

Resources

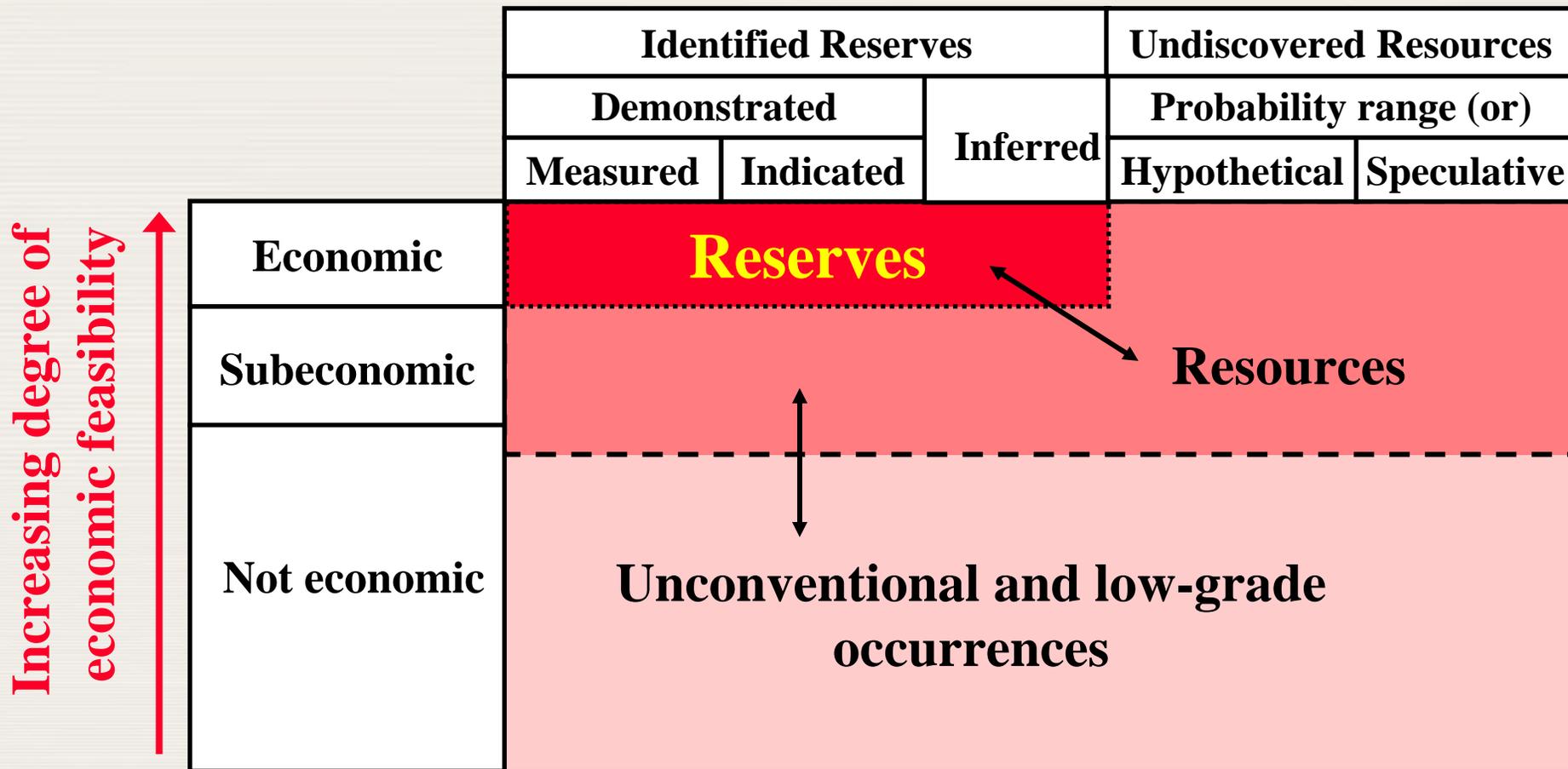
H.-Holger Rogner (NE-PESS)



