Project option, the amount of collected biogas within the project facilities, is estimated to 85% of the total biogas emissions.

15% are granted to continue being emitted in the atmosphere.

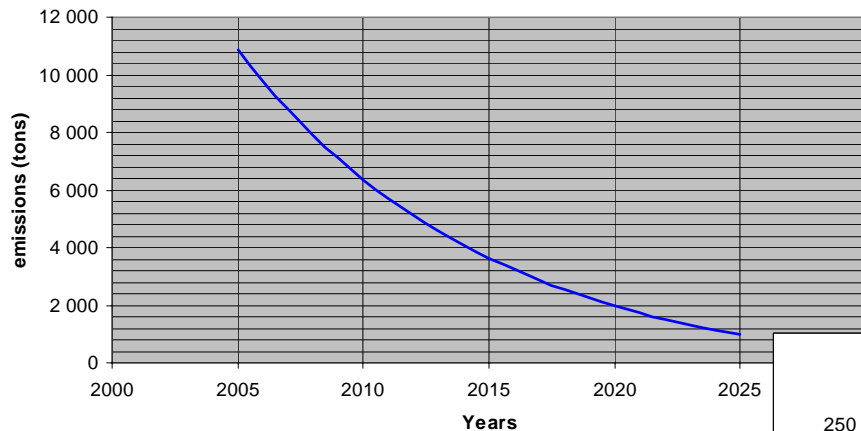
Then, the amount of net biogas emissions within the project would basically be **15%** of the total biogas emissions.



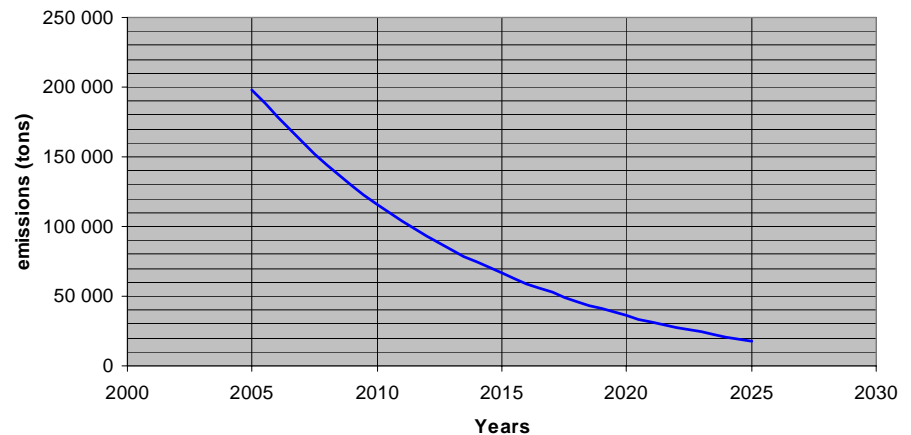
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Baseline results

Methane emissions in the BAU option - Baseline



CO2 Eq emissions in the BAU option - Baseline



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Baseline results

Results presented as in the Moroccan baseline guidelines for landfill gas projects :

Total volume of produced biogas in the landfill in 21 years (m3)	286,805,330
Amount of produced methane in 21 years (tons)	116,844
Amount of methane emitted within the baseline in 21 years (tons)	93,476
Amount of CO2 equivalent emitted in 21 years (tons)	1,962,987
Residual amount of CO2 equivalent in 21 years (tons)	368,060
Reduced amount of CO2 equivalent in 21 years (tons)	1,594,927