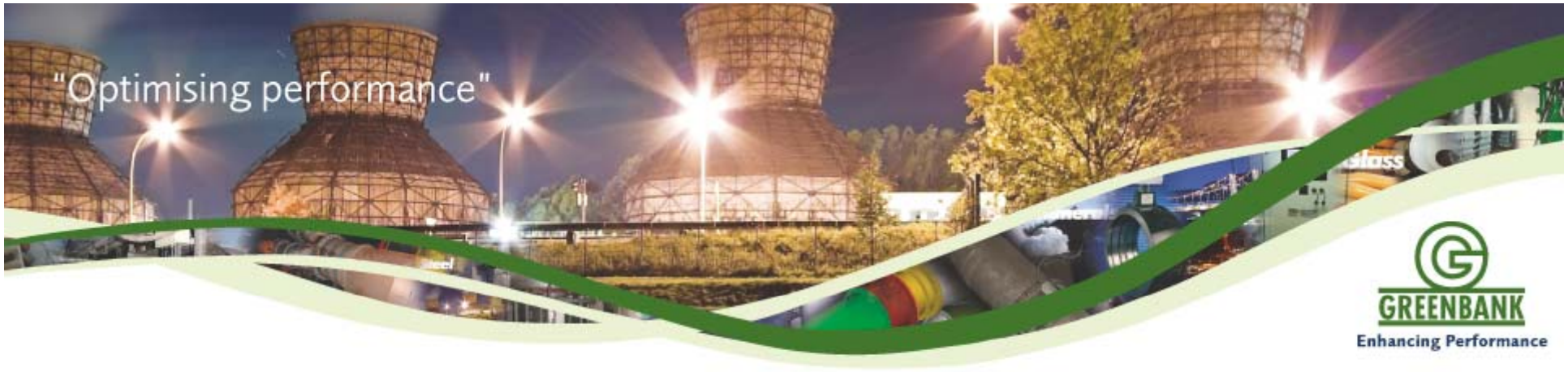


What we need to know about coal

The Manufacturers Perspective

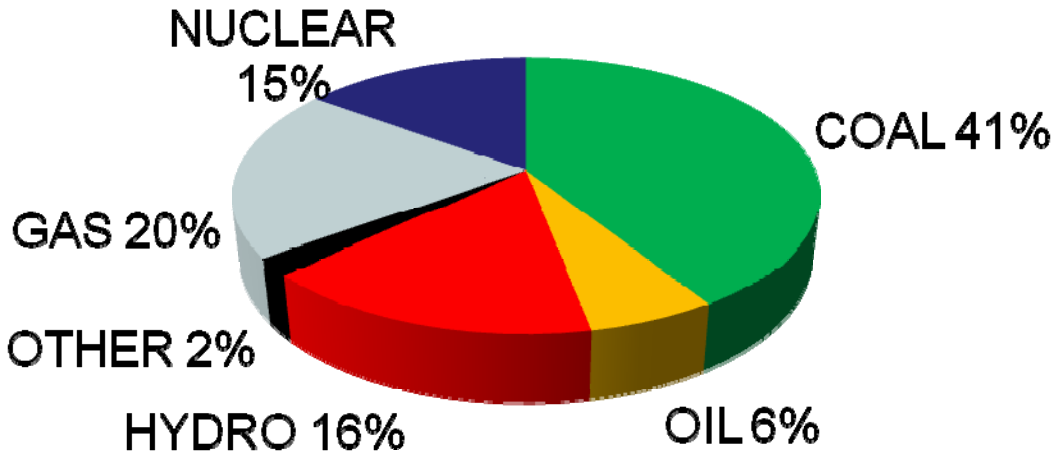
Jacob Roberts
Project Development Engineer
Combustion Group
Greenbank Group UK

Greenbank Terotech - Systems Division
"The implementation and deployment of specialised products for optimising system performance"

Our Main Activities

- Assist operators of coal fired boilers in improving plant
- Improved monitoring and measurement
- Enhancing life-cycle of plant and equipment
- Replacement of plant and equipment

