

Boiler Operating Costs with Natural Gas and #6 Oil

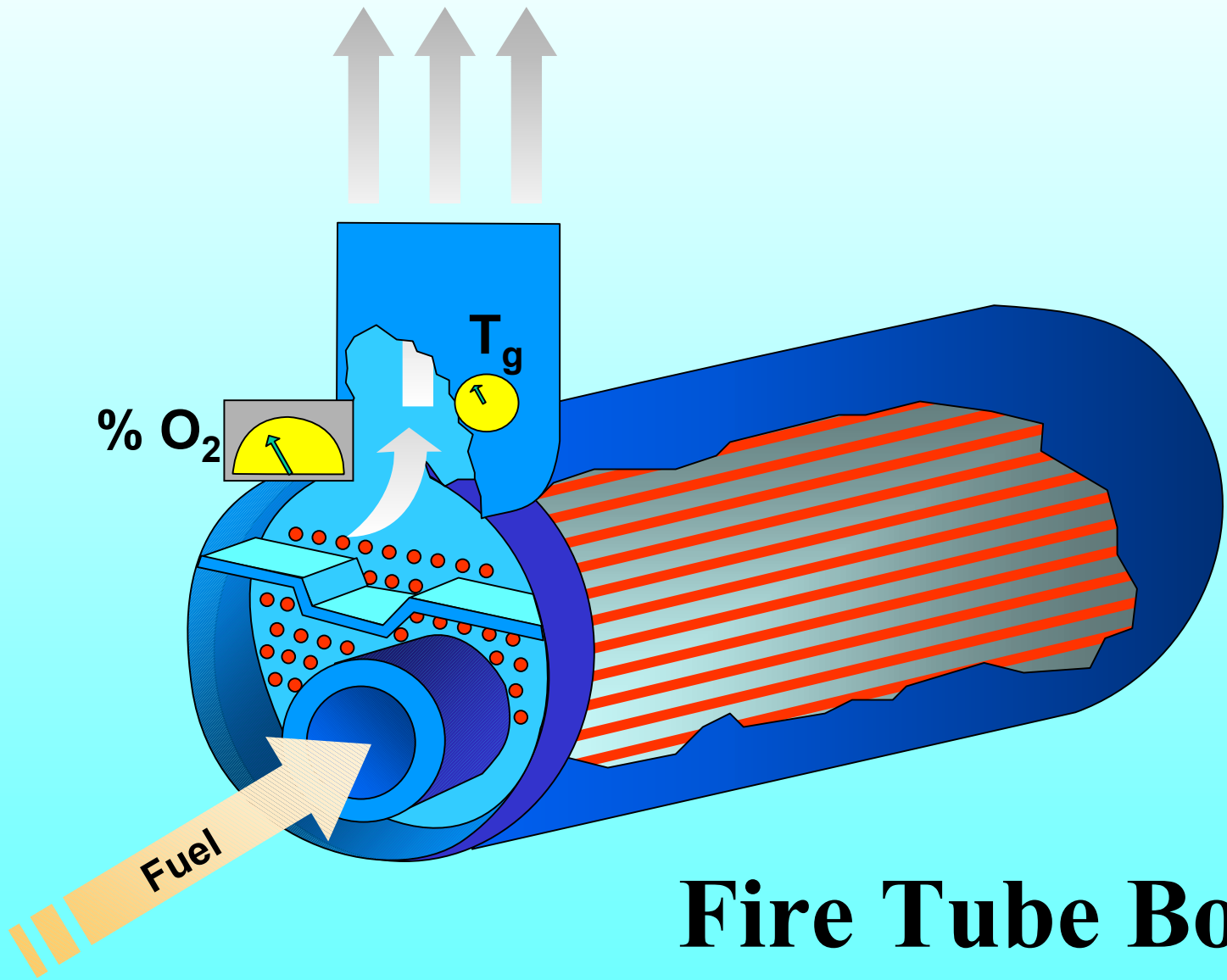
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March 27, 2002

Why Measure Parasitic Losses?

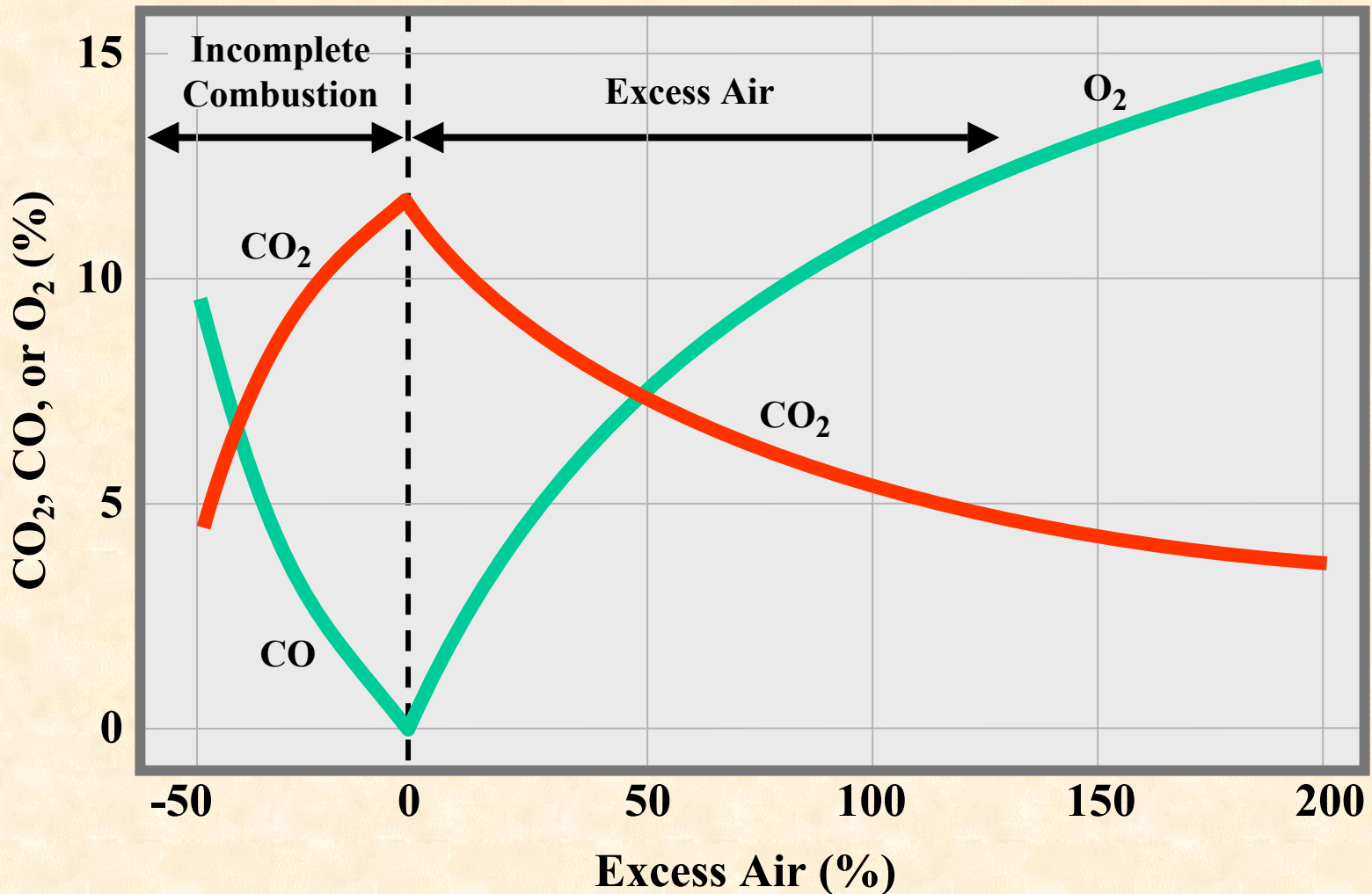
- Cost comparison based on “stack loss” only ignores parasitic losses and costs associated with oil-firing
- Important to quantify thermal losses and parasitic losses to determine the “true bottom line” efficiency and steam cost
- Bottom line efficiency helps in choosing the most economic fuel

