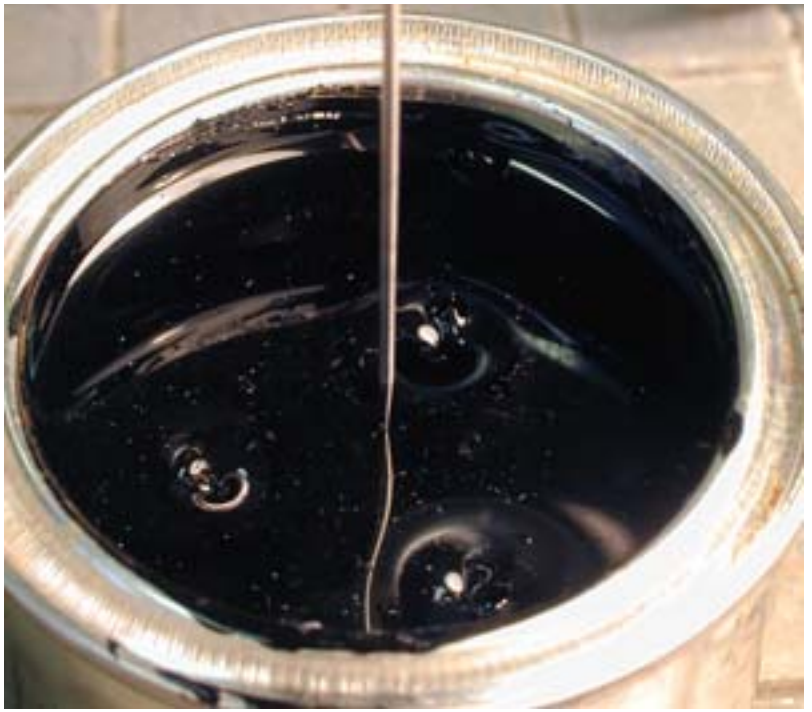
Asphalt Binder Production

Dan Weidman
BP- Bitumen BU
December 7, 2006

How is bitumen made?



Overview

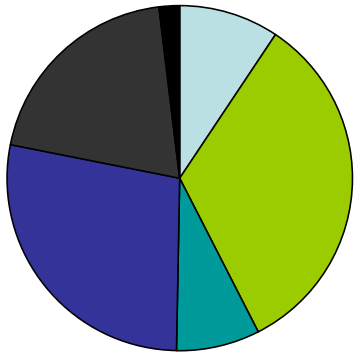


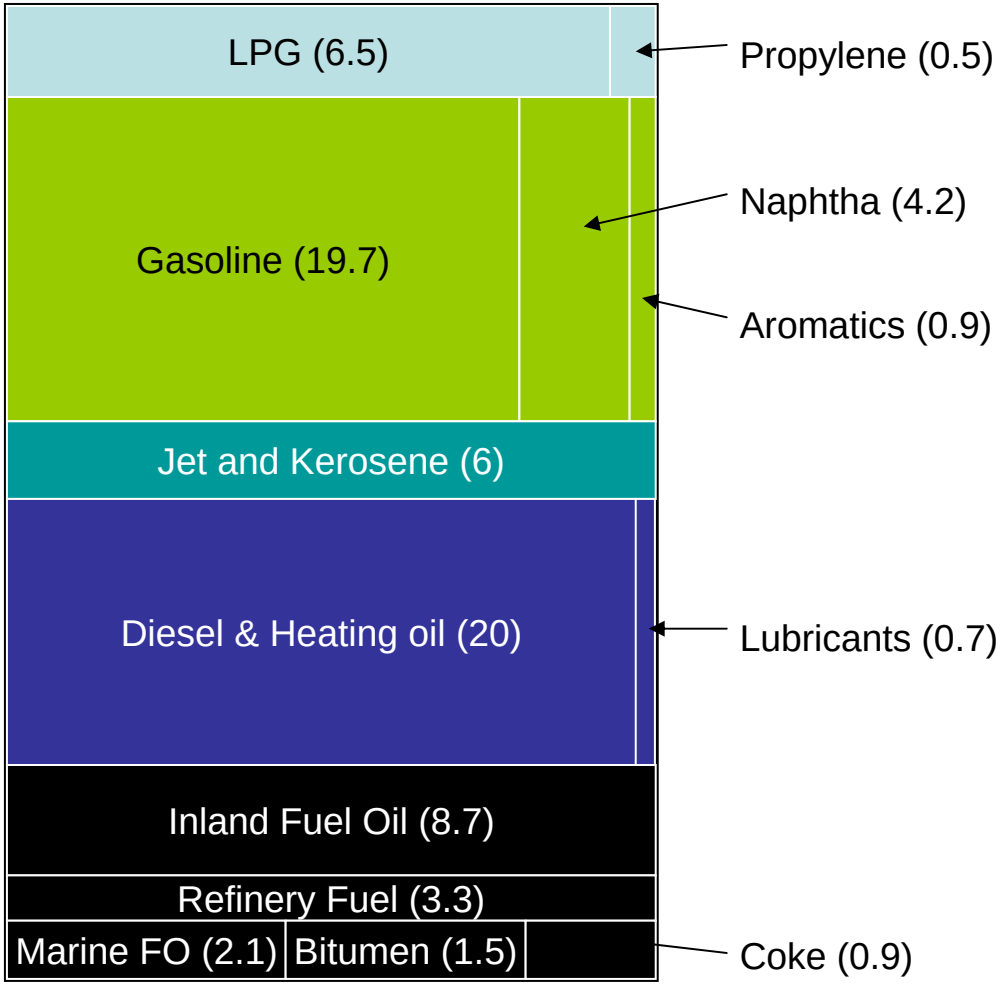
- Process
  - how a refinery makes bitumen
  - how are the different bitumen products made
- Quality
  - how a refinery makes good quality bitumen

Oil products – global consumption

Total = 75 Million barrels/day in 2000

(80 Million barrels/day in 2004)