A Primer on Exhaustible Resources

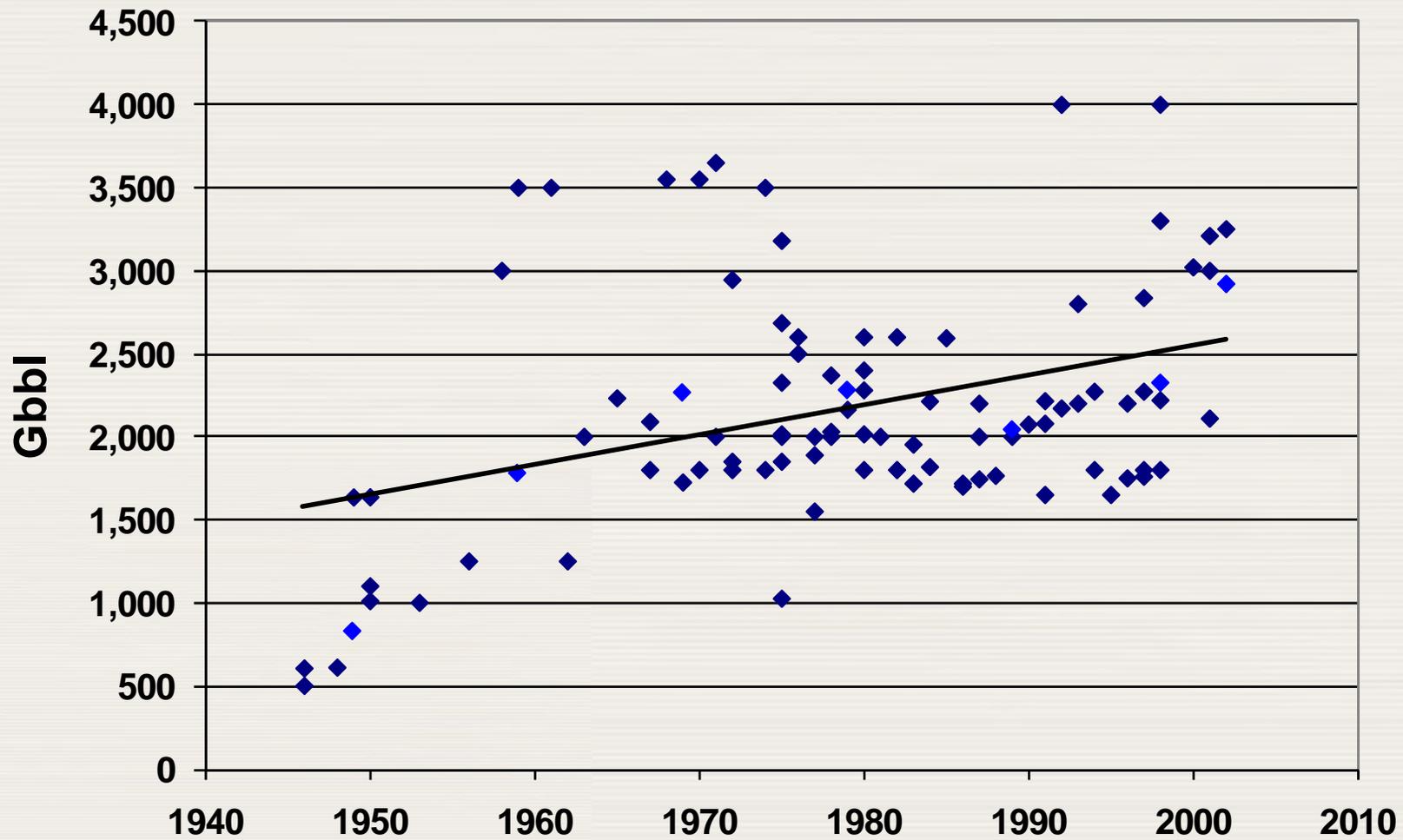
- For economists, there are no exhaustible resources really
- Reserve or resource assessments are efforts of estimating the economic portion of an unknown total
- Demand for a resource “creates” it - without demand a resource remains “neutral stuff”
- If production costs become too expensive, alternative solutions will be sought
- Innovation and advancements of knowledge push the resource frontier of “exhaustible” resources and technology performance
- The future of exhaustible resources must be set in the context of anticipated demand, knowledge and technology

