Technology Fact Sheet for Mitigation
Sector: Industry
Sub sector: Energy Industry
High Efficient Boilers for Steam Generation Using Dual Fuel [i]

A.1 Introduction

A boiler is a closed pressure vessel in which a fluid is heated for use external to itself by the direct application of heat resulting from the combustion of fuel (Solid, liquid, or gaseous) or nuclear energy. Energy efficiency in industrial power house depend on four factors, fuel type, combustion system limitations , equipment design and steam system operation requirements. The boilers should be designed in low maintenance and high efficiency; the burner should be compatible with boiler.

In Sudan we classified boilers as follows:

Fire –tube boilers, which are includes:

a) Locomotive fire-box boilers.

b) Vertical tubular boilers.

c) Horizontal multi-tubular boilers (used in a wide range).

60% out of the total number are using fuel oil which leads to pollution and production of CO_2 due to improper combustion control. Type (a) and (b) are using coal, but not widely. Majority of boilers used in Sudanese industry is old in design and inefficient.

Technology improvements for boilers focus on efficiency and low-cost design while giving increasingly more attention to air pollutant emissions which are carbon monoxide, hydrogen chloride , mercury as well as GHG such as CO_2 and No_x. The emission depends on fuel type (solid, liquid, gaseous). CO_2 emissions are based on input fuel emission factors corrected for boiler efficiency. Basic fuel emission factors are 50.29 kg CO_2/TJ for natural gas, for distillate fuel oil 69.33kg CO_2/TJ, for residual fuel oil 74.69 kg CO_2/TJ, for coal 89.08kg CO_2/TJ.

A.2 Technology characteristics

Improvement of efficiency of industrial boilers can be attained by adding advanced heat recovery and controls measures to the boiler system. Boiler units with high efficiency should have Maximum Continuous Rating (MCR) The technology involve replacing fuel oil and coal by LPG which has heating value of 32000kJ/kg. The burners should be upgraded by suitable dual burners system to LPG or for fuel-oil. Emission reduction in boilers depends on boiler efficiency and fuel type.

Using LPG with (different) efficiency boilers will reduce the CO_2 emission compared with other fuel Table 1.

Table 1 The relation between Boiler Thermal efficiency and CO_2Emission for different fuel

Boiler Thermal efficiency.	Emission preheat output(kgCO2/mm Btu)			
	Natural Gas(NG)	Distilled fuel oil	Residual fuel oil	Coal
80%	66.3	91.4	98.5	117.5
85%	62.4	86.1	92.7	110.6
90%	59.6	81.3	87.6	104.4
94%	56.4	77.8	83.8	100.0

Source: Climate leaders' greenhouse gas inventory protocol offset project

A.3 Country specific / applicability

Using high efficiency boilers will contribute positively in saving energy and consequently is saving money and using LPG as alternative fuel in steam generation has potential in Sudan, in spite of the fact that there is scarcity in the availability, some private gas company start to import mainly for industrial sector demand.

A.4 Status of technology in country

Majority of boilers used in industries are low efficient very few industries uses high efficient boilers. Less than 2% of industries are using LPG as fuel for boilers ignition, there is problem in burners that designed mainly for LPG it is expensive.

A.5 Barriers

• Specification of high efficiency boilers needs technical know-how with reference to type of industry.
• LPG fuel is flammable and toxic; it is proven to be extremely dangerous, leakage makes cause fire or explosions,
• Special requirement are needed to be transported to industrial sector.
• Scarcity of LPG in market for industrial sector, Household sector is given higher priority.
• Efficient and dual burner boilers are expensive.

A.6 Benefits to economic / social and environmental development

Environmentally: clean technology reduces the CO2 emission more 70 % in the case of complete combustion.
Economical: Low cost compared with fuel oil.

A.7 Costs

LPG is less in cost compared to Fuel- oil.
Tonne of LPG is 1200 SDG; Tonne of Fuel –oil is 2000 SDG, considering the Energy content of LPG to be 46.1 GJ/t and of fuel oil to be 42.5 GJ/t. Then the LPG cost is 26 SDG/GJ and fuel oil cost is 47 SDG/GJ
Burner cost 40000-80000 SDG depending on the capacity of the burner.
High Efficiency boiler cost depends on the type and size of boiler.

A.8 Others

The cost of the Fuel oil in the industrial sector is high and unavailable, so introducing LPG as alternative fuel will be solution for the industrial sector.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment for Climate Change Mitigation - Sudan. You can access the complete report from the TNA project website http://tech-action.org/**