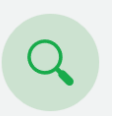


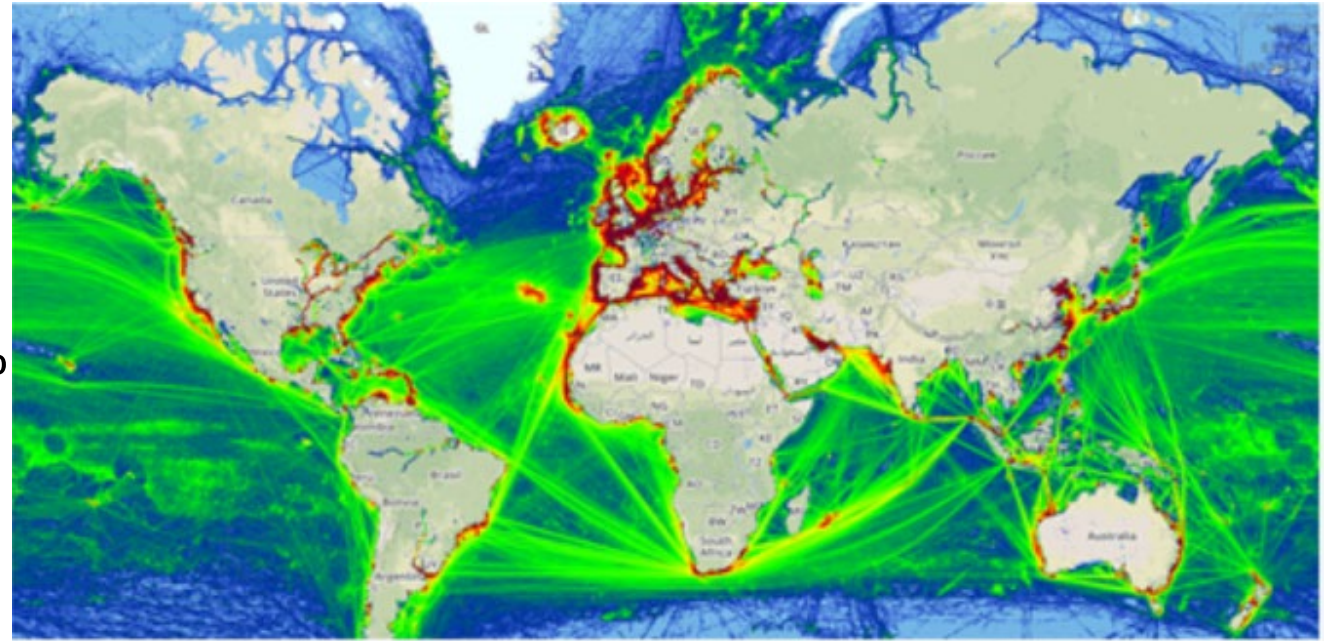
Oil and Gas Volatility, Security and Optionality

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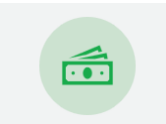
The Roots of Volatility of Oil and Gas Markets



- 1. Three Drivers of Price Formation**
 - Fundamental supply and demand
 - Speculation and hedging in paper markets
- 2. Marginal Pricing and Transmission**
 - Inherent decline rate and investment
 - US decline is 30%+ vs global rate of 7%
 - The one-bucket reality guarantees
- 3. Low Elasticity**
 - Supply not easily moderated, as subsurface dictates operations
 - Nobody drives to work twice
- 4. Substitution**
 - Band of substitution has narrowed as world has moved to greater efficiency