Coal use for Electricity



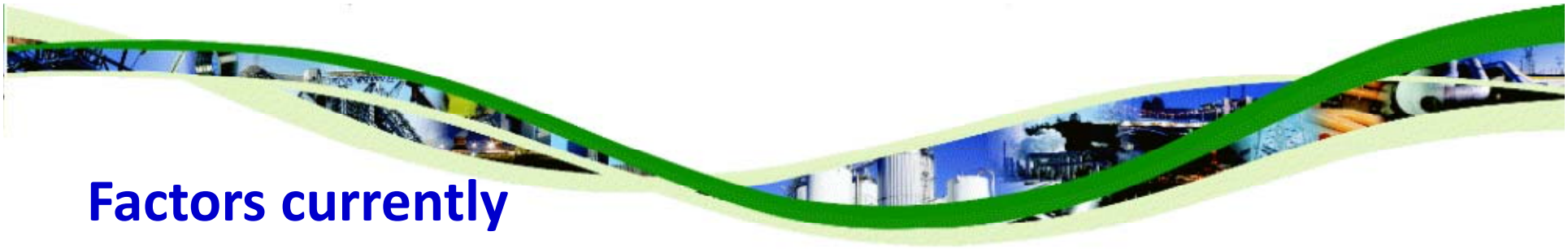
Forecast is for coal use to exceed 44% by 2030

Total World Electricity Generation by Fuel (2006)
Source: *IEA 2008*

Coal usage for Electricity Production

South Africa 93%	Poland 92%	PR China 79%
Australia 77%	Kazakhstan 70%	India 69%
Israel 63%	Czech Rep 60%	Morocco 55%
Greece 52%	USA 49%	Germany 46%

Source: IEA 2010



Factors currently affecting our activities

- UK energy strategy and LCPD European legislation
- Several existing coal stations are closing
- Coal prices have increased in recent years
- Many plants looking at biomass and renewable fuels
- Many enquiries are coming from overseas
- Huge interest in combustion optimisation from other parts of Europe and China

What we need to know

Dependent on the job being carried out.

- A material handling job requires different information from supplying combustion optimization equipment.

- Often the information is not available.

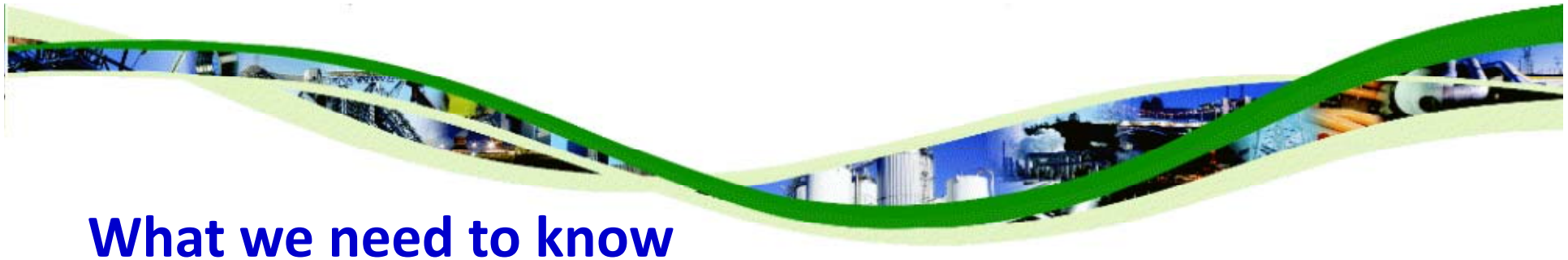
- Often the information is required online.