Stack Loss

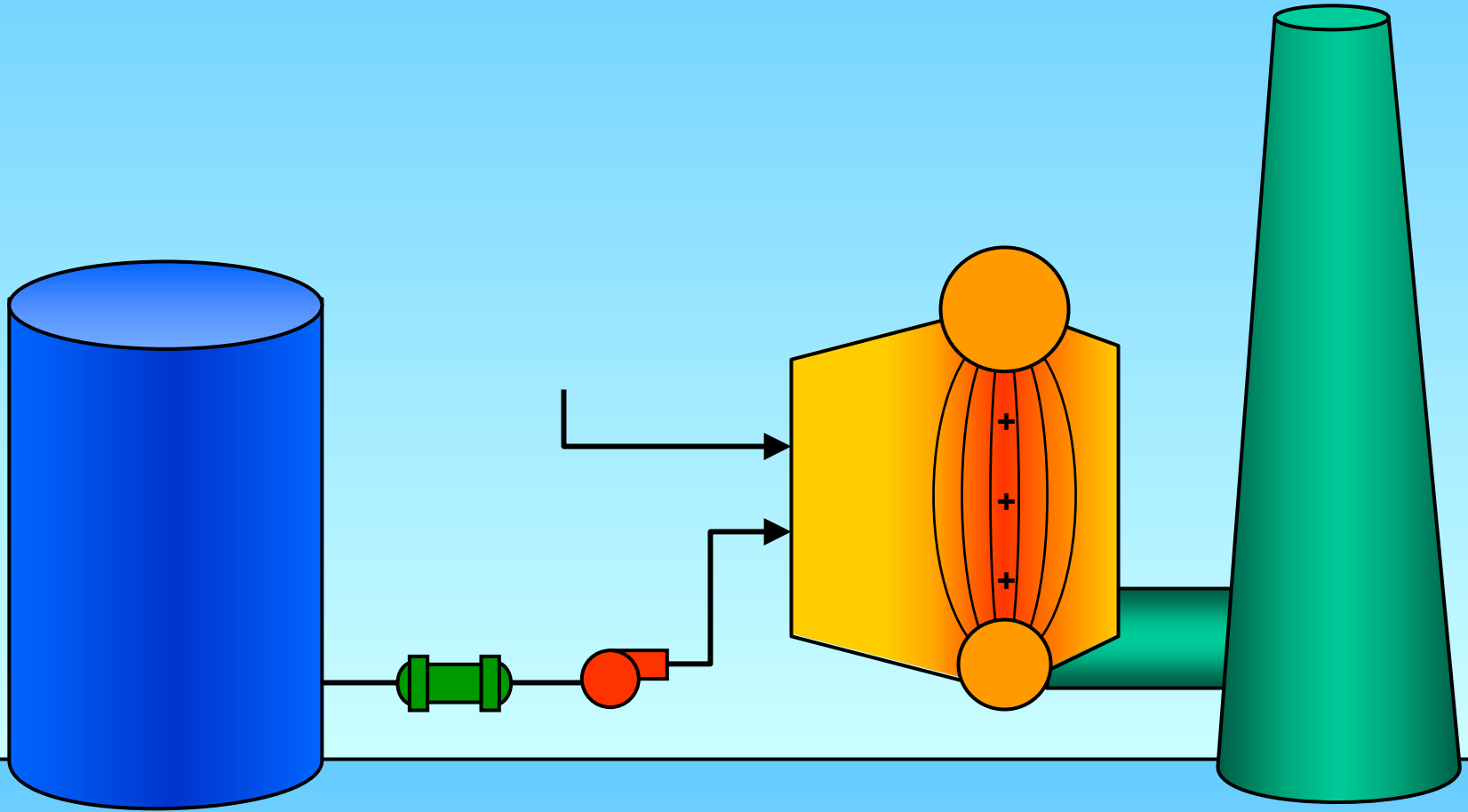


Fire Tube Boiler

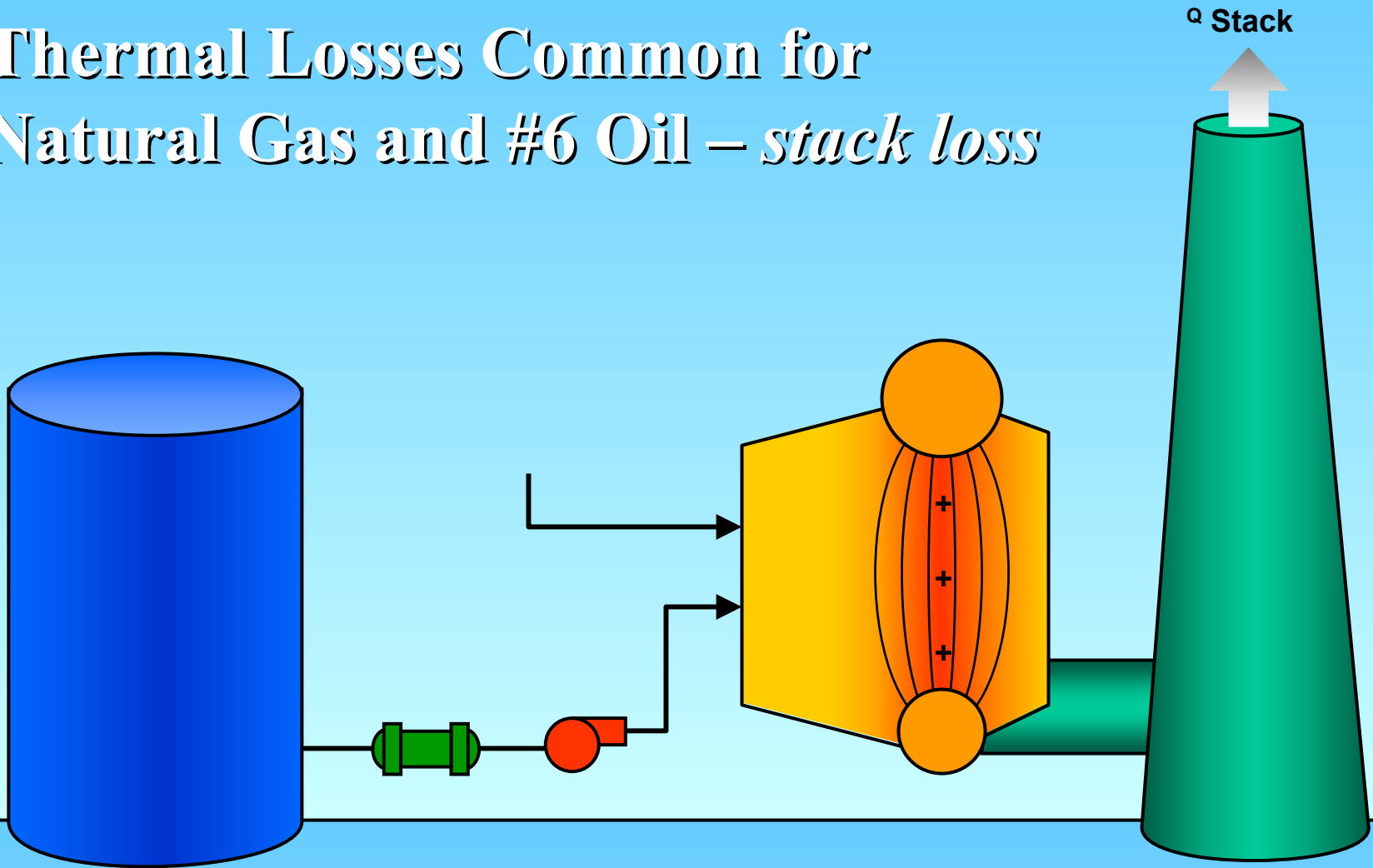
Effects of Excess Air on Flue Gas Composition



