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Big Ways to Decarbonize the Energy System

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Bankside Power Station, London

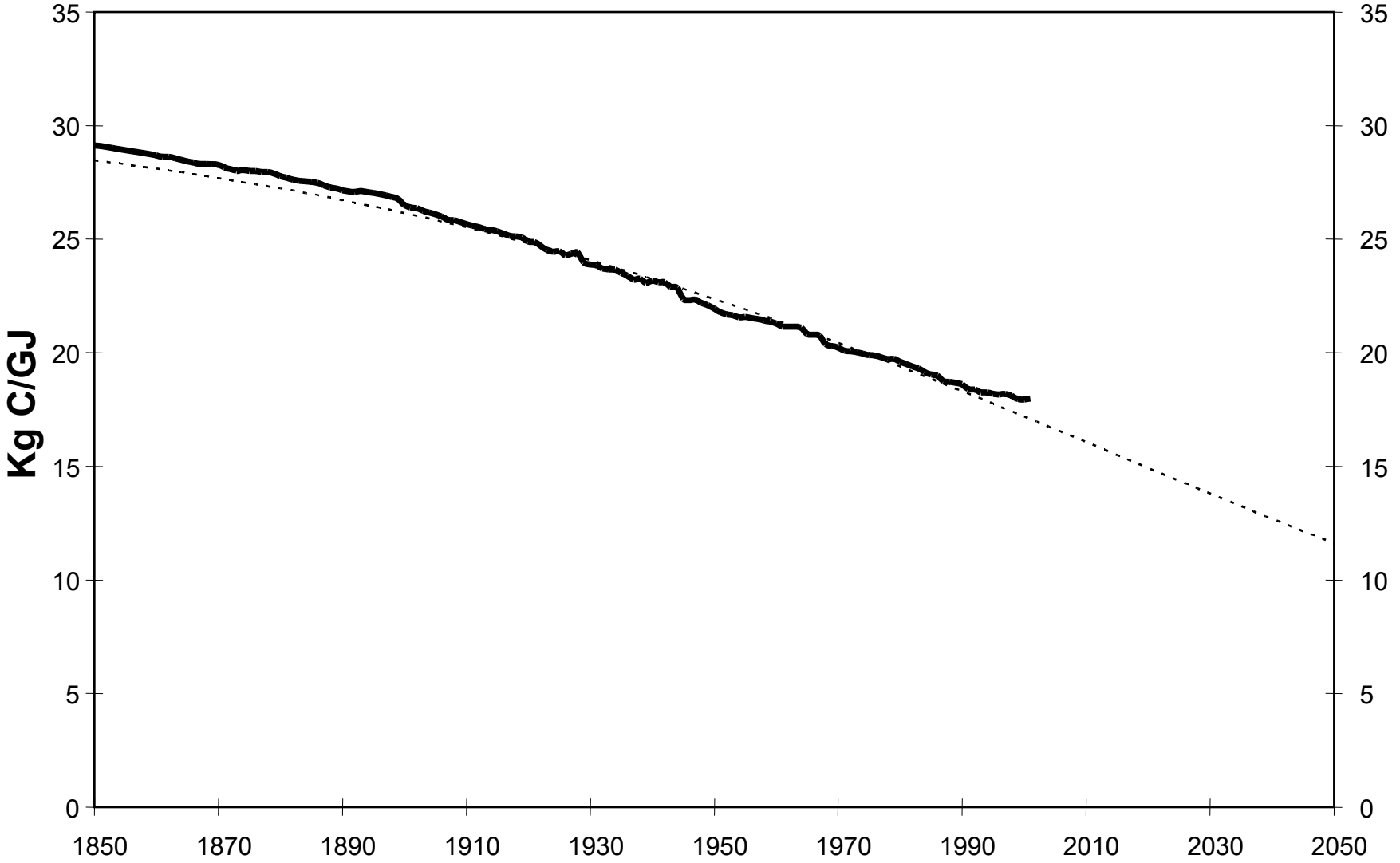
Opened for power generation in 1953, became Tate Gallery in 2000

100m tall

“Footprint” covers 3.5 hectares

Comparably powerful plant built today could fit in 1/10th the space

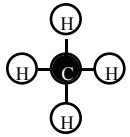
Falling Global Carbon Intensity of Primary Energy



Data sources: IIASA, BP (1965-2001), CDIAC http://cdiac.esd.ornl.gov/trends/emis/em_cont.htm

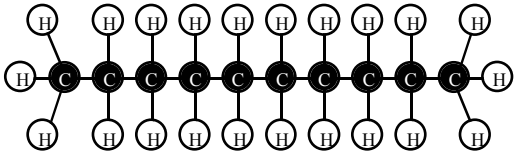
Carbon-Hydrogen Composition of Fossil Fuels