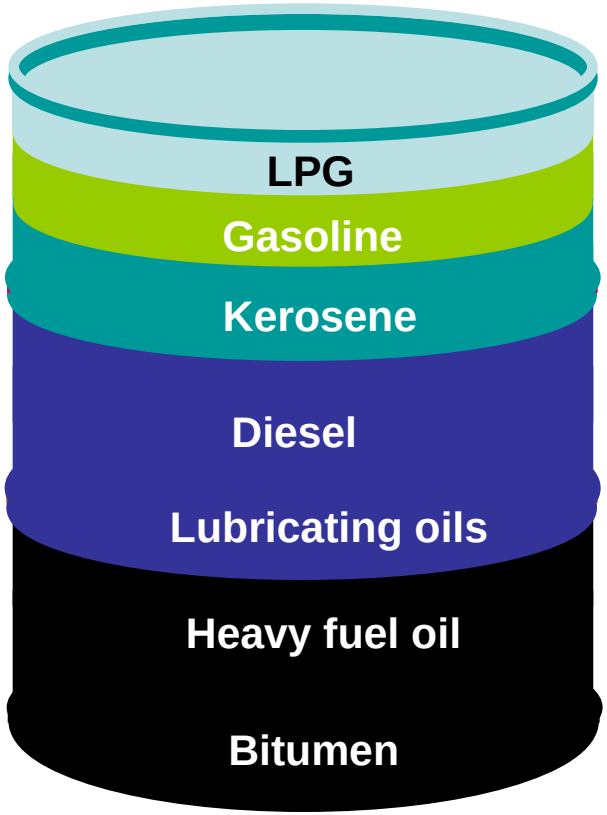




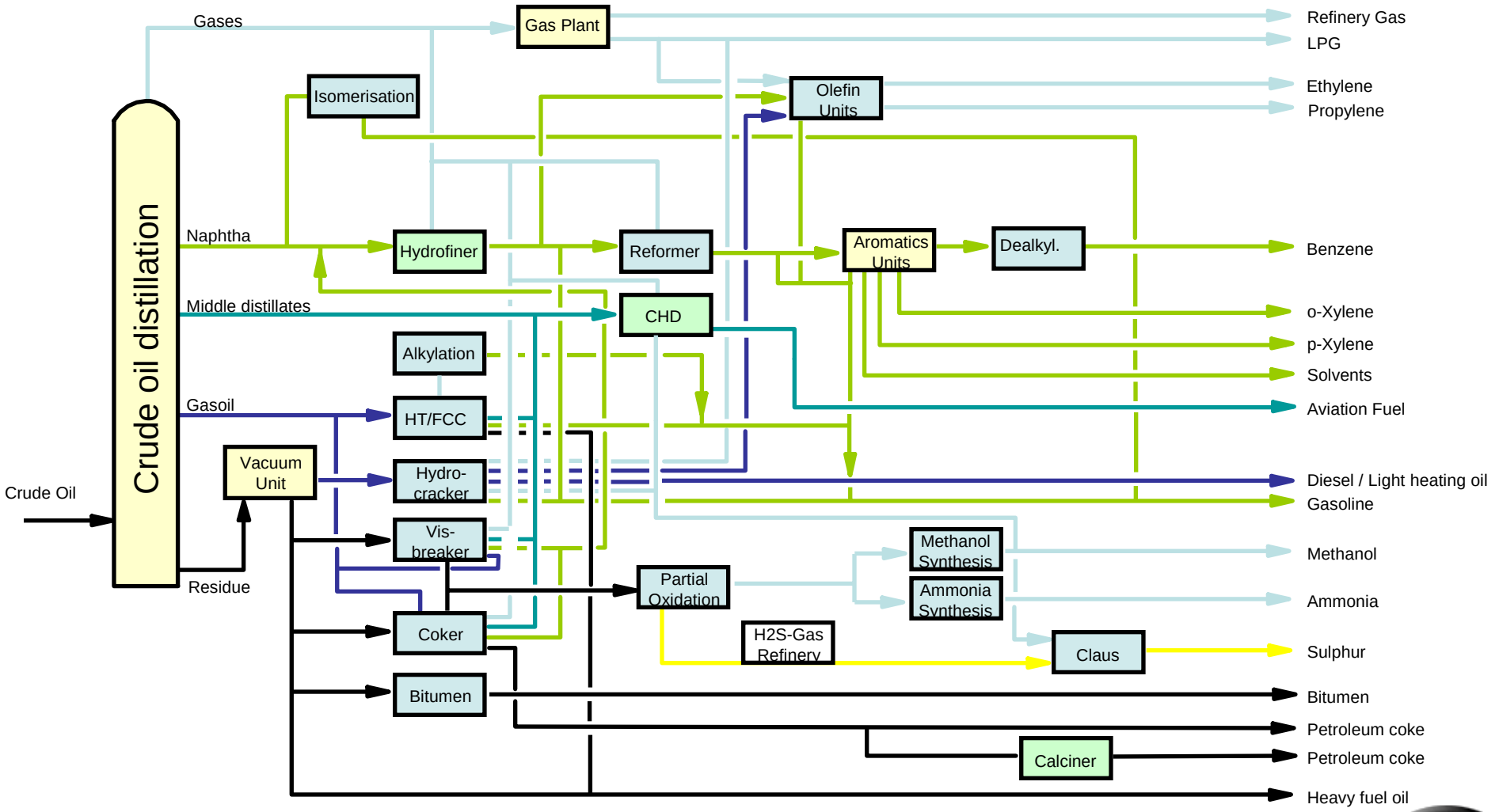
Source: BP

Product properties

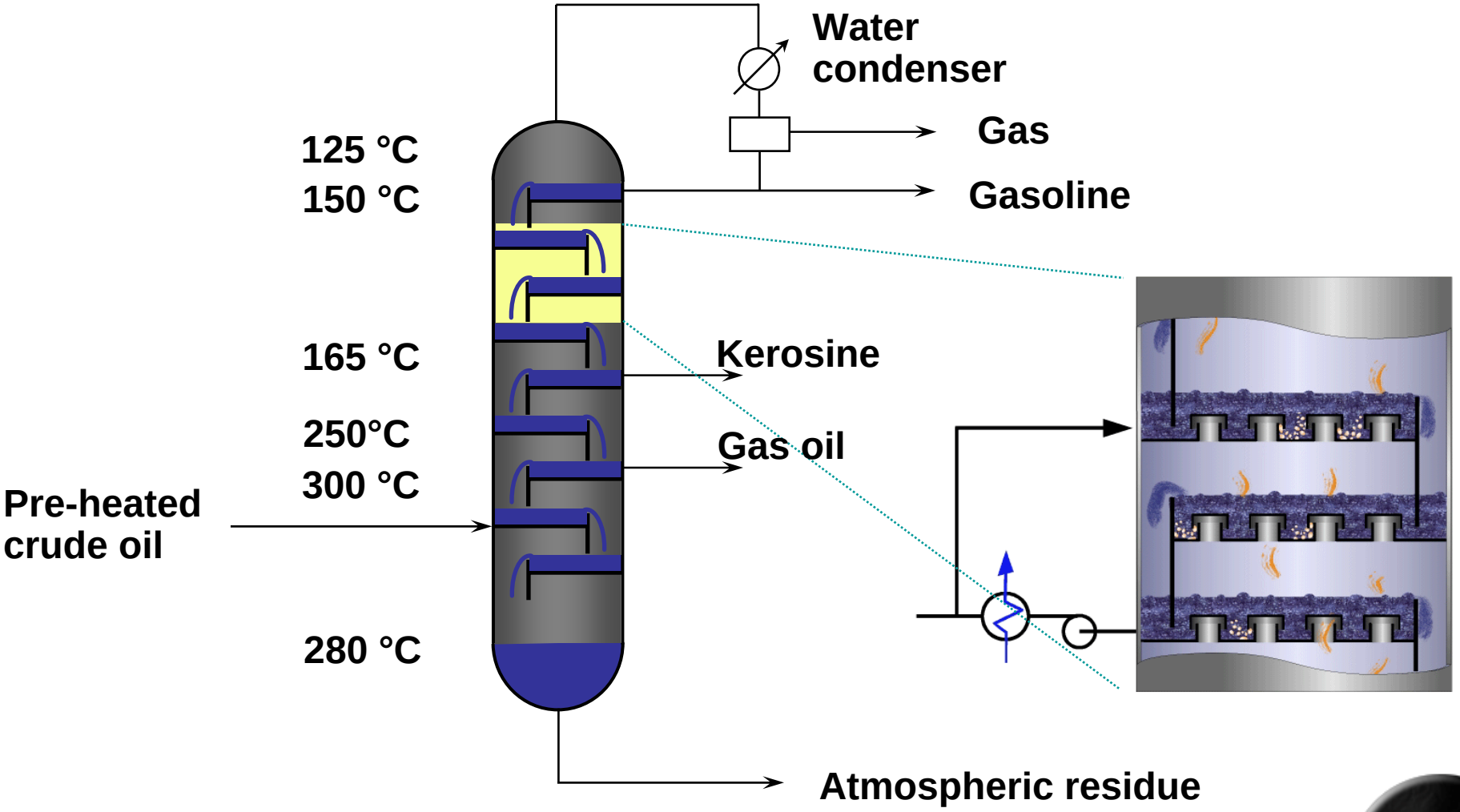
Carbon number		Boiling point (°C)
3 - 4	LPG	-10 - 15
5 - 10	Gasoline	15 - 150
12 - 18	Kerosene	150 - 260
18 - 24	Diesel	230 - 370
24 - 40	Lubricating oils	370 - 525
24 - ~300	Heavy fuel oil	370 -
~40 - ~300	Bitumen	525 -