Typical Oil Firing Set-up



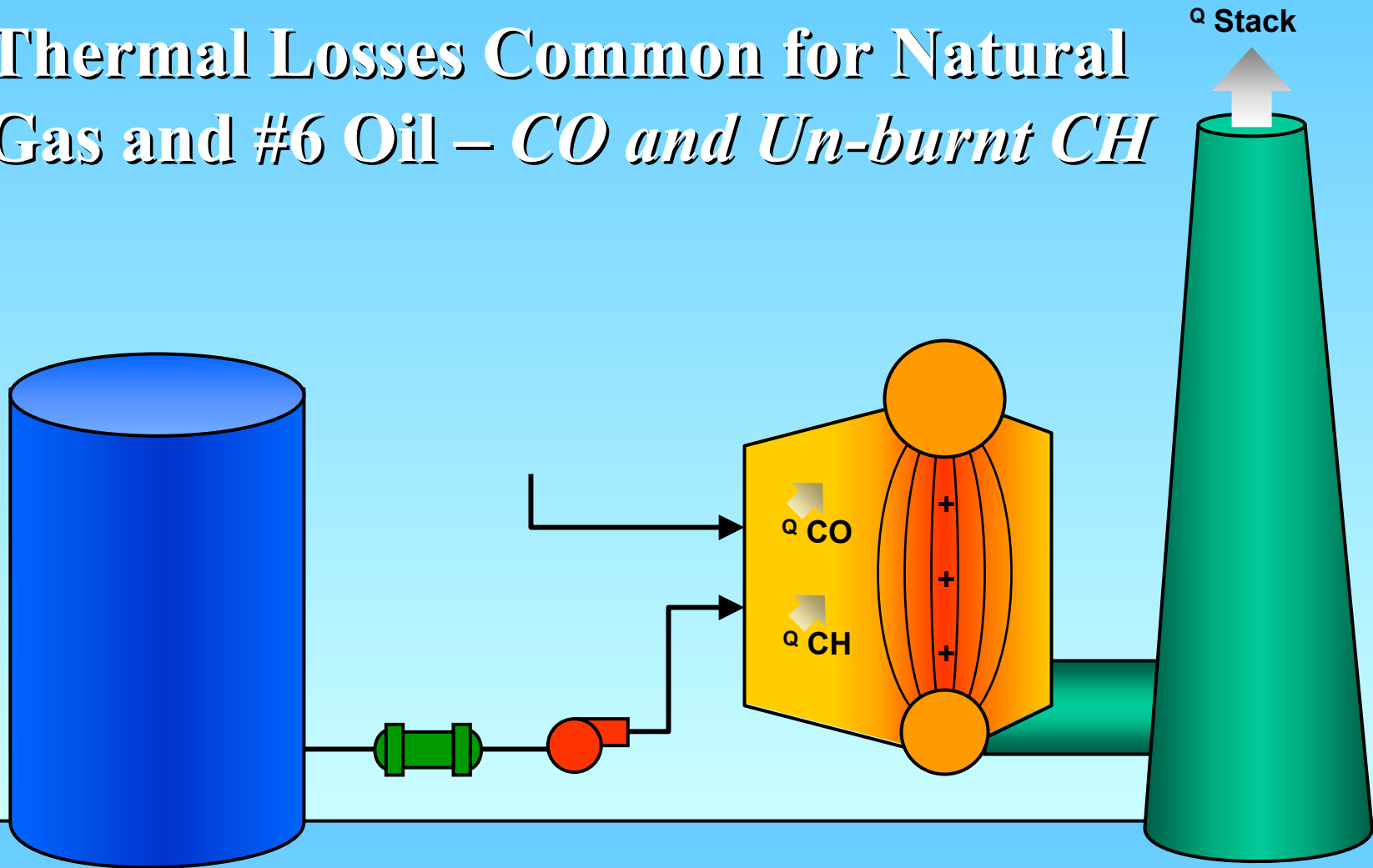
Thermal Losses Common for Natural Gas and #6 Oil – *stack loss*



Thermal Losses Common for Natural Gas and #6 Oil

- Stack Loss
 - Largest single loss
 - Depends on flue gas temperature, ambient air temperature, excess air and type of fuel
 - To determine stack loss, measure all above parameters