Methane Gas



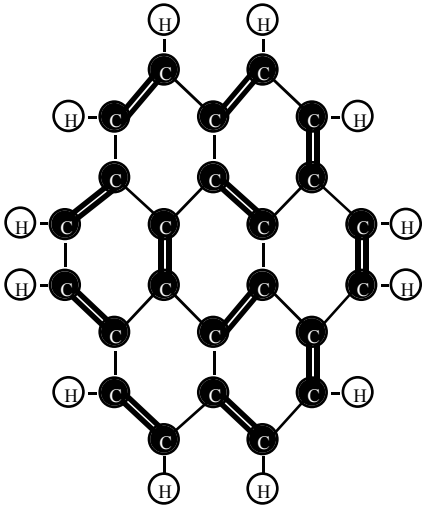
C:H = 1:4

Typical Oil

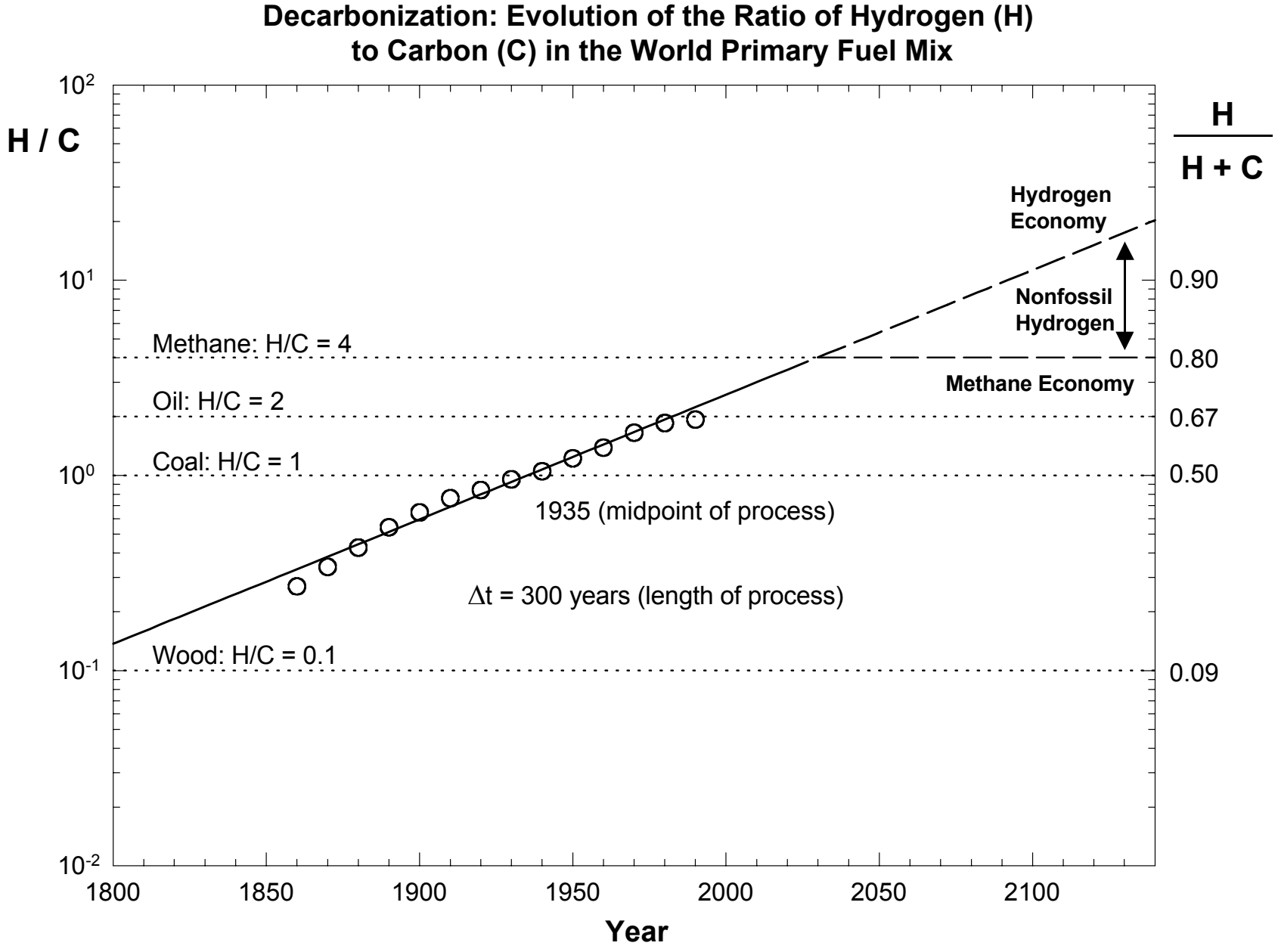


C:H = 1:2

Typical Coal