- This has lead to the development of technologies to obtain this information. Some of which we have developed ourselves

What we need to know

Technical Parameters

- Look at the system from the mill inlet to the burners
- Understand how well the coal is being ground in the pulveriser
- Understand how the fuel is being transported to the boiler
- Provide a solution to the problems that we find



What we need to know

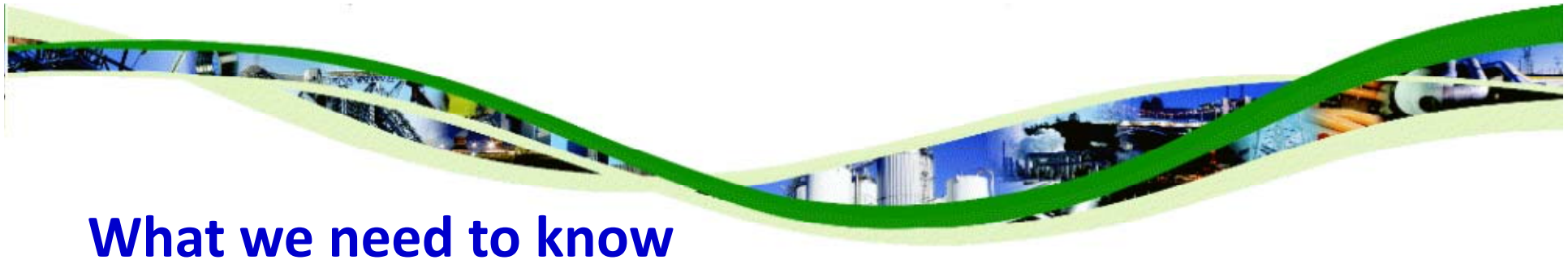
Understanding the pulveriser behaviour

- What is the current grind?

How is it measured?
What method is used?
To a specific standard?

- What is affecting the grind?

Hardgrove index?
Moisture content?
Overcapacity due to low heating value?



What we need to know

Understanding the pulveriser behaviour

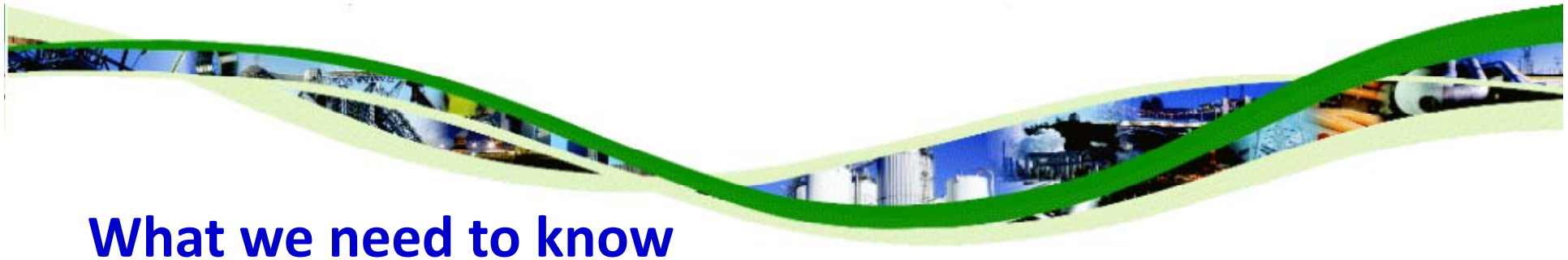
- Where do we get this information from?

Historical data?

Coal suppliers data?

Our own testing and measurements?

In practice it tends to be a combination of all three.