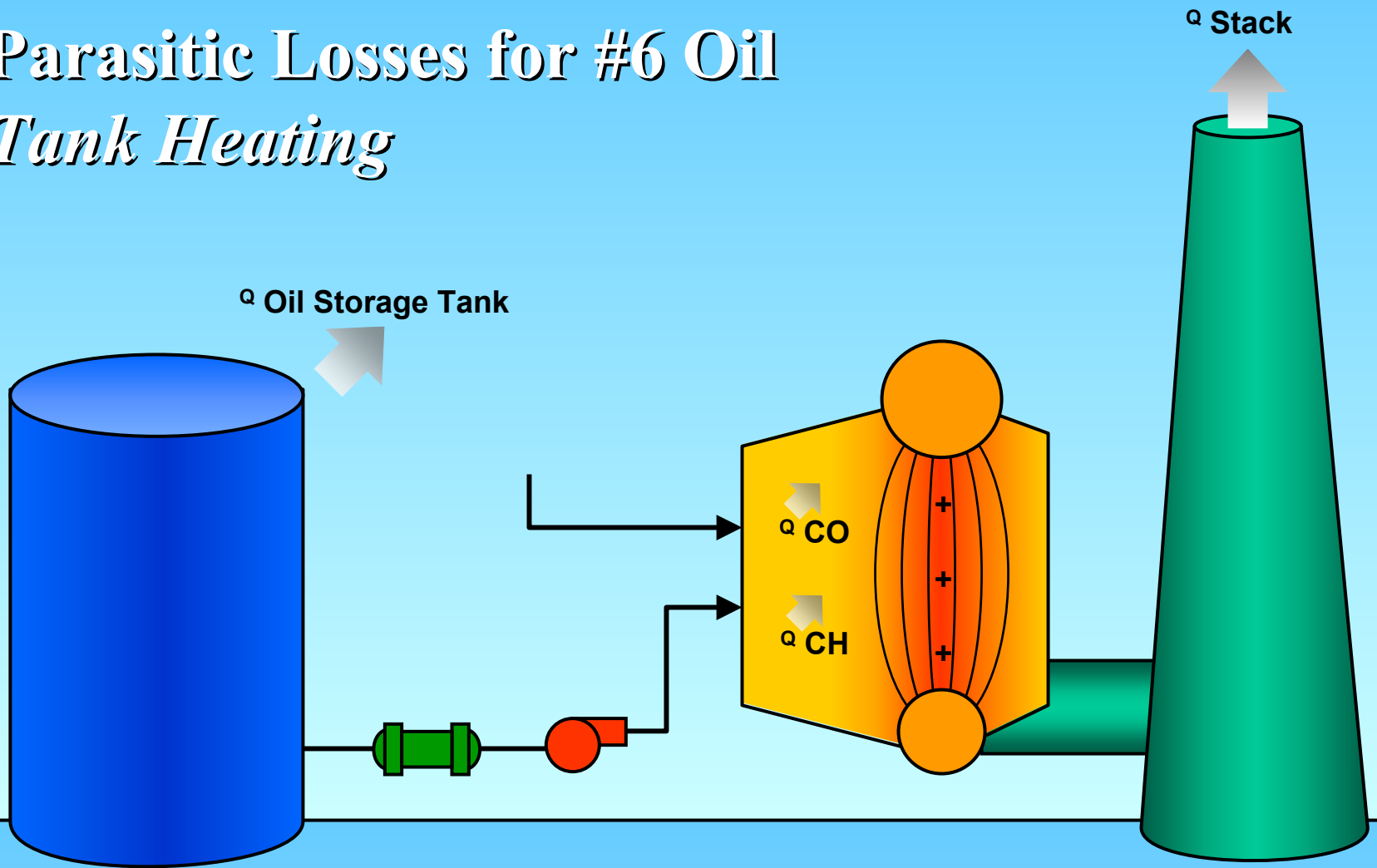
Thermal Losses Common for Natural Gas and #6 Oil – *CO and Un-burnt CH*



Thermal Losses Common for Natural Gas and #6 Oil

- CO and un-burnt CH
 - Caused by incomplete combustion
 - Lack of air to support complete combustion
 - Poor mixing of fuel and air
 - Poor atomization of fuel oil

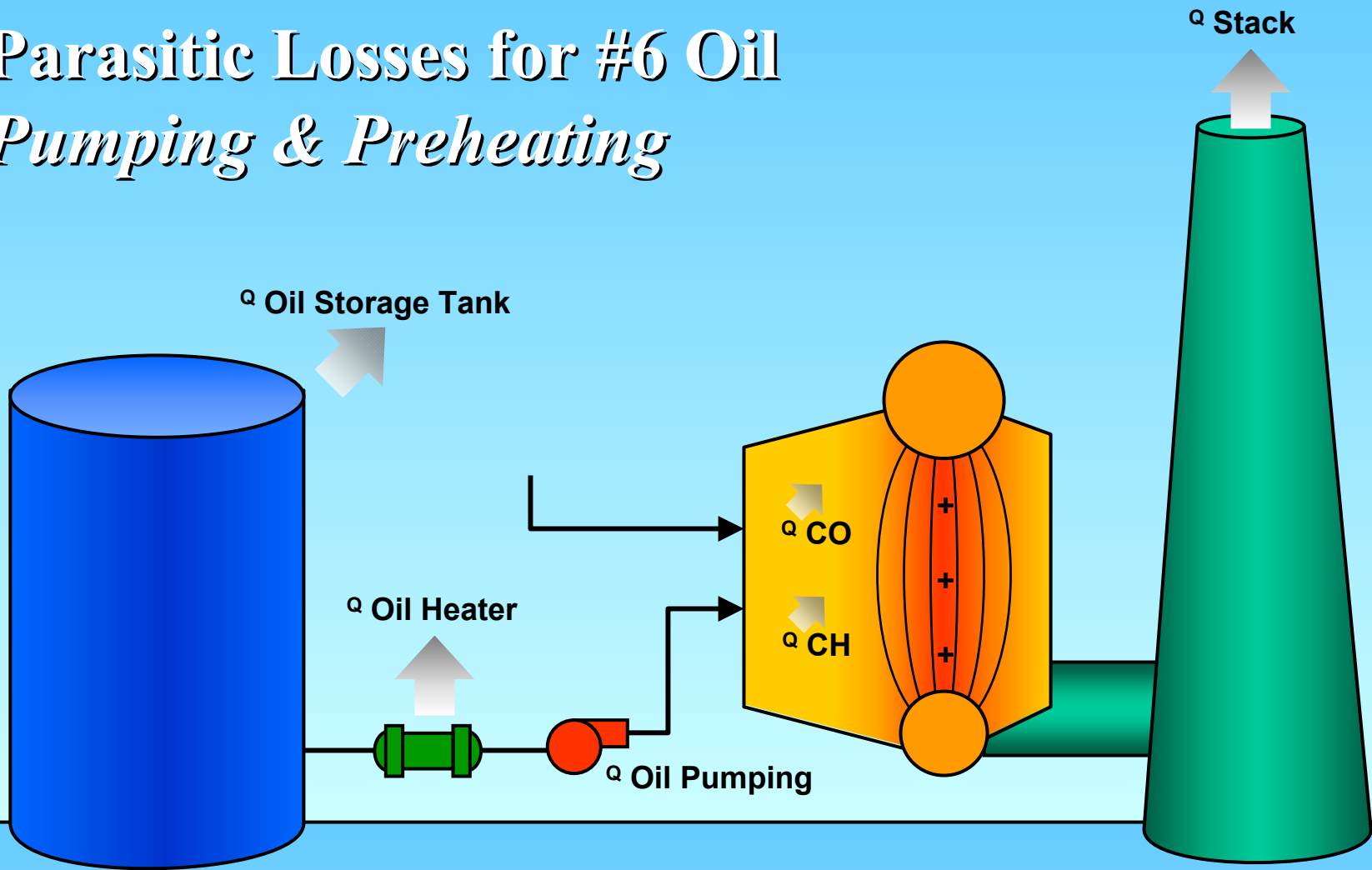
Parasitic Losses for #6 Oil *Tank Heating*



Parasitic Losses for #6 Oil

- Oil Tank Heating
 - Fuel oil is viscous and requires heating to facilitate pumping
 - Generally heated to 140 F
 - Heat loss can be quite high for single wall un-insulated oil storage tanks