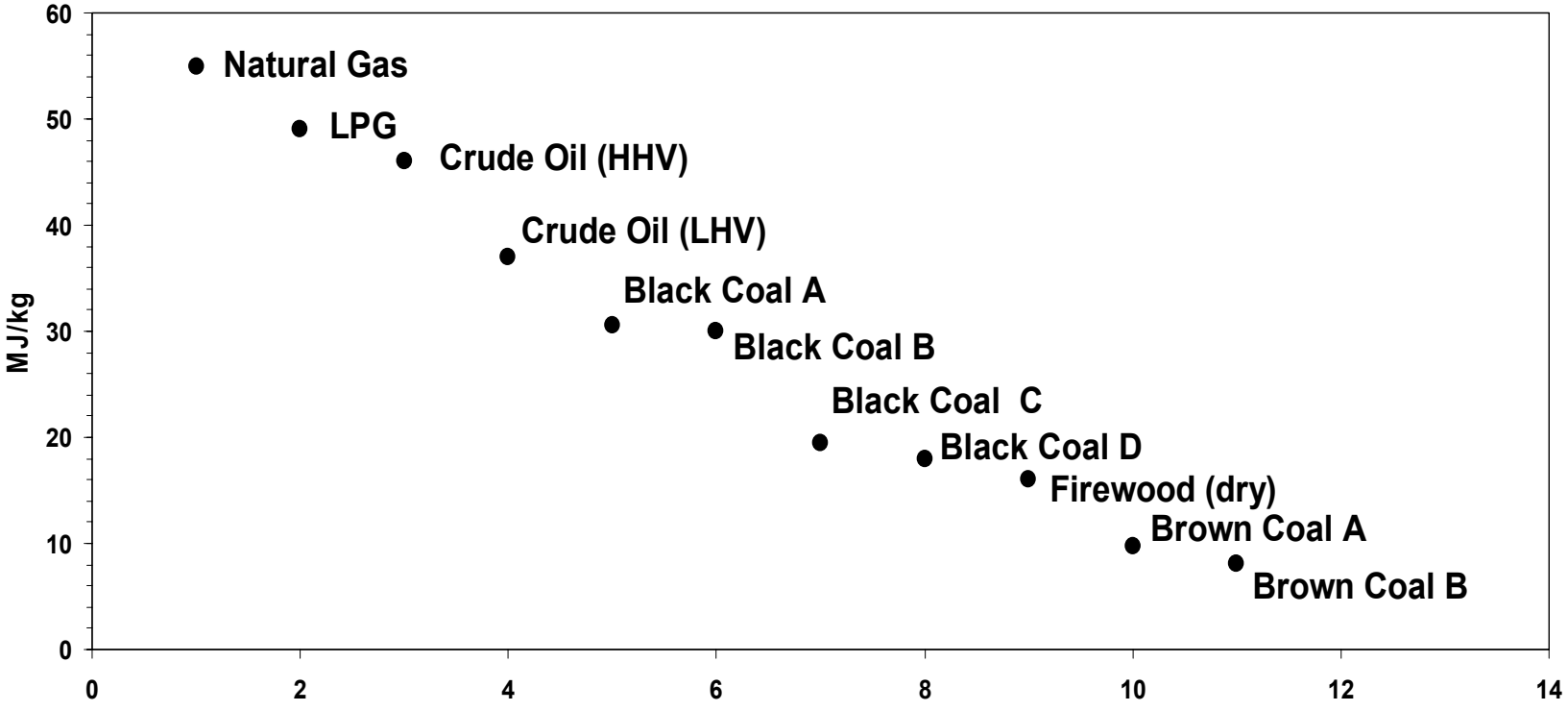


C:H = 2:1



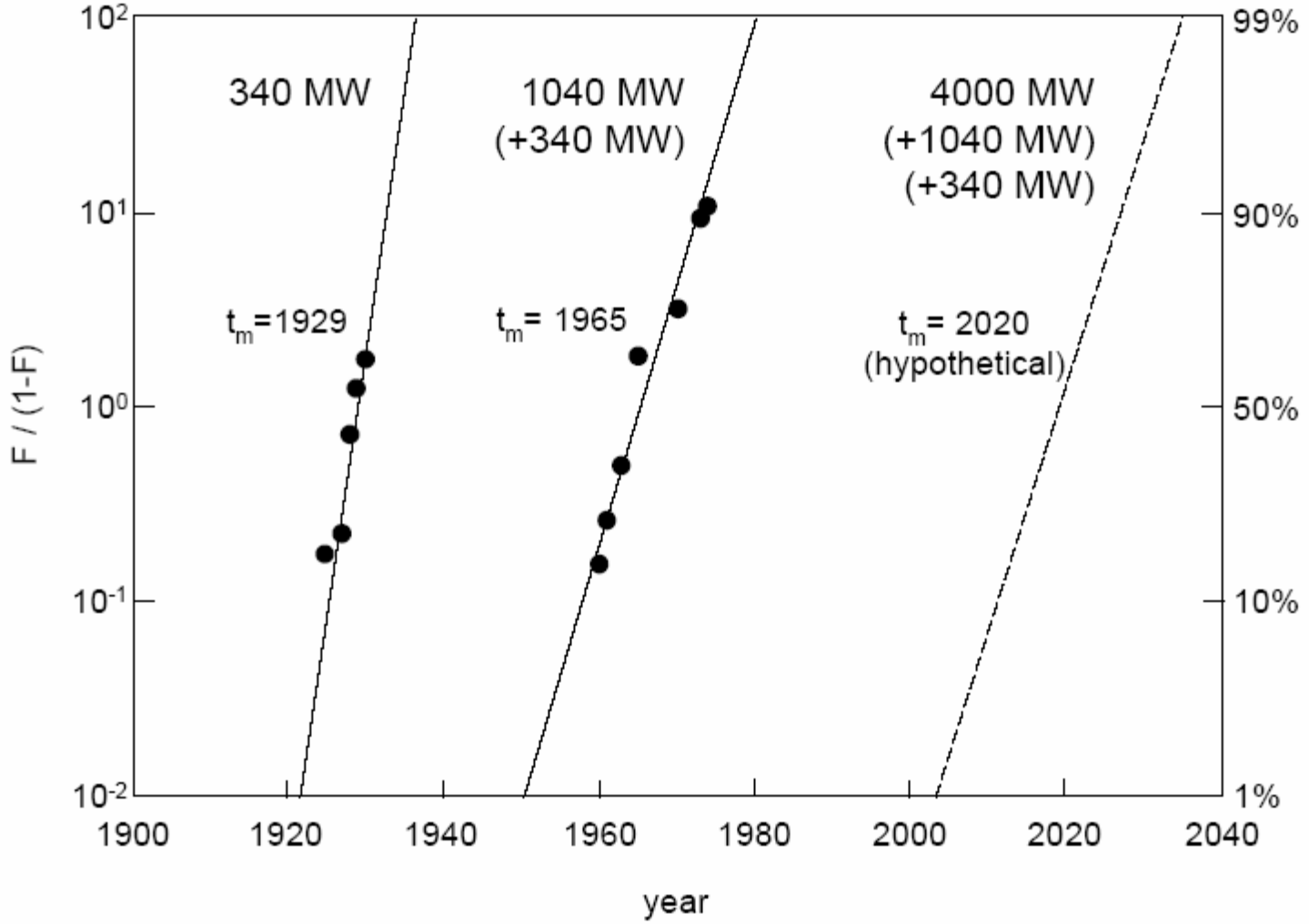
Source: Ausubel, 1996, after Marchetti, 1985