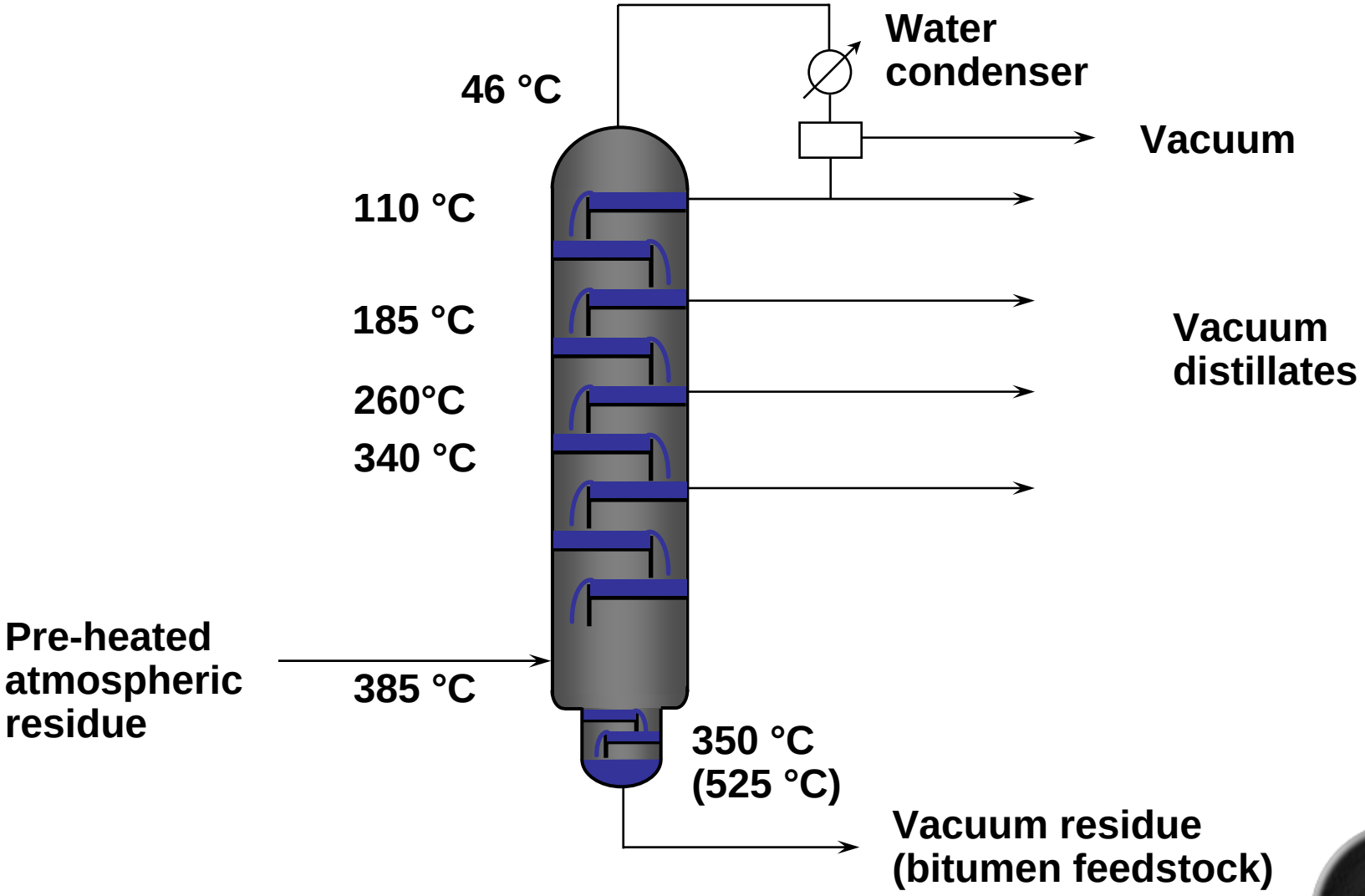
Complex refinery process flow diagram



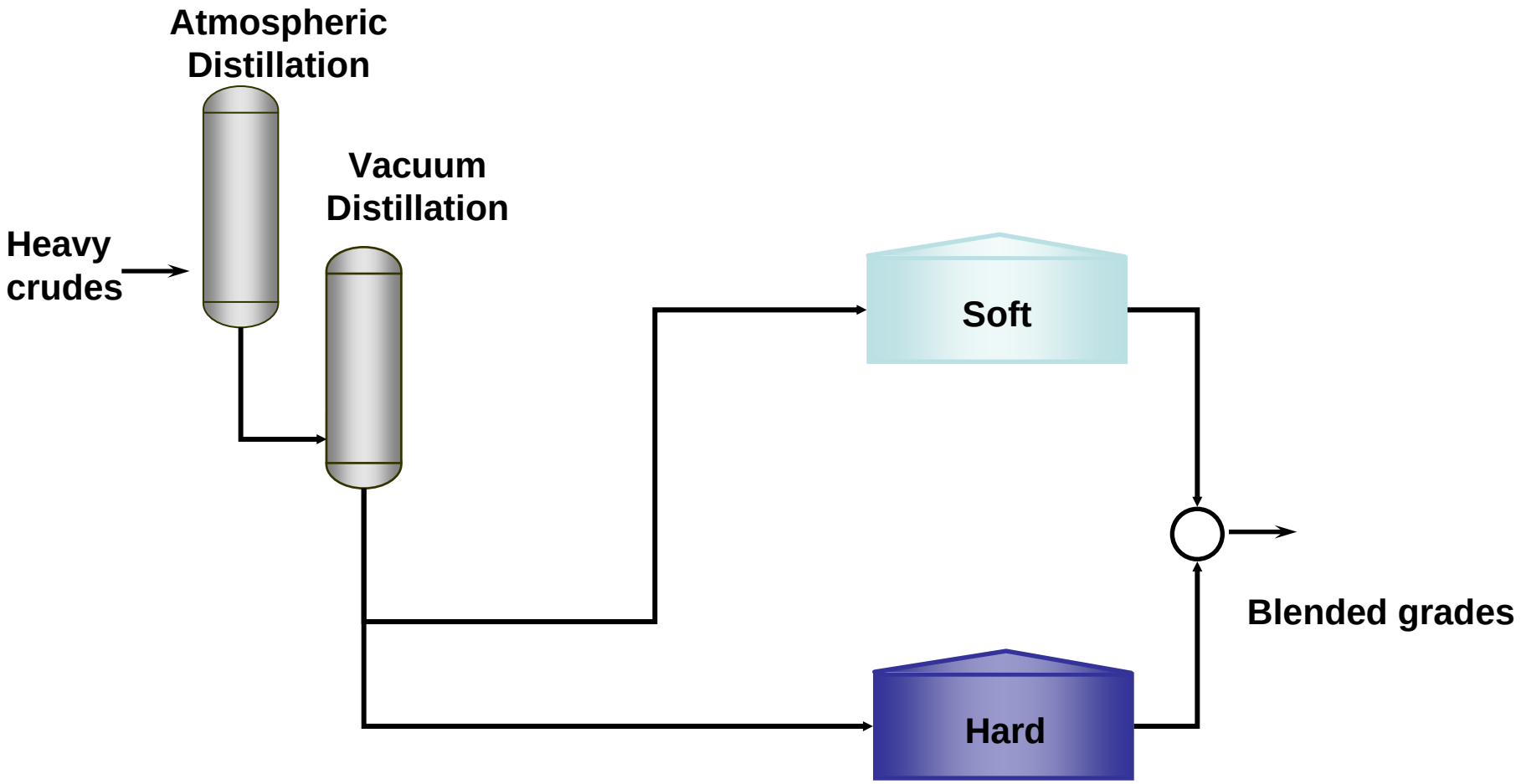
Atmospheric distillation



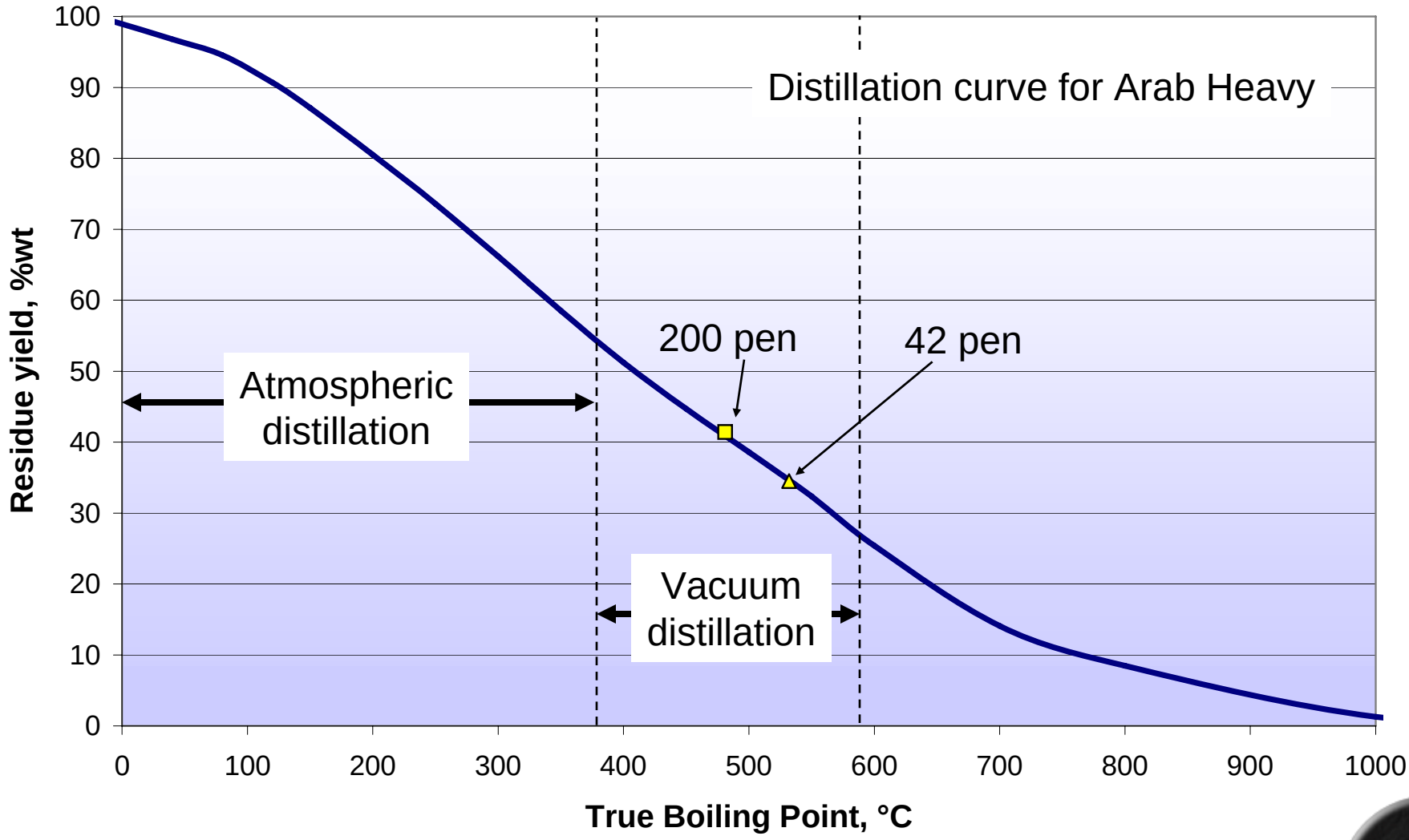