What we need to know

Understanding the pulveriser behaviour

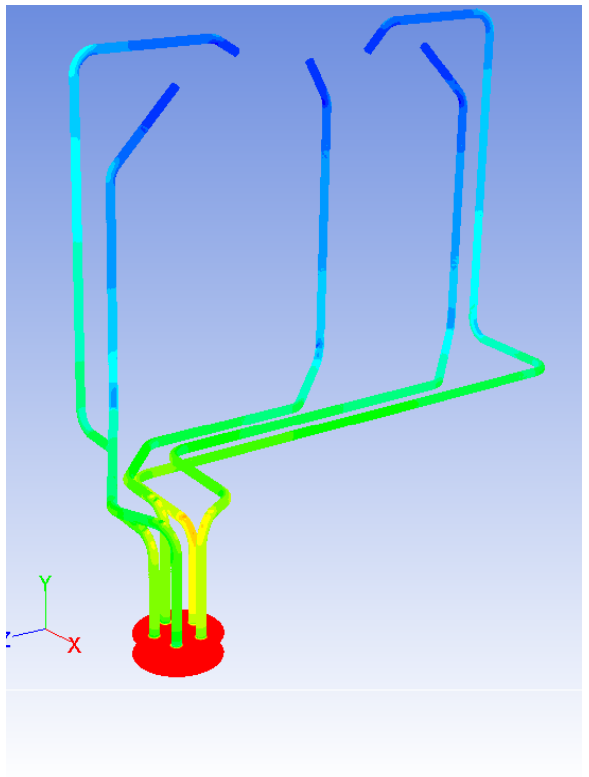
- Usually the information is not available online.
- Online information relating to certain coal parameters can be used to set up the mill.
- Online particle size analysis is something that is so important that we have had to create our own device to do it.

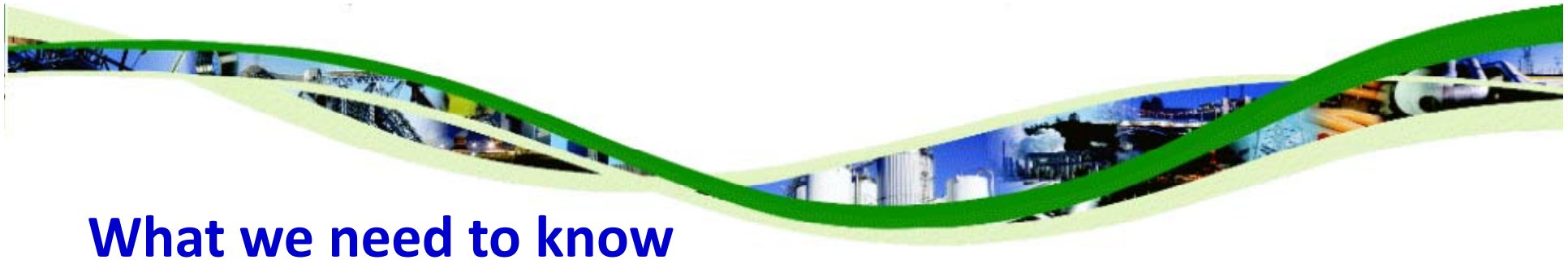
What we need to know

Understand how the fuel is being transported to the boiler and its distribution

- Whenever we begin a PF distribution job we need to investigate a variety of different parameters.

- Ultimately, information is required for our computational fluid dynamic studies to determine the current state of play.





What we need to know

Understand how the fuel is being transported to the boiler and its distribution

For CFD, what do we need to know about the coal?

The particle size.

The coal density.

The heating value.

Where do we get this information from?

Historical data?

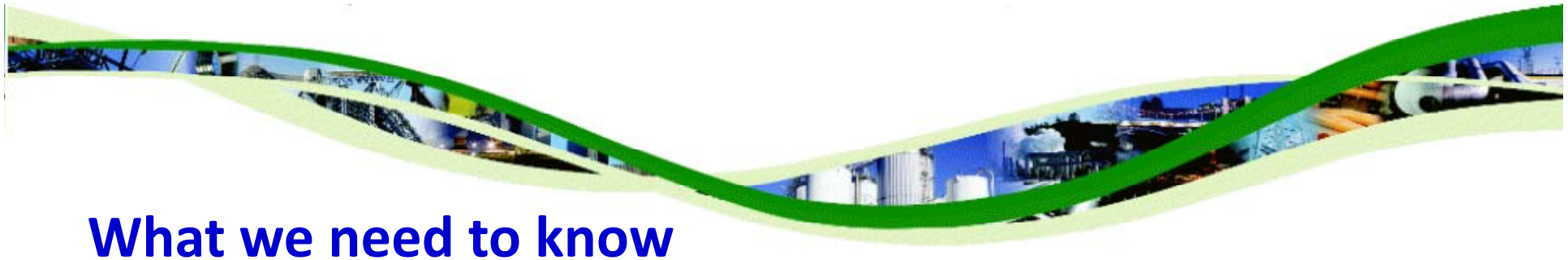
Coal suppliers data?