Hydrocarbon fuels ranked by heat value



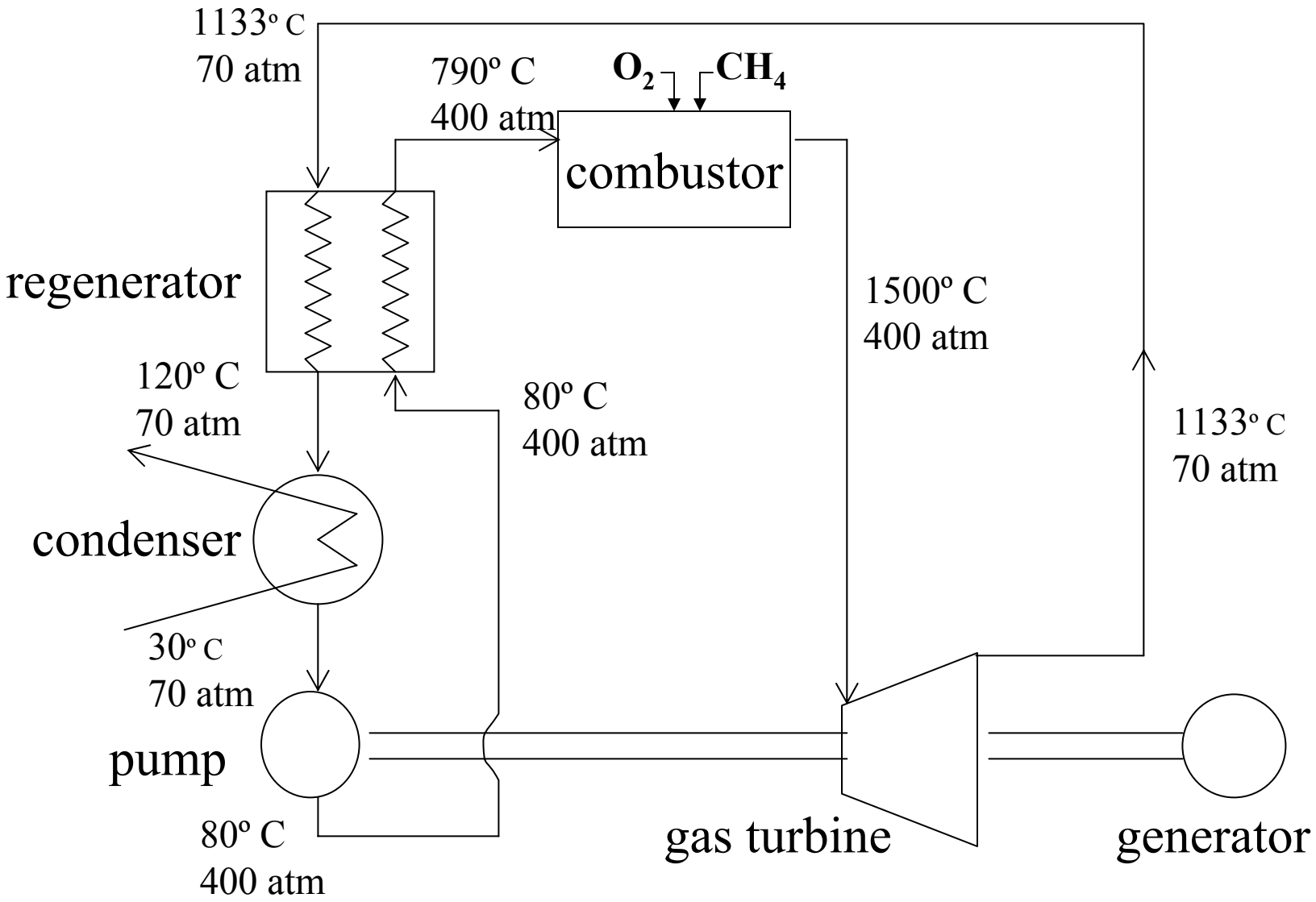
Source: N. Victor & J. Ausubel, 2003

Growth pulses of maximum size of power plants



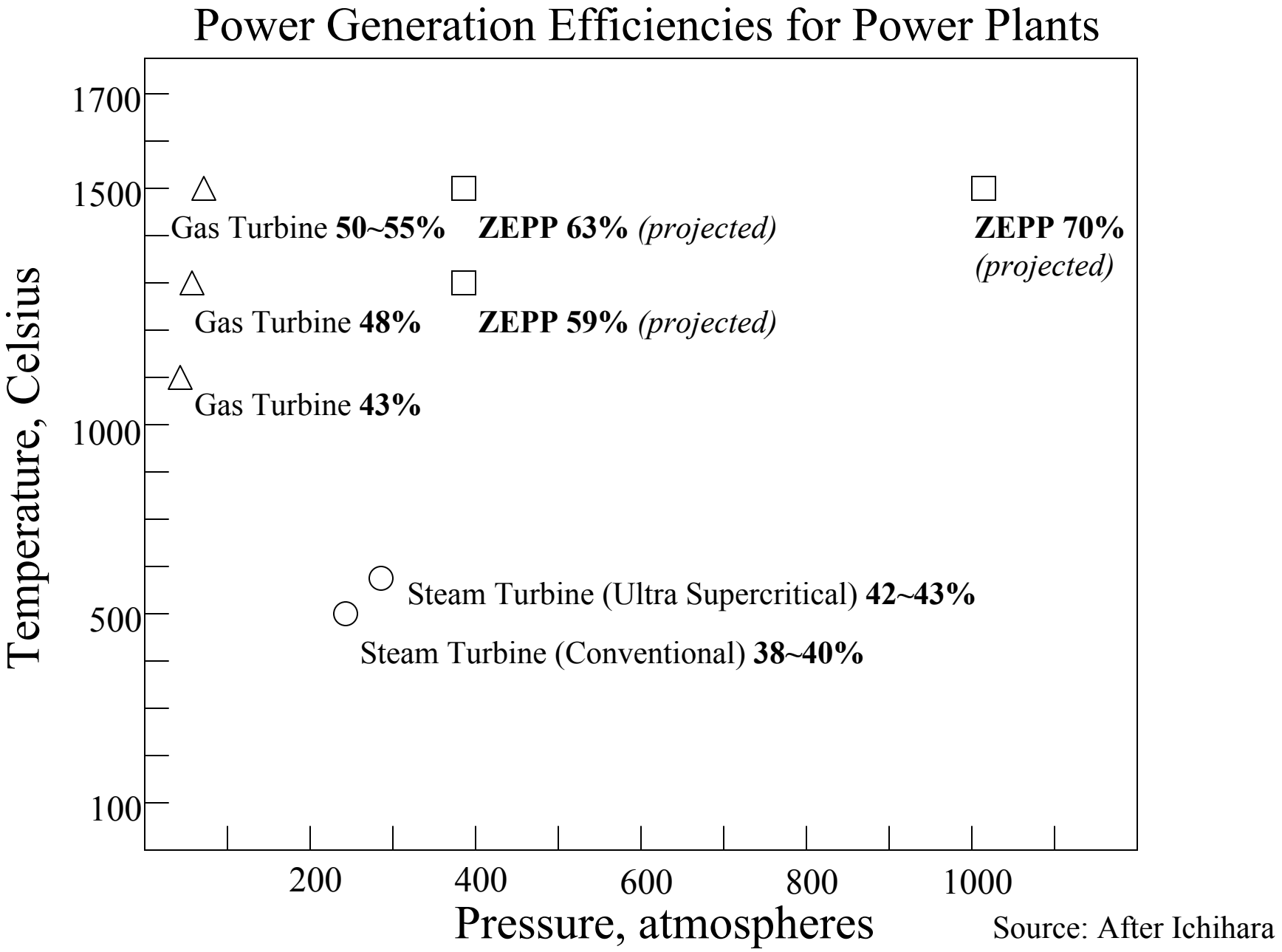