Vacuum distillation



Simplest production route for bitumen



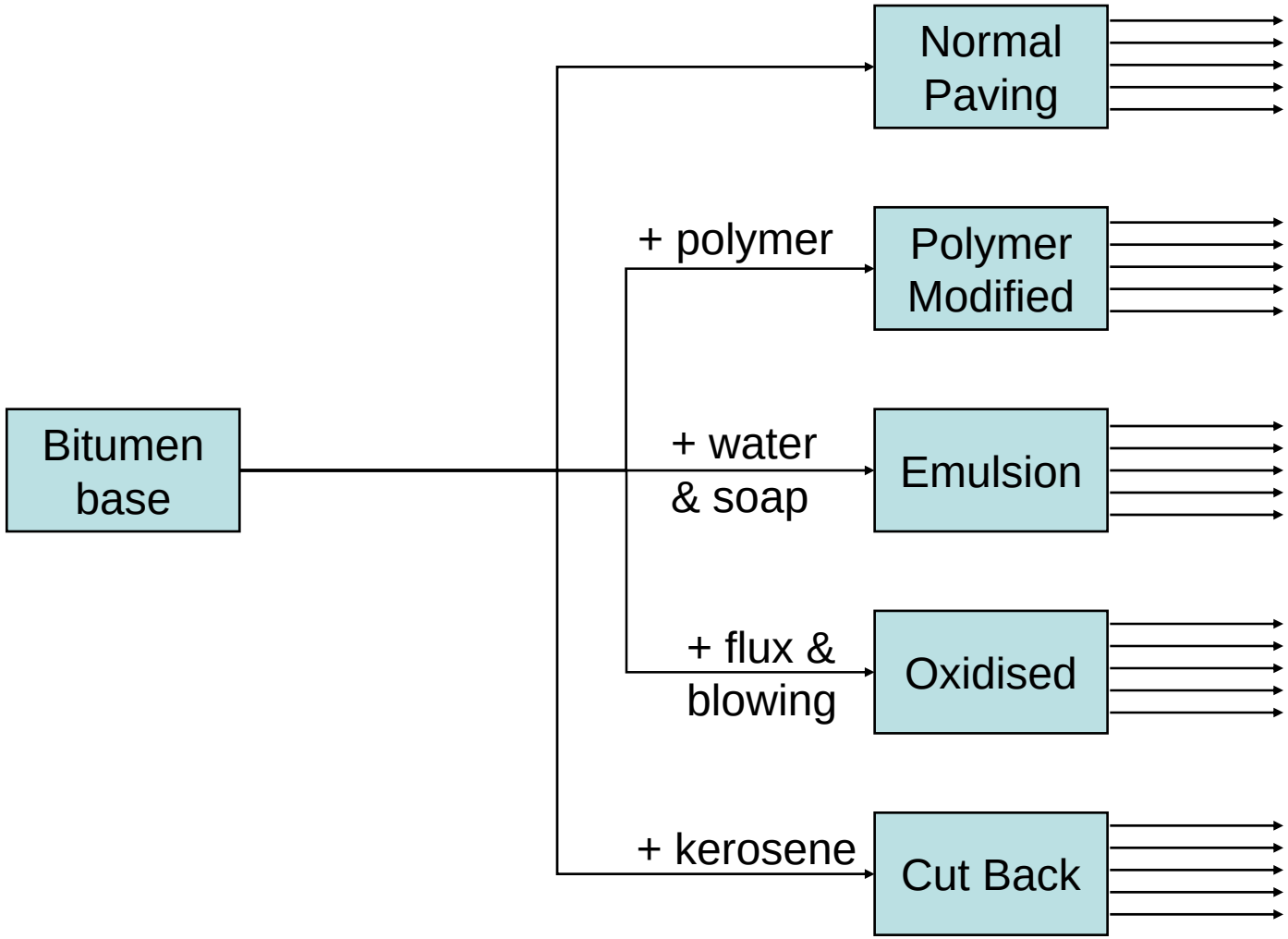
Higher boiling point = harder bitumen



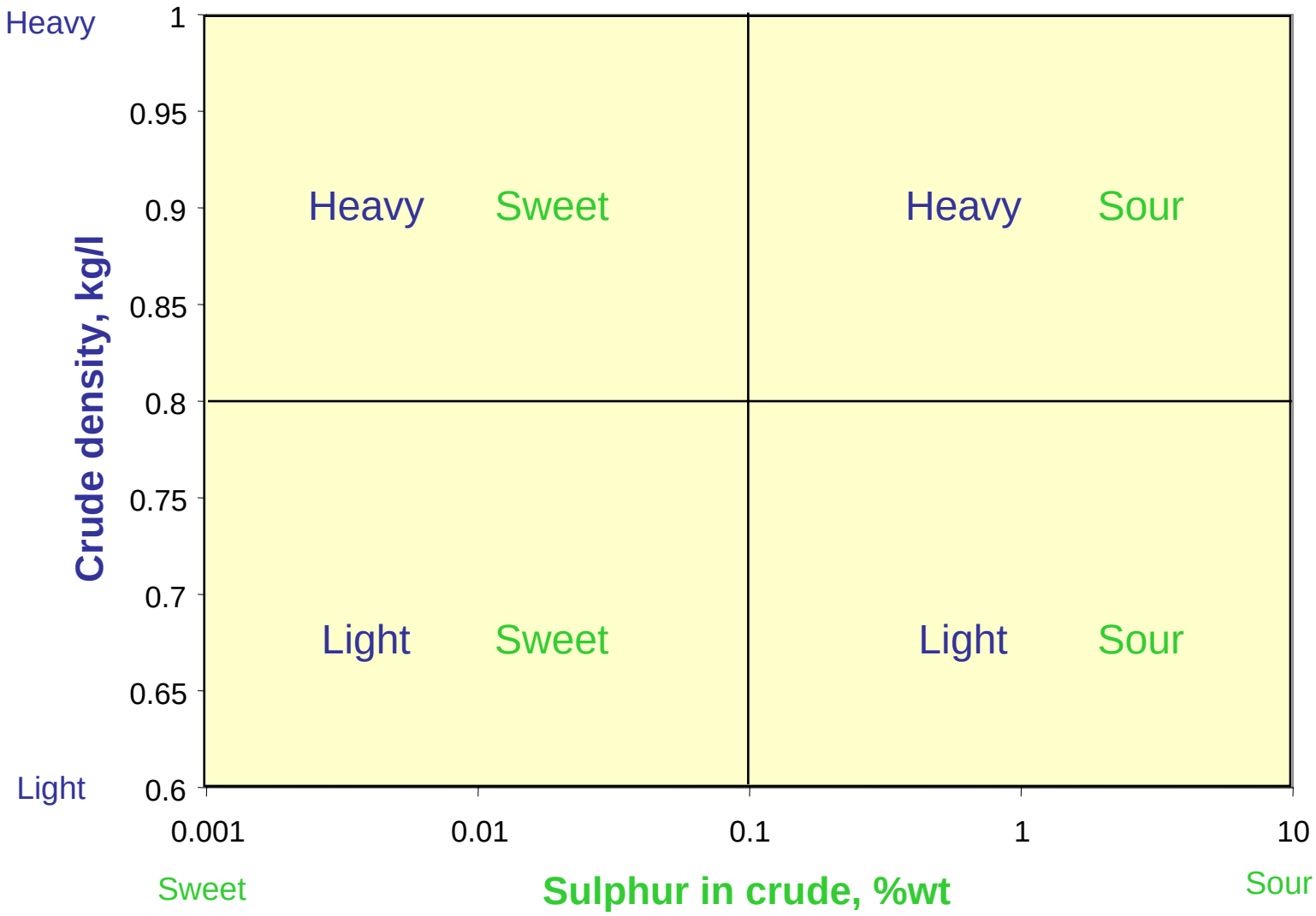
Essential properties of refined bitumen

- Specific consistency at key temperatures
- Durability = resistance to ageing
- Adhesion
- Cohesion
- Low fuming tendency