Resource Classification: The McKelvey Box

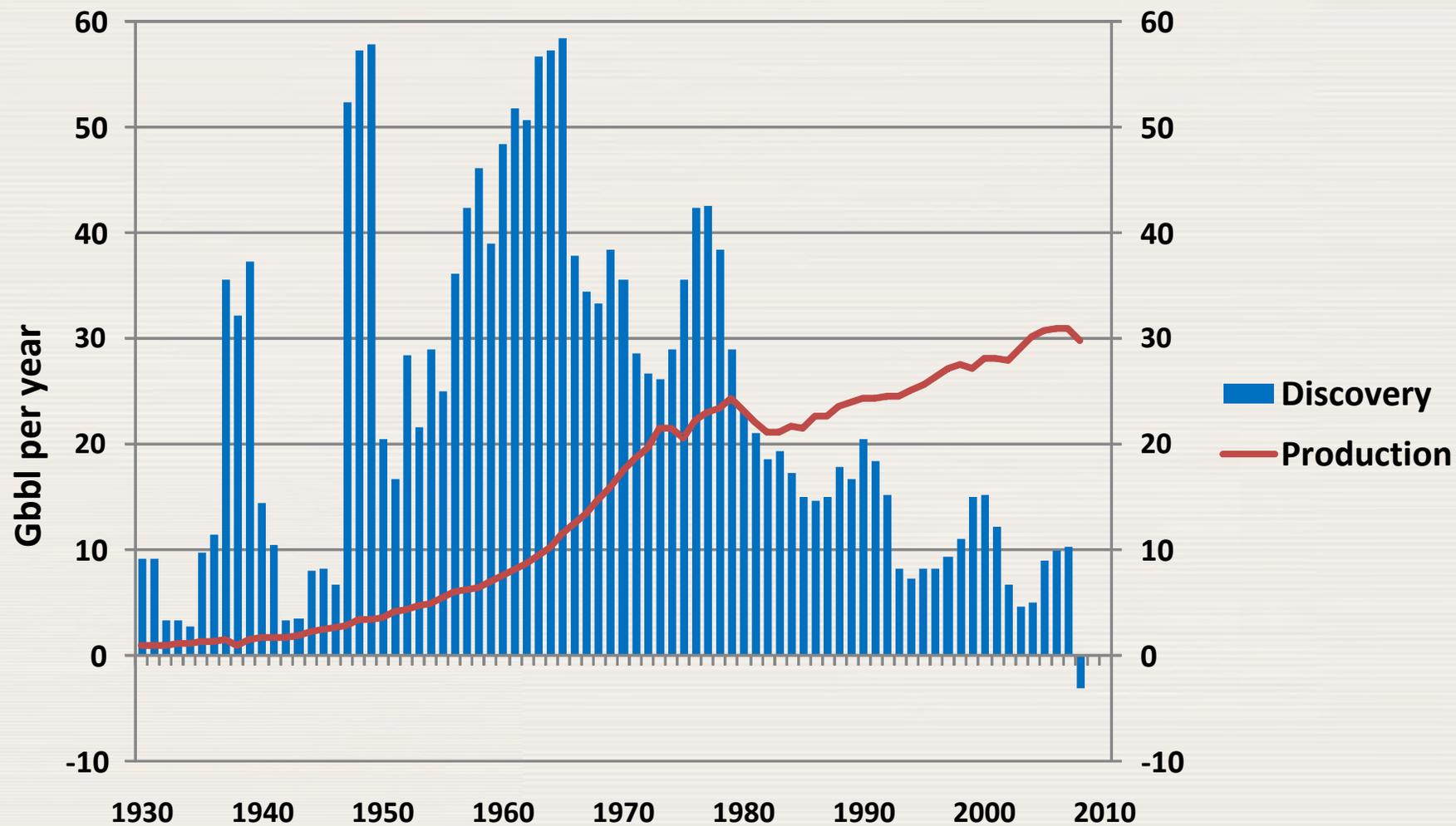


Increasing degree of geological assurance

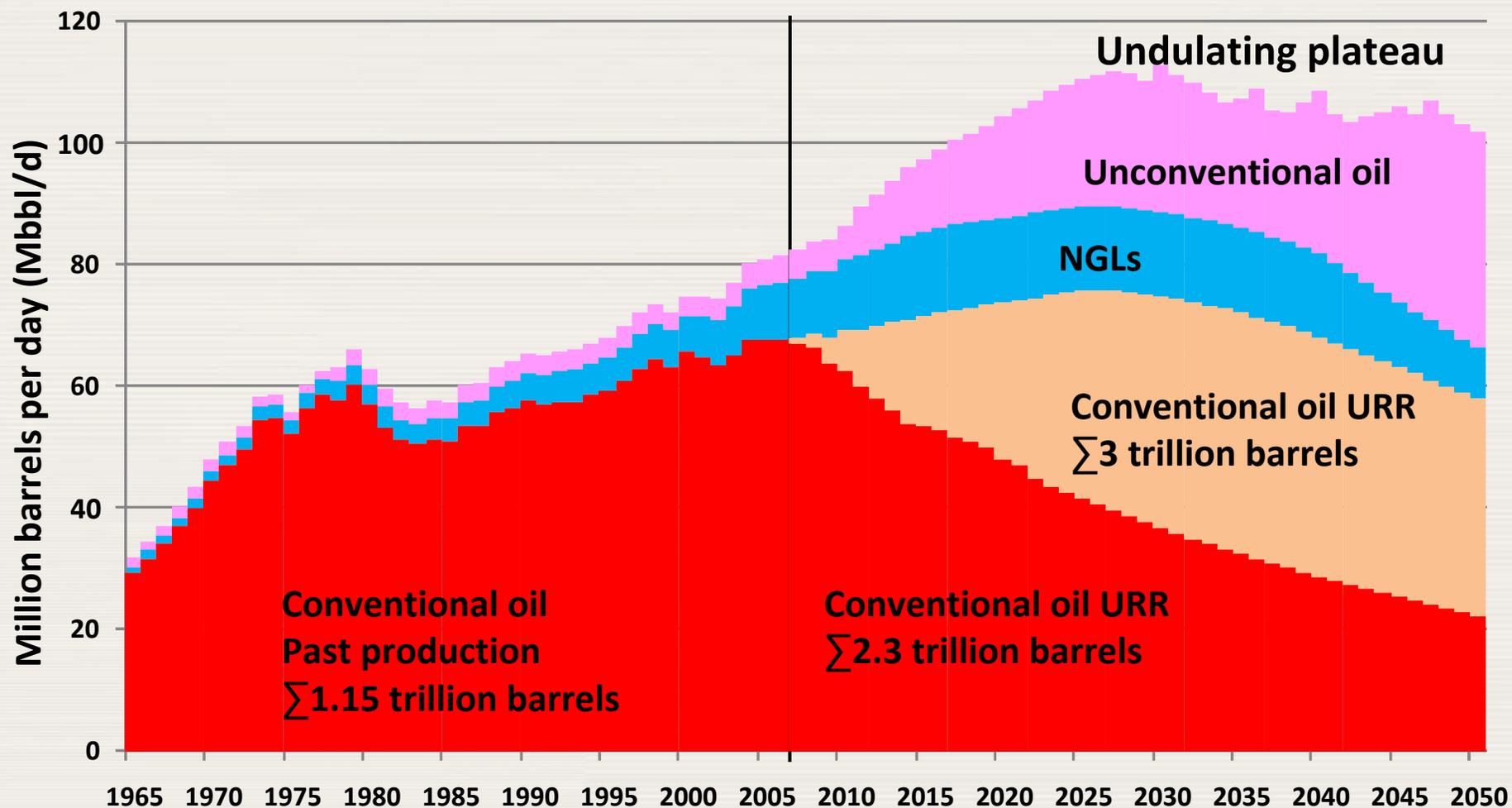
Ultimate oil reserve estimates



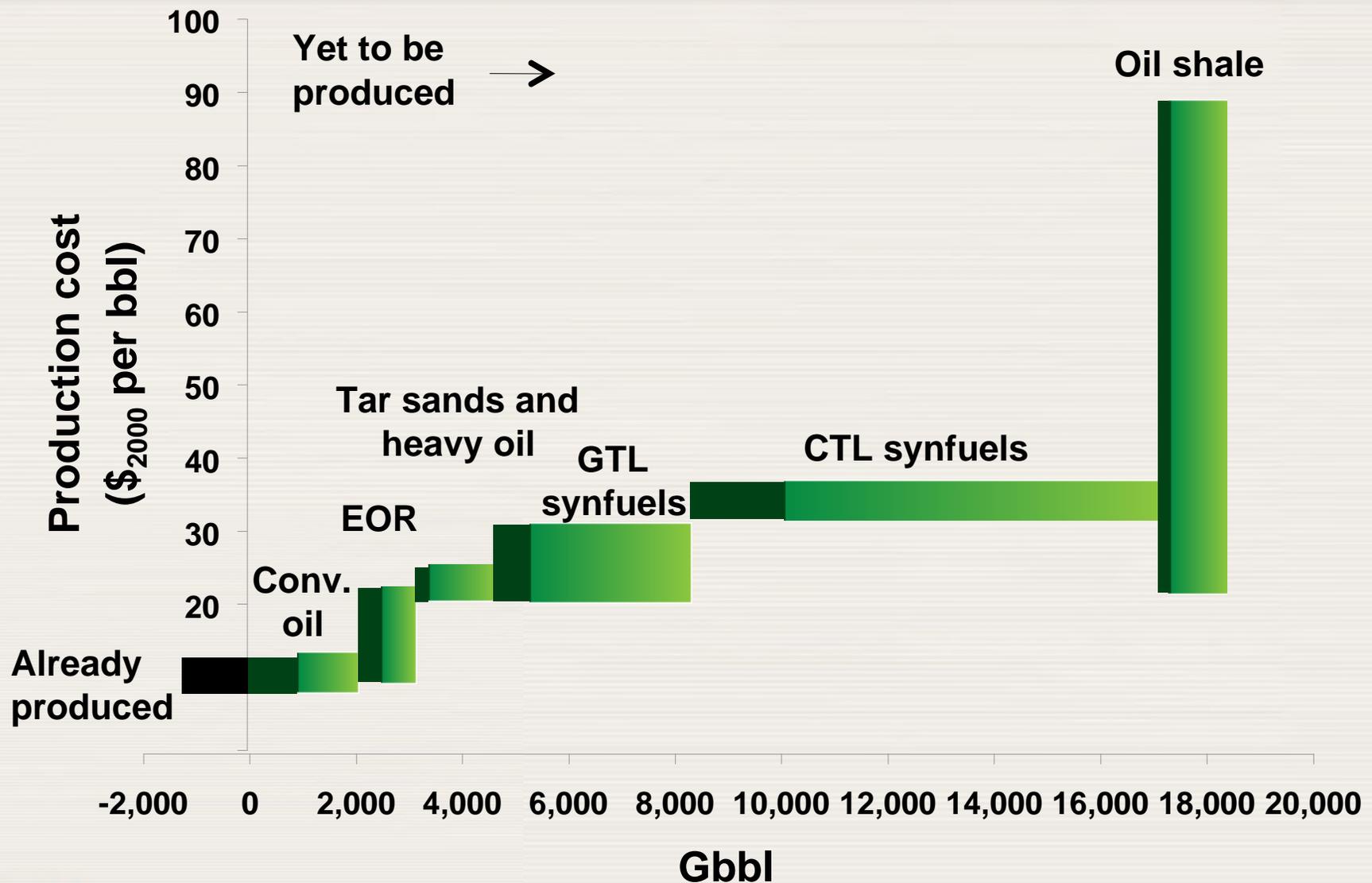
Peak oil debate



Peak oil



Potential for future liquid hydrocarbon production



Non-Fossil Energy Resources: Abundant

- Annual renewable energy flows are some 1000 times current global energy use
- The challenge is how to utilize the often low energy density flows
- The techno-economic potential of renewables depends on adequate site availability and performance of conversion technologies (learning-by-doing)
- Nuclear resources are quasi “unlimited” if breeding and recycling or lowest concentration uranium occurrences are considered