Source: Ausubel, 2001

Basic ZEPP configuration, 400 atm case



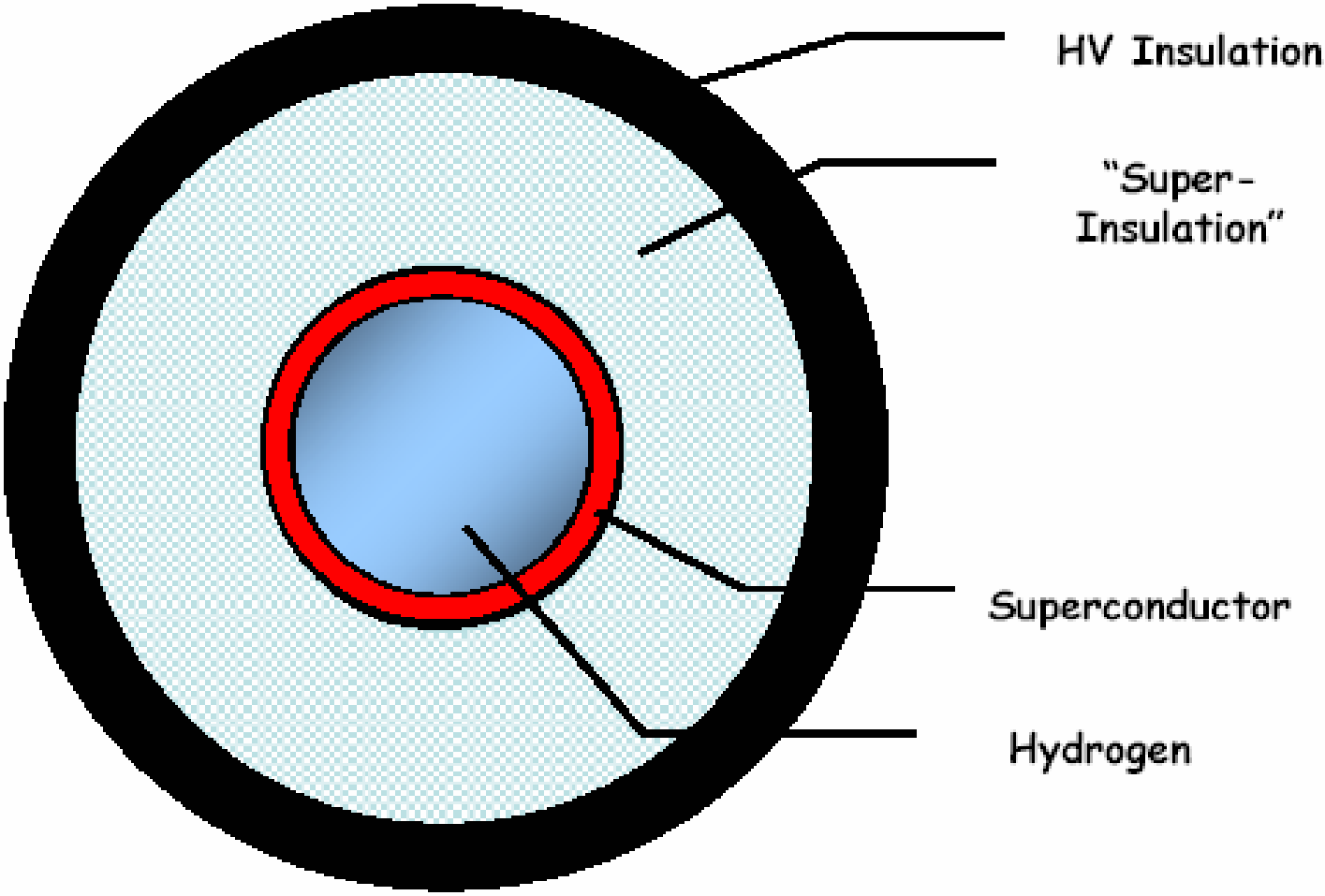
Source: After Ichihara, Tokyo Electric Power

Efficiency increases with higher pressure and temperature.