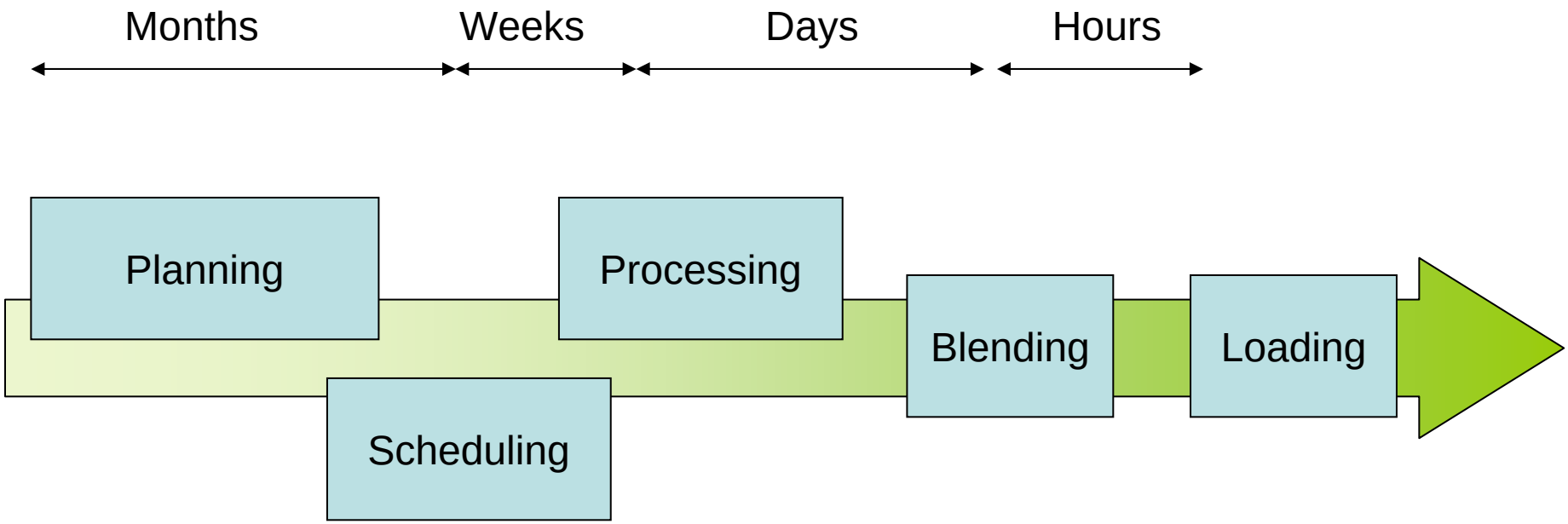
Bituminous products



Bitumen quality depends mainly on choice of crude



Refinery activities that influence bitumen

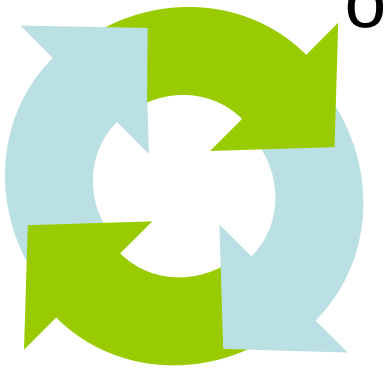


Summary of Feedstock Selection Criteria

Composition

Impact on other products

Quality



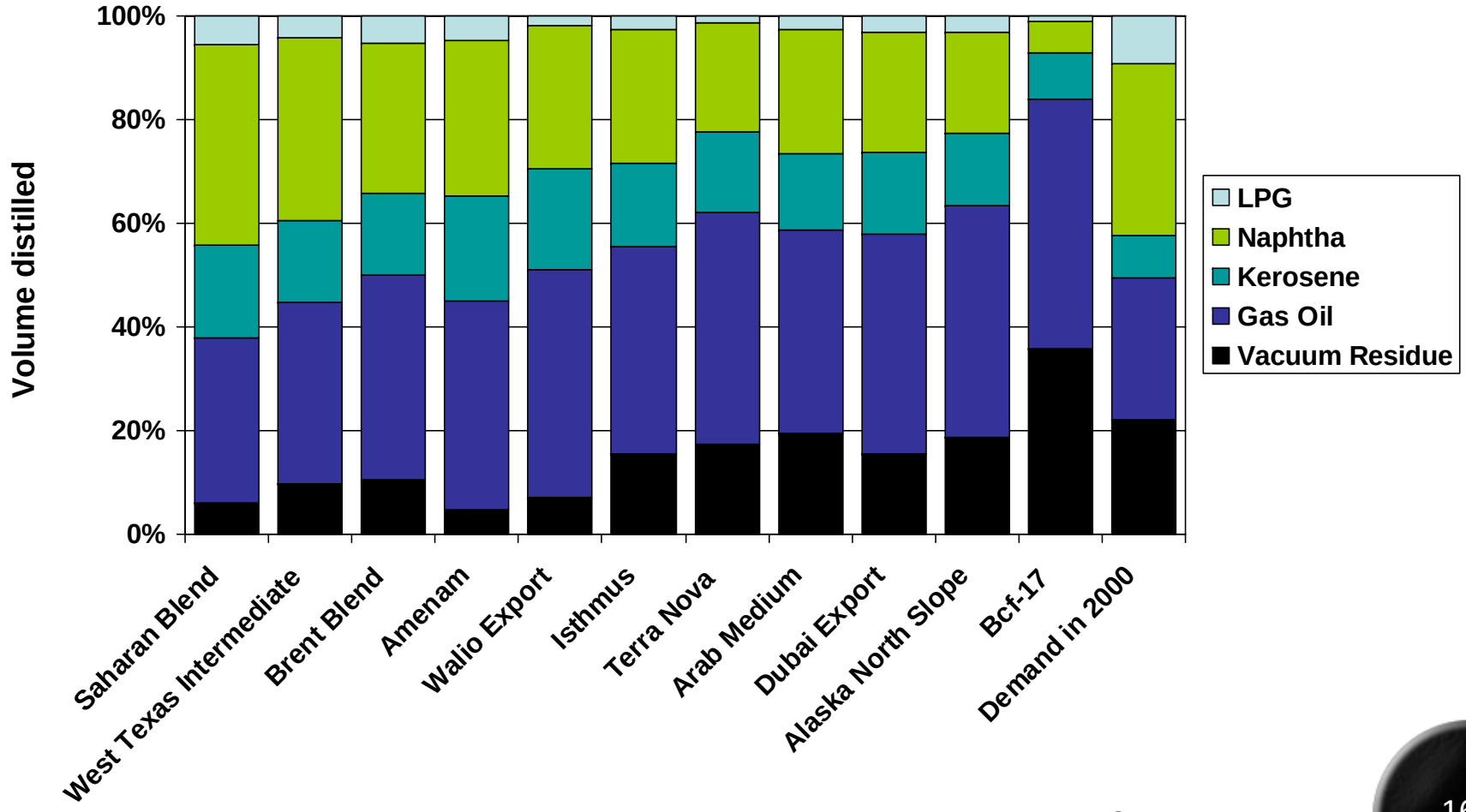
Economic

Available process equipment

Bitumen Yield

Product yield varies from crude to crude

API gravity	45.2	39.8	37.9	37.8	36.3	32.8	31.8	30.8	30.4	27.9	16.2
Sulphur, %wt	0.09	0.39	0.44	0.16	0.56	1.36	0.56	2.40	2.05	1.11	2.33