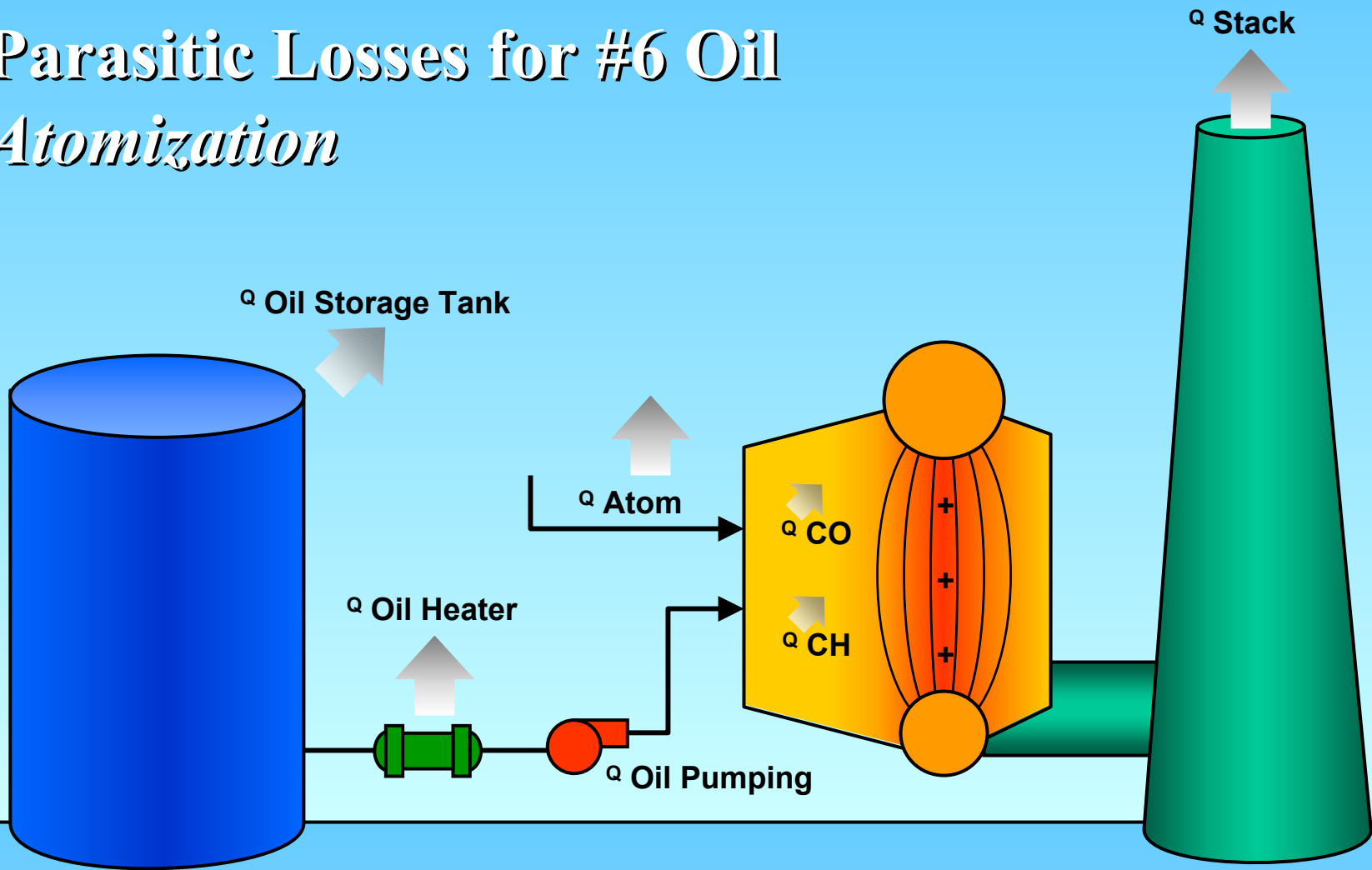
Parasitic Losses for #6 Oil *Pumping & Preheating*



Parasitic Losses for #6 Oil

- Oil Pumping
 - Pumps are required to circulate oil from storage tank to the burner
- Oil Preheating
 - To ensure proper atomization, oil must be heated 200 – 220 °F
 - Generally heated by steam or hot water
 - In some fire tube boiler application, steam/hot water heating is augmented by electric heating

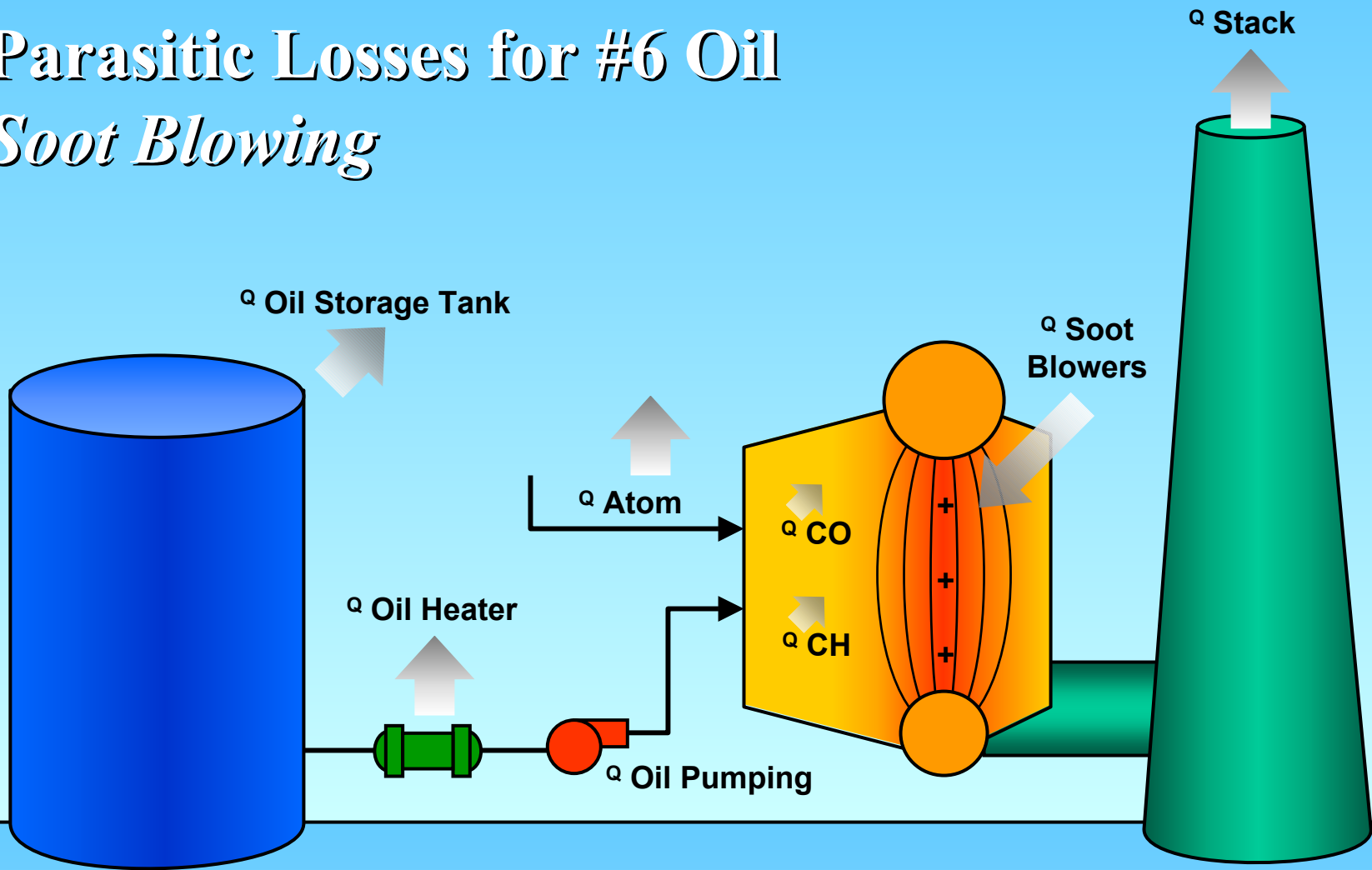
Parasitic Losses for #6 Oil *Atomization*