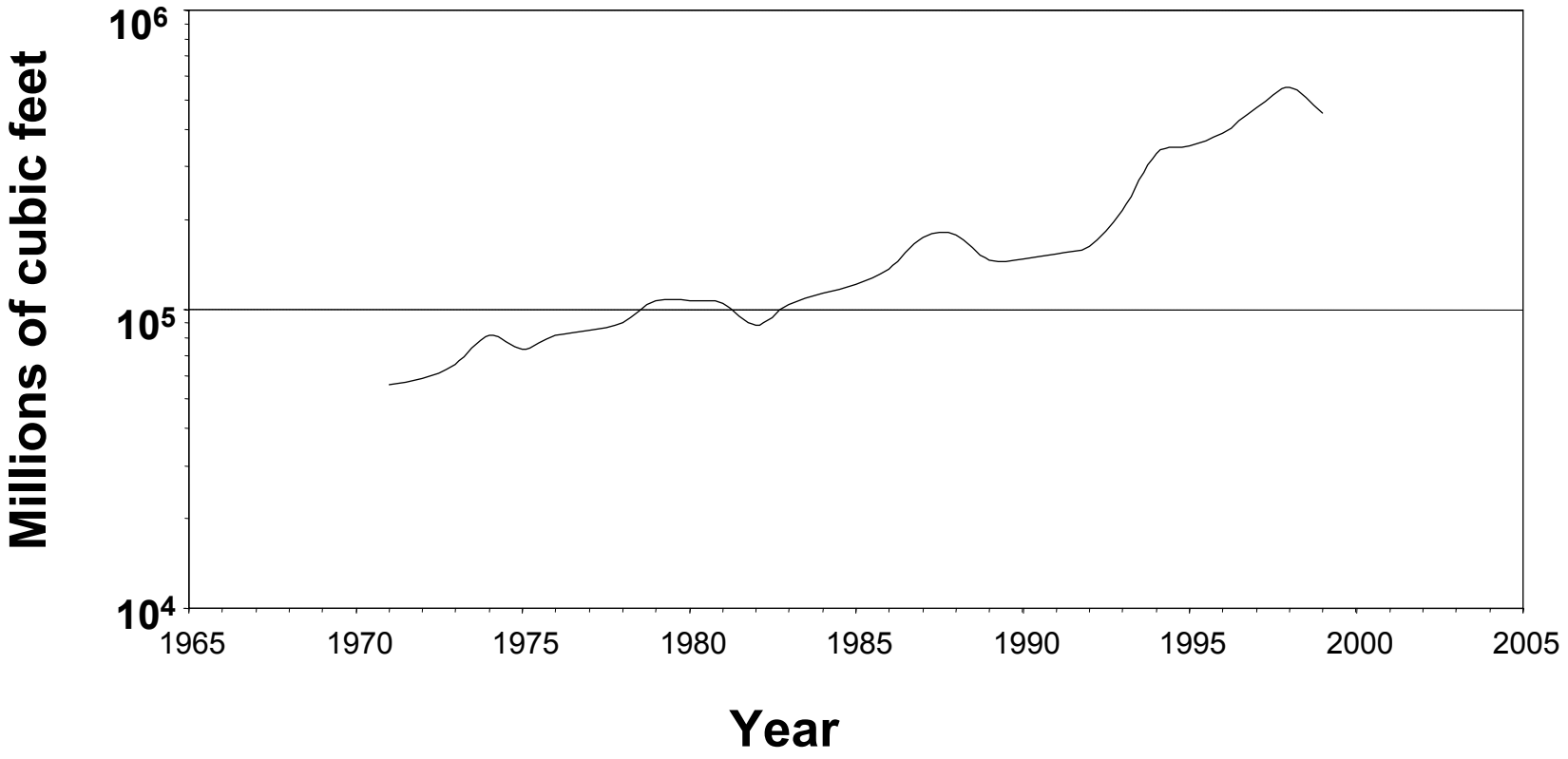
Source: After Ichihara

SuperCable Cross-Section



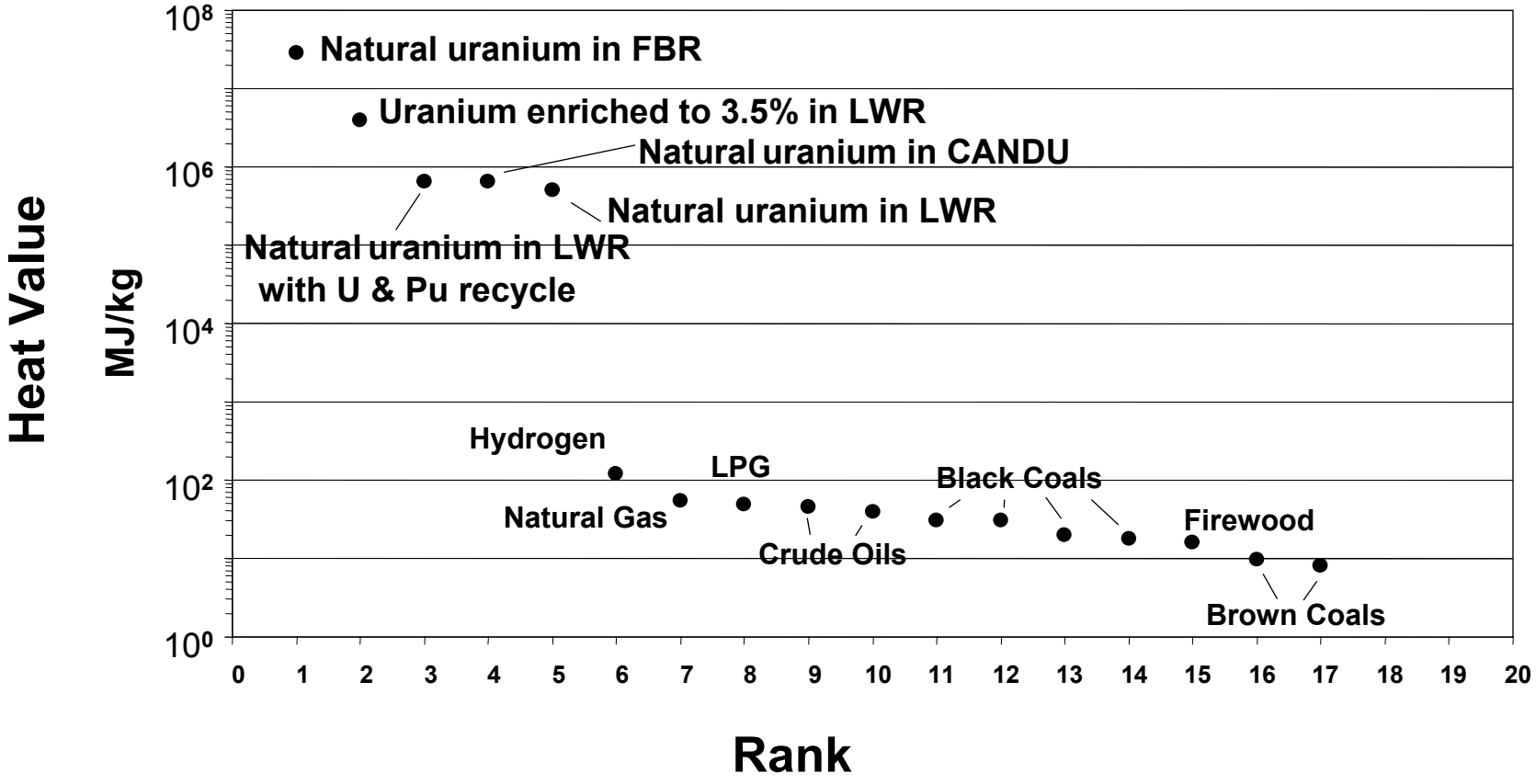
