Case Study – 4	Tableware manufacturing industry having tunnel kiln (Fuel: Natural Gas)
Implementing the technology	Flue gas exhaust at the tunnel kiln furnace & decoration kiln was monitored. % O_2 in flue gas is more than 11 % in tunnel kiln and more 9 % in decoration kiln. % O_2 in flue gases should be between 2 – 6%. The same can be maintained by regular monitoring of flue gas sample with the help of a portable flue gas analyzer or by installing O_2sensor at the furnace exhaust for flue gases and a modulating motorized damper or RPM of combustion air blower through VFD for combustion air control. The sensor will provide constant feedback of O_2% to the damper / VFD which will in turn regulate the flow of combustion air to maintain the combustion efficiency at optimum level of 80 - 90% (Achievable combustion efficiency).

Table: Flue Gas Monitoring Parameters at Tunnel Kiln

Parameter	Unit	At Kiln Exhaust	Firing Zone
Net Temperature	0C	215	482
O2	%	14.2	11.9
CO	ppm	11	53
Combustion Efficiency	%	69	55.2
CO2	%	3.9	5.2
Flue Gas Temperature	0C	233	507
Ambient Temperature	0C	20.6	25
Excess Air	%	198.5	127.1
Pressure	mbar	0.06	0.29

Table: Flue Gas Monitoring Parameters at Decoration Kiln

Parameter	Unit	Firing Zone
Net Temperature	0C	502
O2	%	10
CO	ppm	0
Combustion Efficiency	%	57.3
CO2	%	6.0
Flue Gas Temperature	0C	534
Ambient Temperature	0C	29.5
Excess Air	%	100.9
Pressure	mbar	0.02

It is suggested to control the combustion air through reducing the RPM of combustion air blower by 1-2 Hertz at a time by monitoring required temperature within kiln and set the appropriate frequency and monitoring the required O_2 percentage in flue gas to optimize the air fuel ratio and thus combustion efficiency at the kiln.

The proper control of air to fuel ratio can result in combustion efficiency more than 75 % with old burners as well. Thus increase in 10% combustion efficiency will result in saving of approximately **19,782** SCM gas per annum.

Benefit	
Environmental	• Per Day reduction in the gas consumption: 54.15 SCM. Per Year reduction in gas consumption: 19,782 SCM. • Per Day reduction in GHG (CO_2) emission: 113 Kg Per Year Reduction in GHG (CO_2) emission: 41,344 Kg
Economical	Investment: **Rs. 20,000/-** (For VFD) Savings: **Rs. 6,33,000/-** per annum Payback Period: **Immediate**