Parasitic Losses for #6 Oil

- Oil Atomization
 - For proper combustion, oil must be broken up into small particles
 - Done by injecting steam or compressed air into small oil supply at the burner

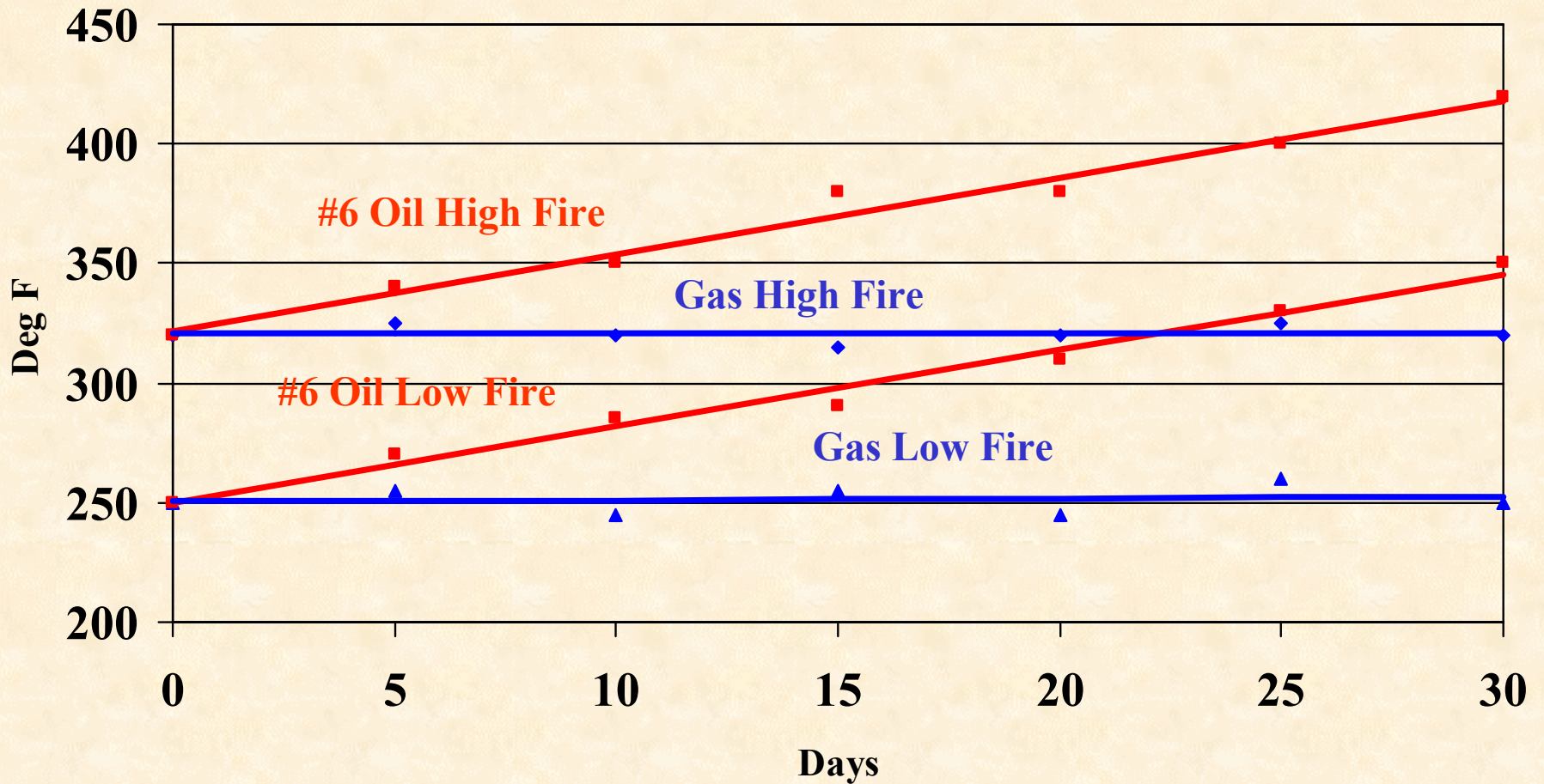
Parasitic Losses for #6 Oil *Soot Blowing*