USA: Hydrogen production, 1971-1999

semi-log scale



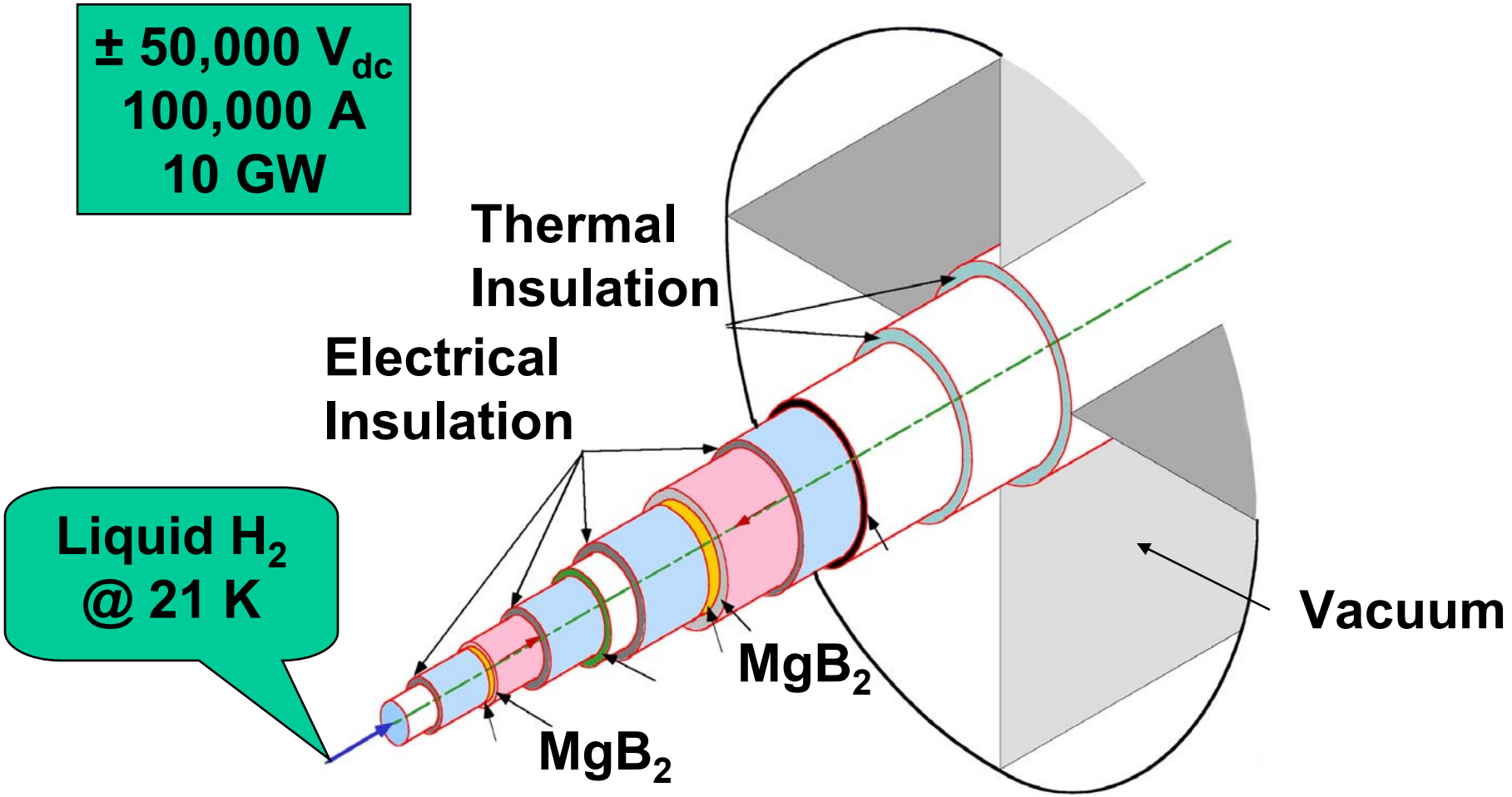
Source: N. M. Victor and J.H. Ausubel, 2002