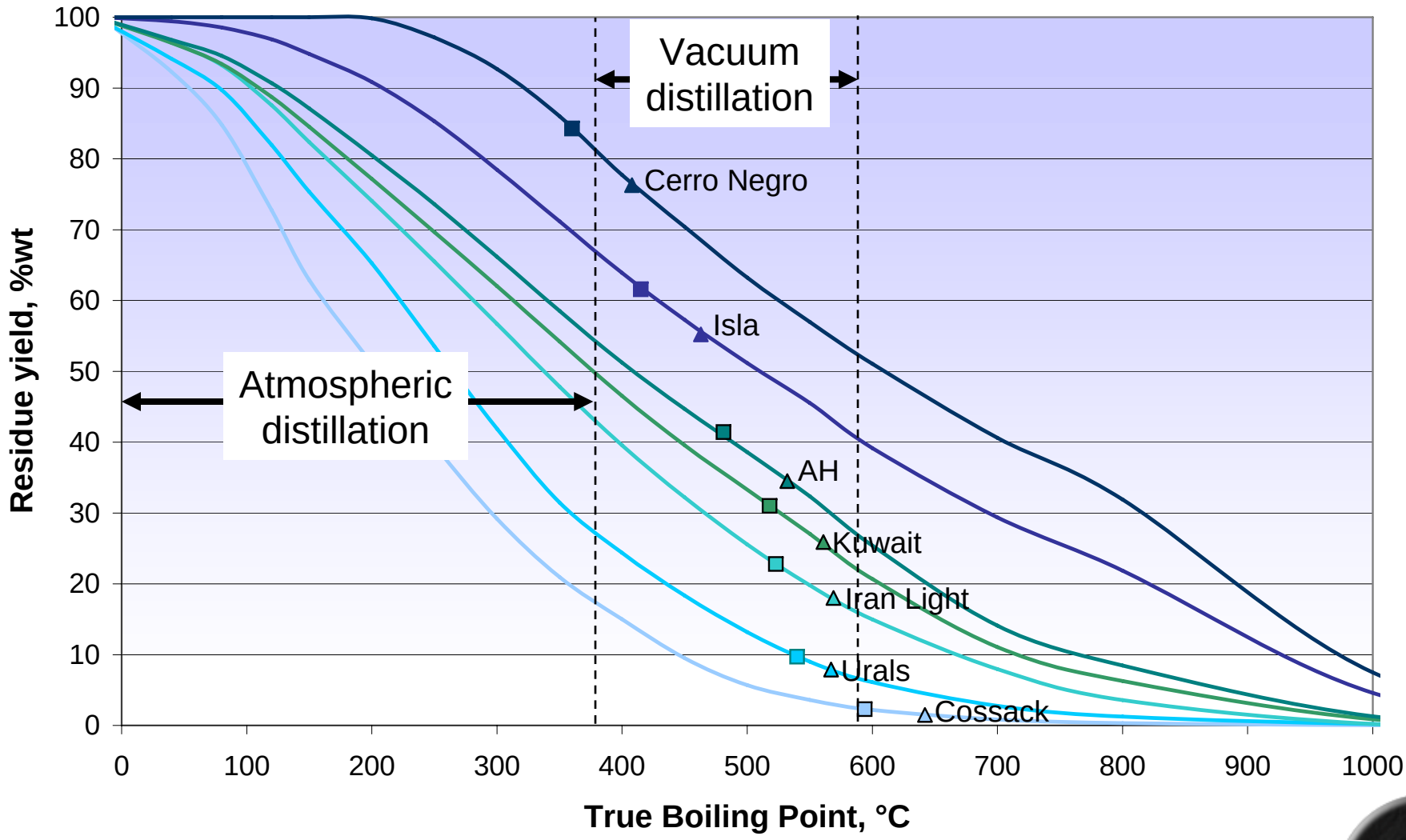


Source: BP

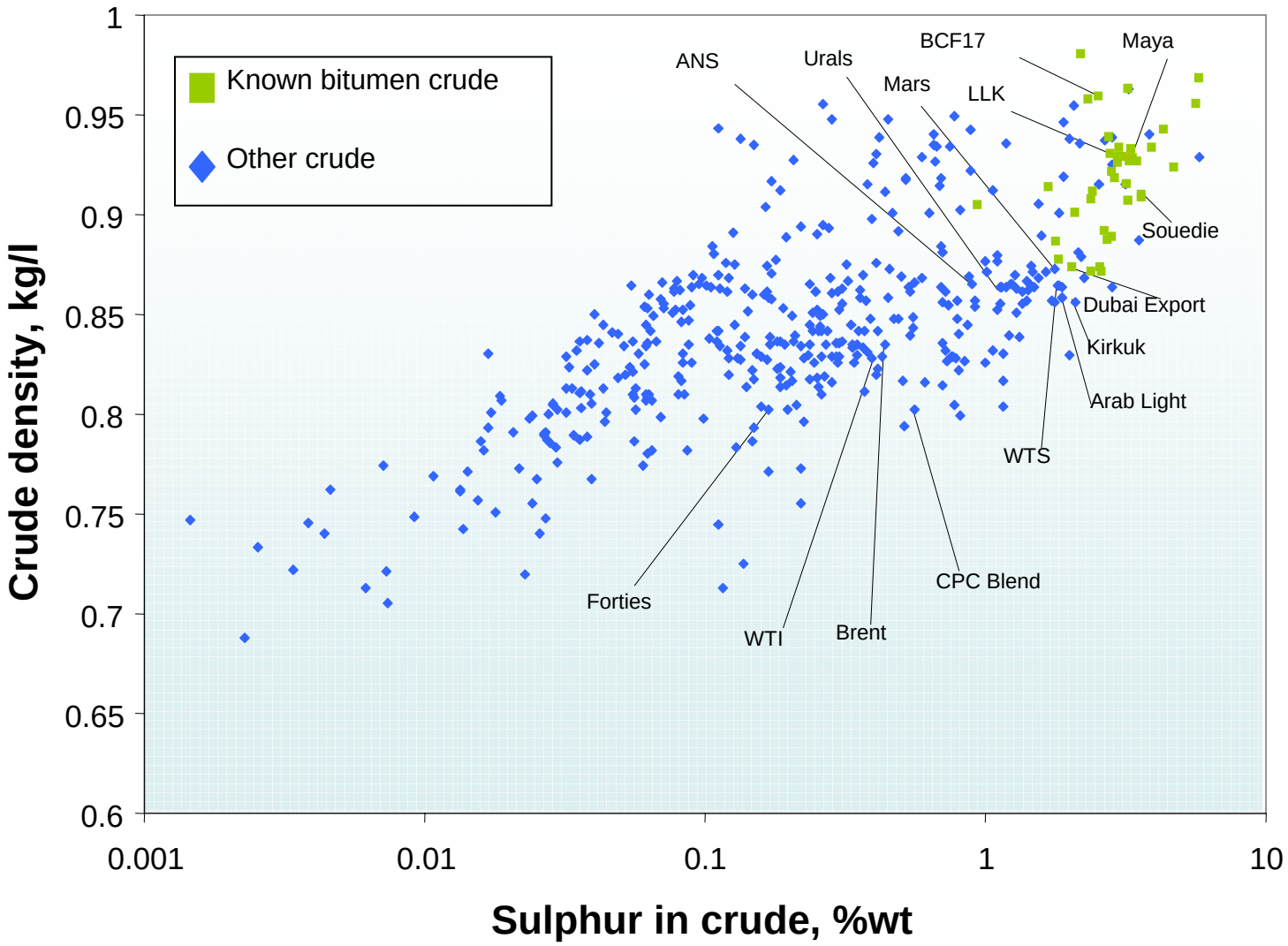
To make good quality bitumen

- Bitumen that meets specs & is fit for purpose
  - specific refinery components
  - with the right physical properties
  - determined by **composition**
    - determined by **choice of raw materials**
    - and **processing** **–and know-how**

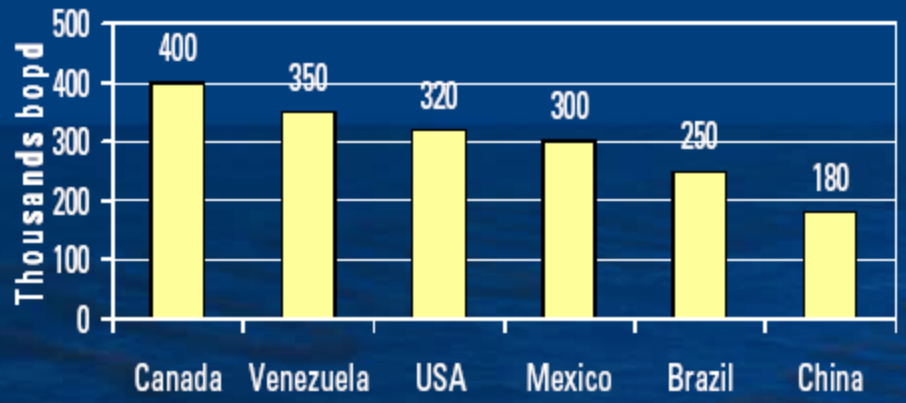
Distillation curves



Heavy crudes are best for bitumen