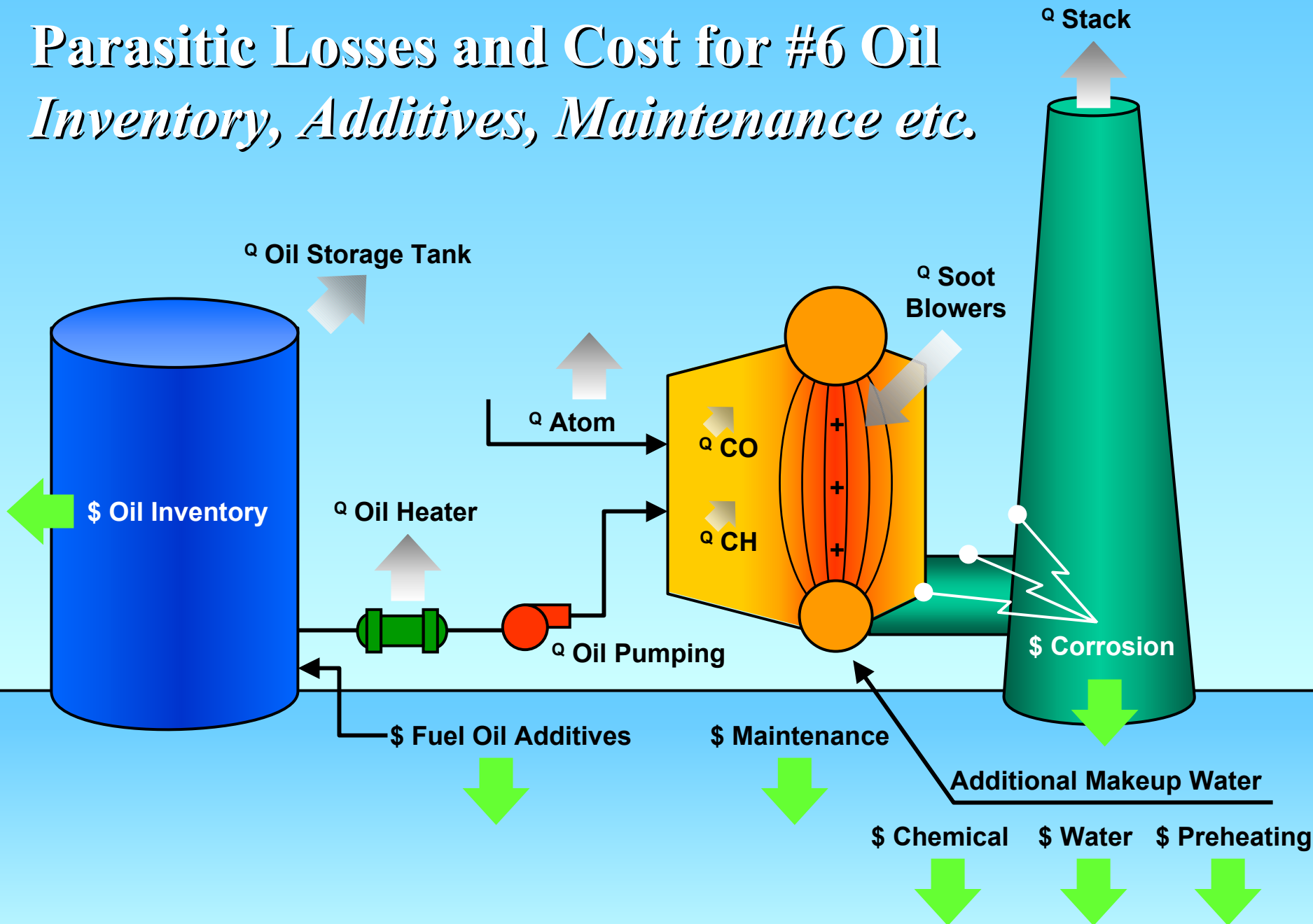
Parasitic Losses for #6 Oil

- Soot Blowing
 - Soot is created by oil burning
 - Soot leaves deposits on boiler tubes
 - Reduces heat transfer to boiler fluid
 - Generally cleaned by steam or compressed air
 - Fire tube boiler generally do not use soot blowers
 - Soot removal must be done by punching the tubes when stack temperature gets too high
 - Should be done at least quarterly to prevent high stack temperature resulting in high stack loss
 - Boiler must be shut down when tubes are punched

Flue Gas Temperature Over Time



Parasitic Losses and Cost for #6 Oil Inventory, Additives, Maintenance etc.



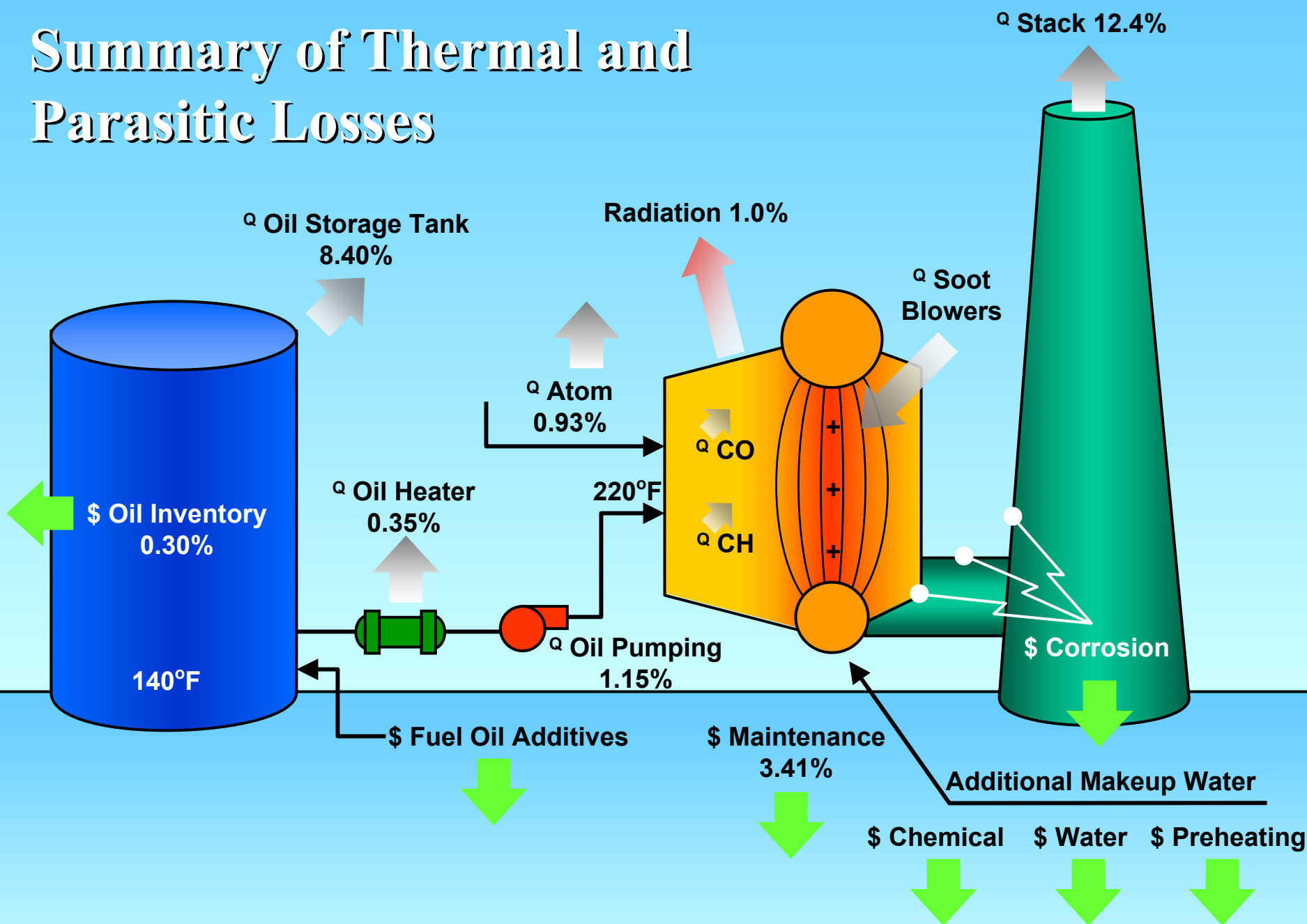
Parasitic Losses and Cost for #6 Oil

- Oil Storage Inventory
 - Storing oil on site ties up capital
 - This investment yields no return
- Oil Additives
 - Purposes
 - Reduce sludge in oil storage tank
 - Improve combustion
 - Reduce soot deposits
 - reduce cold end corrosion