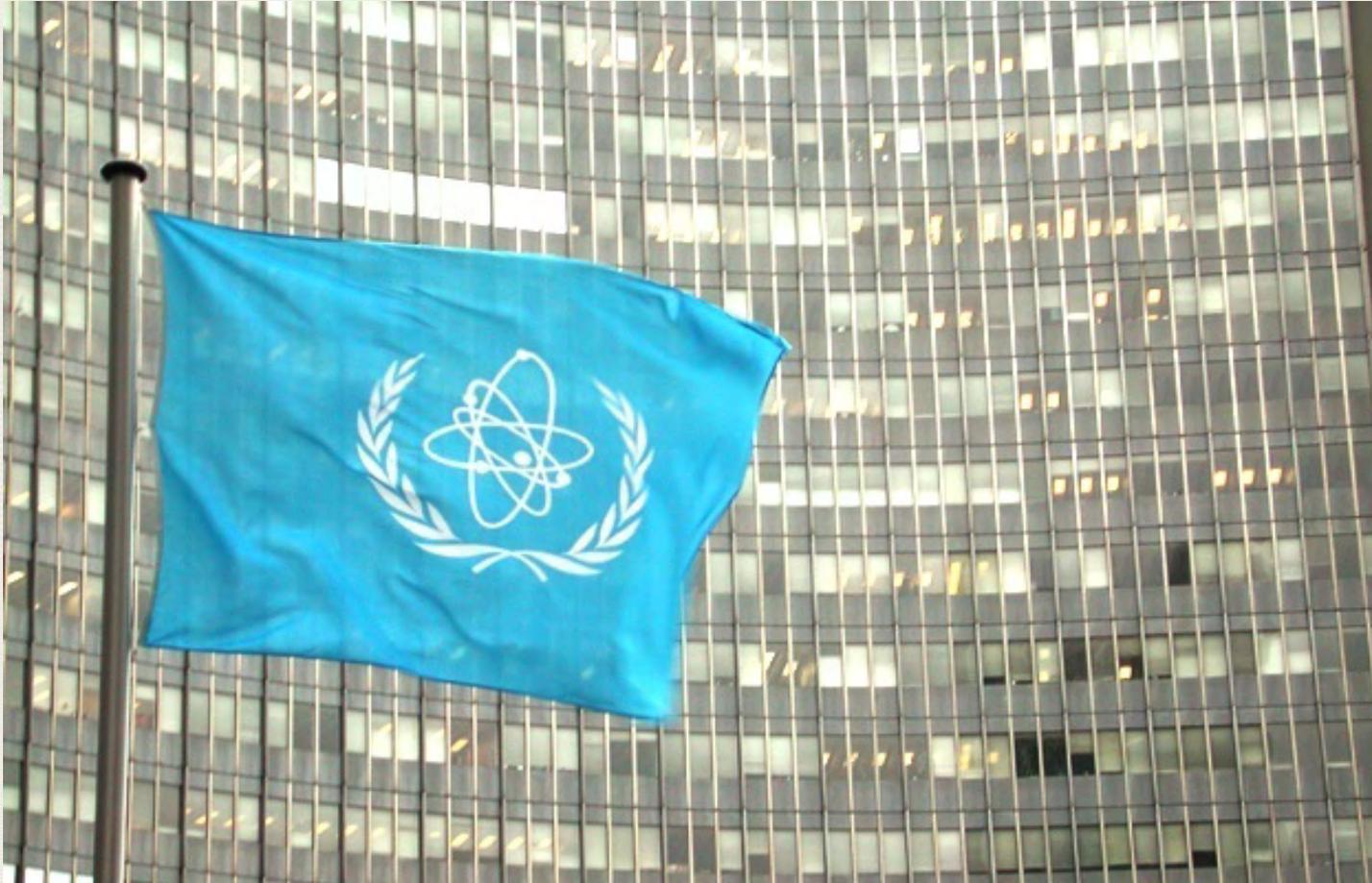
Facts to consider

- Geological features determine the location and quantity of oil/gas/coal/uranium deposits (“the neutral stuff in place”)
- But they do not determine “supply”
- Supply depends on investment in exploration and production capacity
- Time lags between investment and production
- Market risks & demand expectations
- Geology creates the playing field - past investment in capacity determines what actually can be produced at any time

Final remarks

- Occurrences of hydrocarbons and fissile materials in the earth's crust are plentiful
- There is enough carbon to keep global warming going
- Renewable energy flows are gigantic
- Above ground investment unlocks below ground resources
- Likewise RD&D and investment enables tapping renewables
- Resources pose no inherent limitation to development and meeting even rapidly growing future global energy need as long as....
- But environmental considerations may cap their use

IAEA



...atoms for peace.