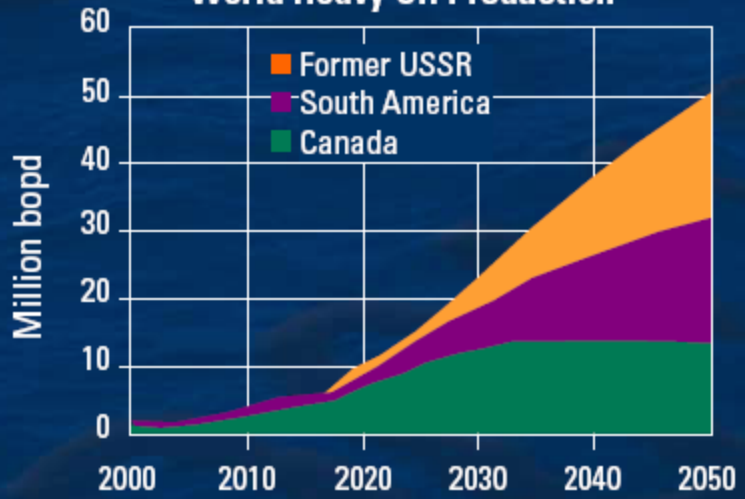


Heavy Oil – It's Happening!



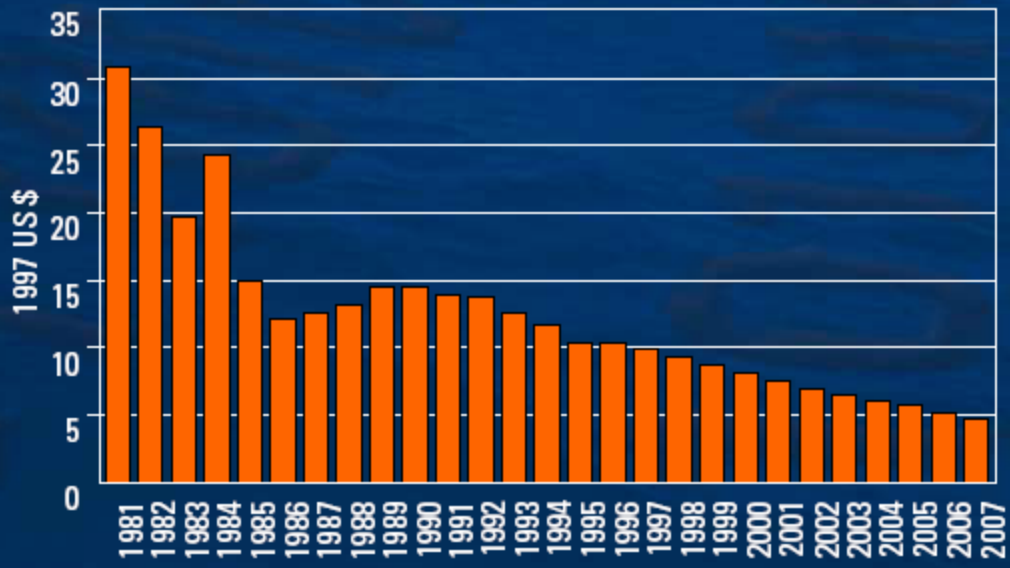
Source: OGJ report on 2002 production (API <20)

World Heavy Oil Production



Source: DOE, 2003

How Canadian Oil Sands Costs are Declining



Canadian crude to US



Summary

- Adhesive, durable, waterproof, thermoplastic
- Many applications
- Not all residues suitable
- Complex chemistry
- Processing /modifiers can alter properties
- Heavy oil production growing