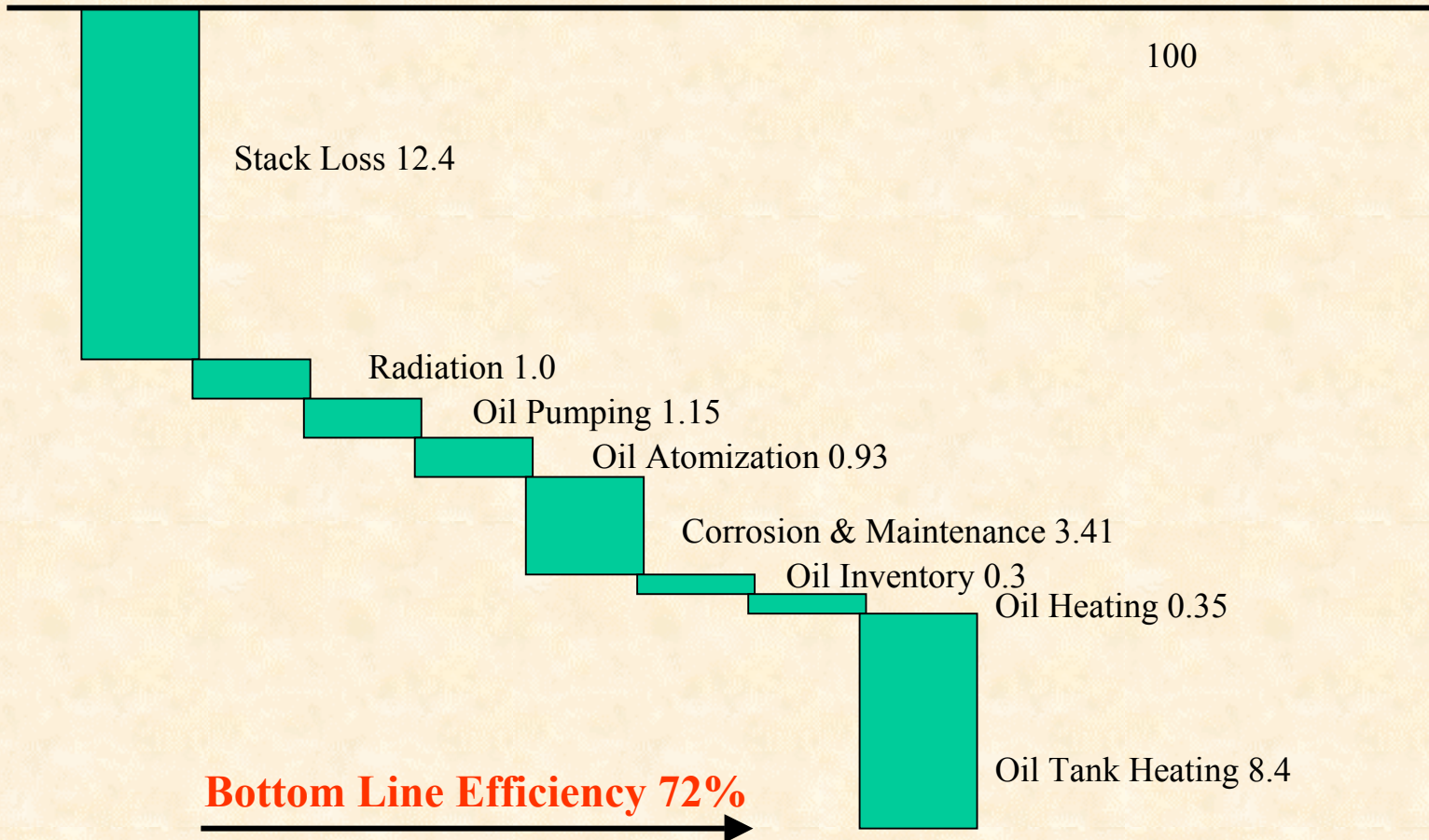
Parasitic Losses and Cost for #6 Oil

- Corrosion and Maintenance
 - Sulphur in oil causes cold end corrosion
 - Adds to maintenance costs
 - Reduces boiler life

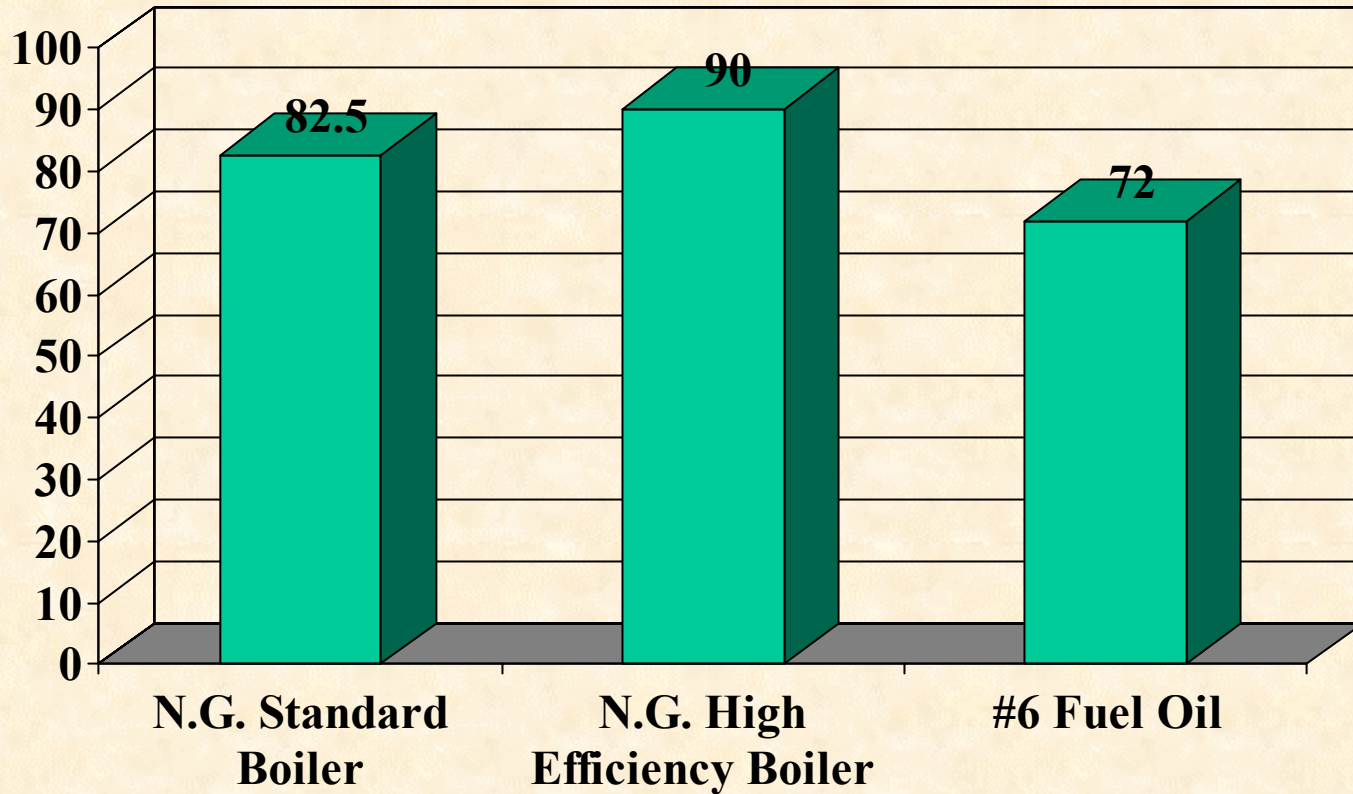
Summary of Thermal and Parasitic Losses



Bottom Line Efficiency for Oil Firing



Bottom Line Boiler Efficiency Comparison



Effect of Parasitic Losses on Cost of Delivered Steam

Average Fuel Cost	cents/litre \$/GJ	22.0 \$5.27
Cost of Delivered Steam (considering stack and radiation losses)	\$/GJ	\$6.09
Cost of Delivered Steam (considering stack and parasitic losses)	\$/GJ cents/litre	\$7.32 30.6
Incremental Cost Increase (due to parasitic losses)	\$/GJ cents/litre	\$1.23 8.6

Conclusions

- On average, parasitic losses can add about 9 cents per litre to #6 fuel oil price
- Take into account all parasitic losses and costs associated with #6 fuel oil firing while comparing costs with natural gas
- Keep boilers properly tuned for maximum efficiency