Major fuels ranked by heat value



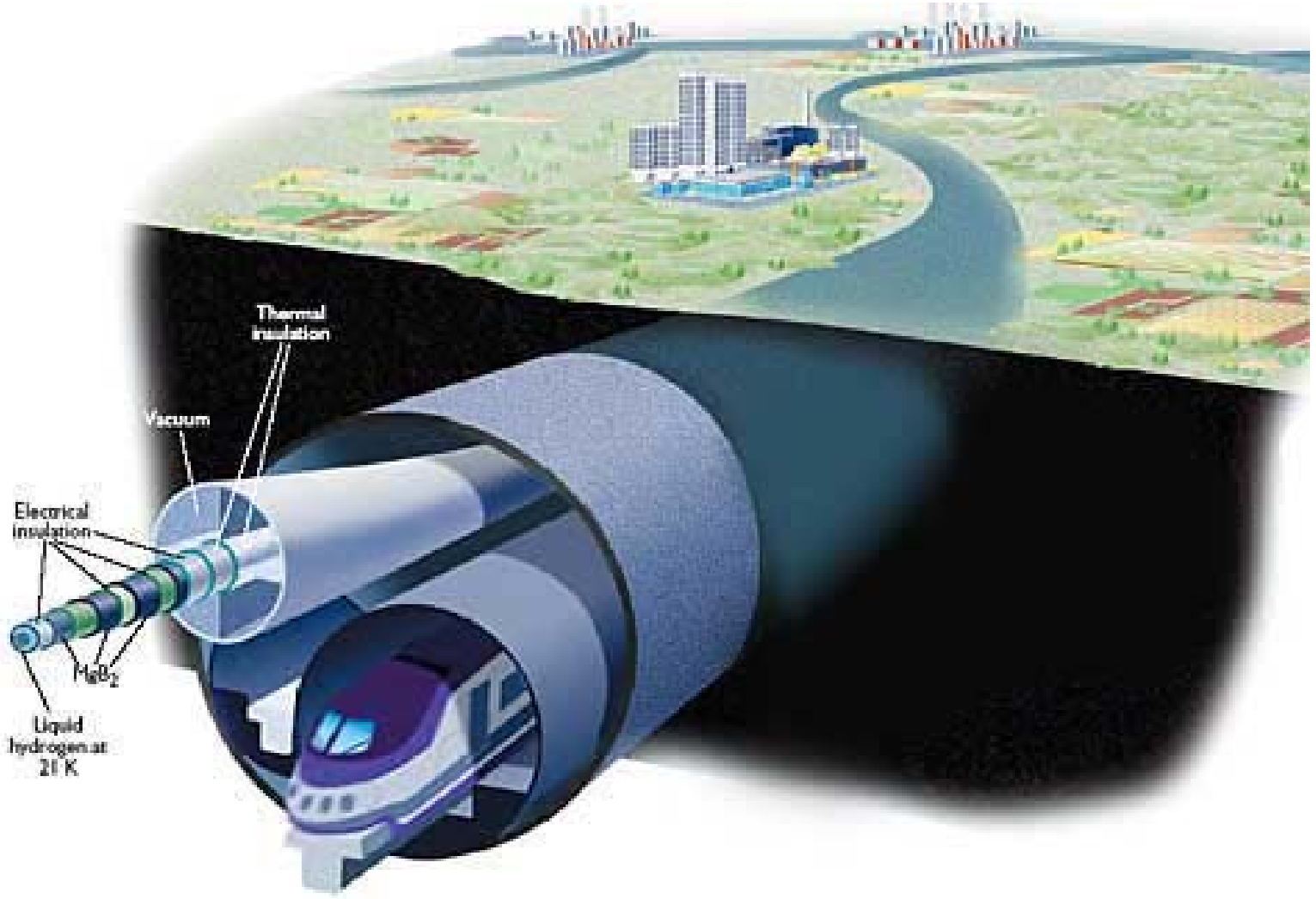
Source: N. Victor and J. Ausubel, 2003

Hypothetical SuperGrid energy pipe



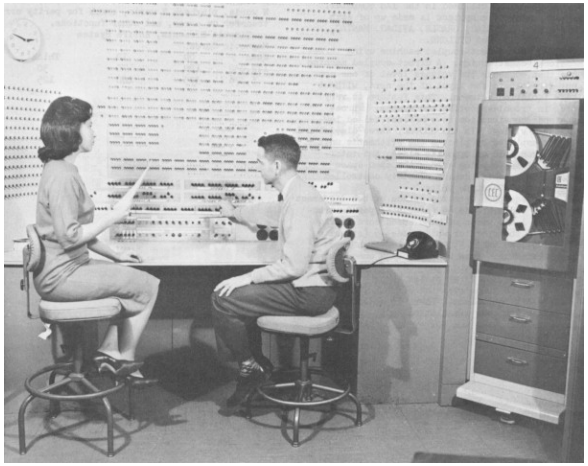
Source: P. Grant, EPRI

Supercable transporting hydrogen and electricity
Sharing tunnel with magnetically levitated train in low pressure tube



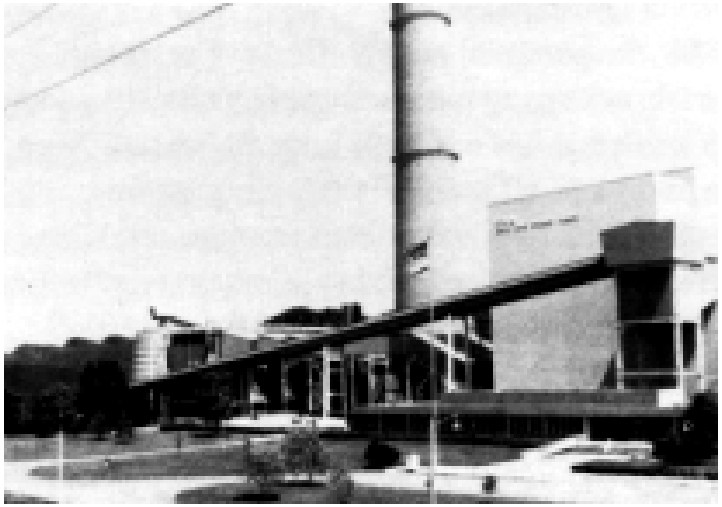
Source: Ausubel, 2004

Like computers that comprise the Internet, power plants become more powerful AND SMALLER

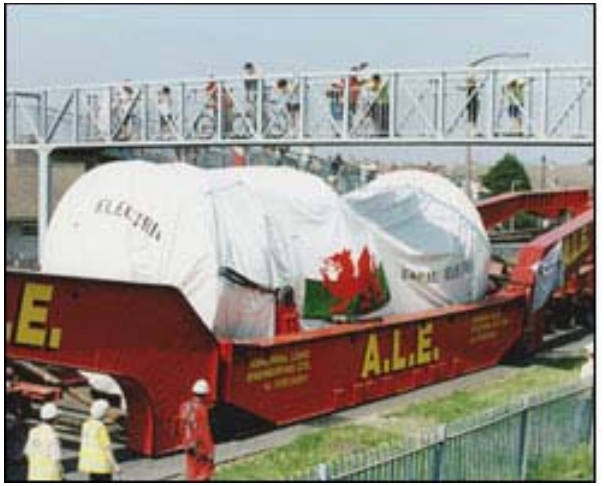


US Ballistic Research Lab computer, mid 1950s

Dell laptop, 2004



Tennessee Valley Authority coal plant
(date unknown)



Delivery of General Electric
480 MW natural gas turbine, 2000

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