Our own testing and measurements?

What we need to know

Example enquiry

- Large Chinese power station looking to improve combustion in Datong Province
- Customer interested in our technology and looking for a combustion improvement proposal
- Opposed wall fired boiler approx 3 years old
- 6 multi-outlet mills with static classifiers
- 5 fuel lines per mill feeding 30 burners
- 6 rows of 5 burners, 3 front and 3 back
- Each mill feeds its own row of burners



What we need to know

What did we need to know to provide a solution?

Coal parameters?

For CFD

The particle size.

The coal density.

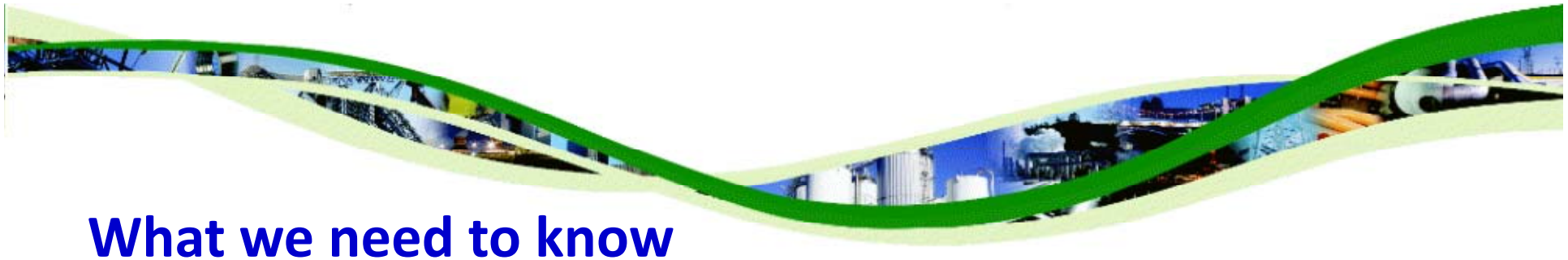
Distribution.

For understanding the system

Moisture.

Hardgrove index.

Heating value.



What we need to know

Did we get what we wanted?

Coal parameters?

For CFD

The particle size. ?

The coal density. _/

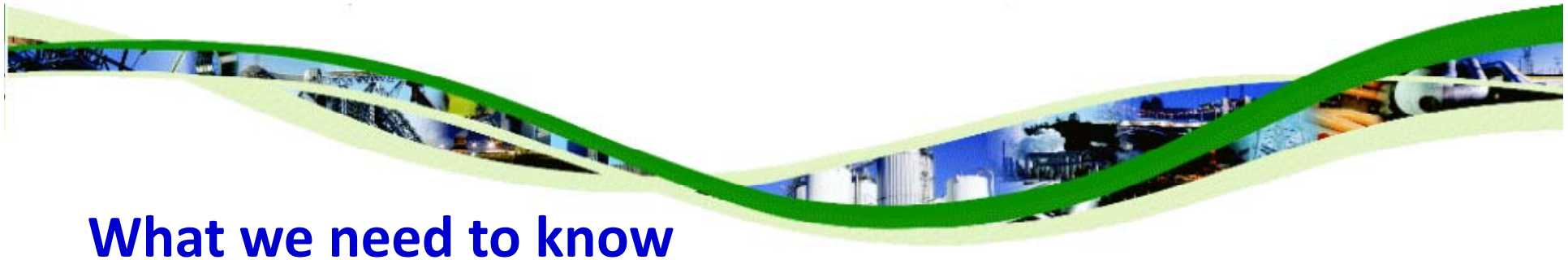
Distribution. X

For understanding the system

Moisture. _/

Hardgrove index. _/

Heating value. _/



What we need to know

Conclusion

- Dependent on the manufacturer will what will be needed.

- Knowledge of coal makes modelling and design a lot easier.

- Good information is what is desired, online information is always desirable.