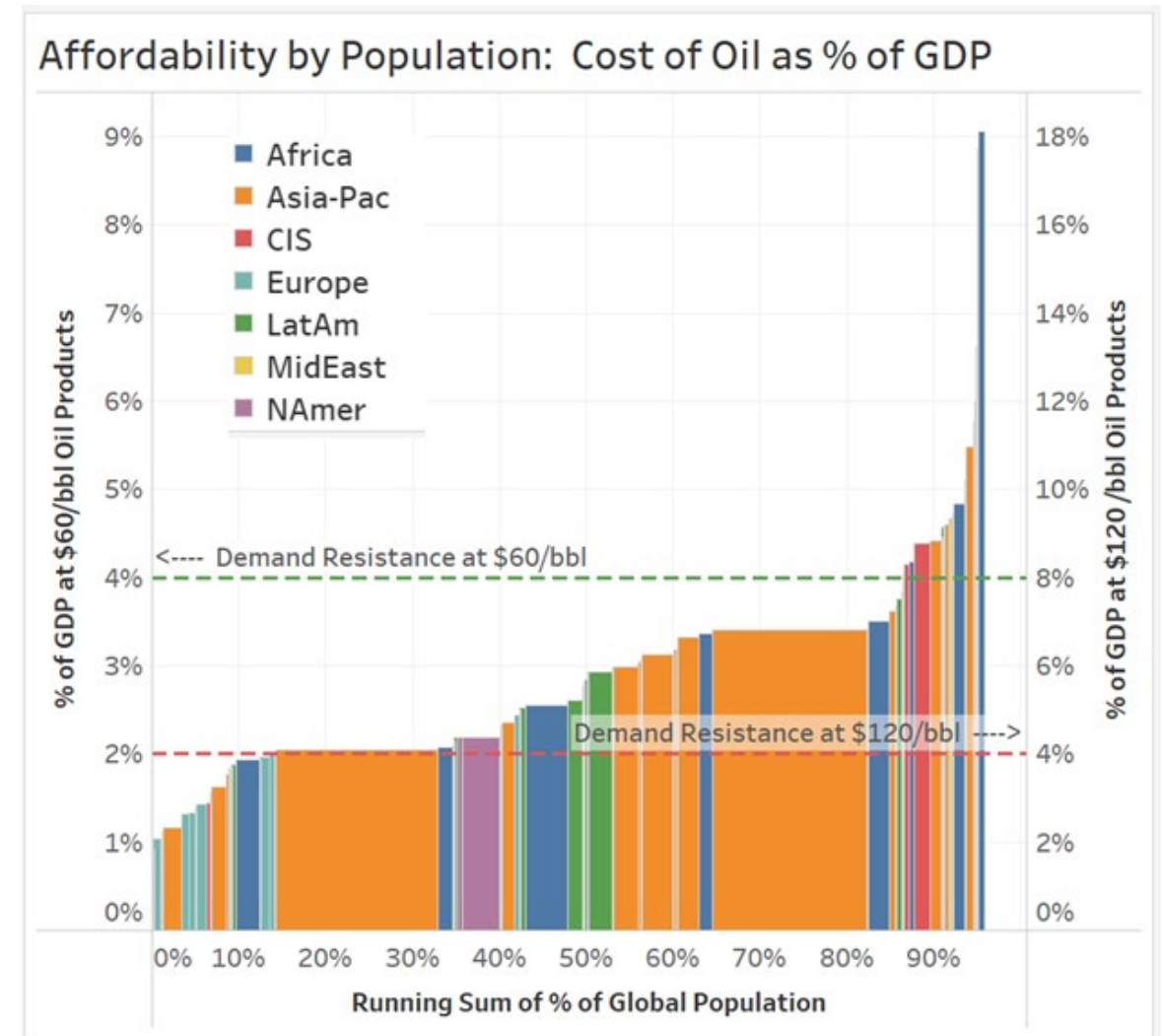


Source: S&P Global



What's the Problem? Availability vs Affordability

- Both **producers and consumers** seek security.
 - *Neither buyer nor seller has more inherent power.*
 - *Consequences of a stoppage usually more acute and immediate for **consumers**.*
- For consumers, physical shortfalls may be **catastrophic**: energy is life.
 - *But they are also **rare** in the modern context.*
- Global, flexible markets usually **convert availability risk to affordability risk**.
- Most important and immediate energy security measure is already in place: **inventories**.
- Focusing protection on avoiding physical shortage protection may be like buying an additional lock to protect against a hurricane
- Markets **ration energy every day**.
 - *Recent events have exposed **developed** countries to this phenomenon.*

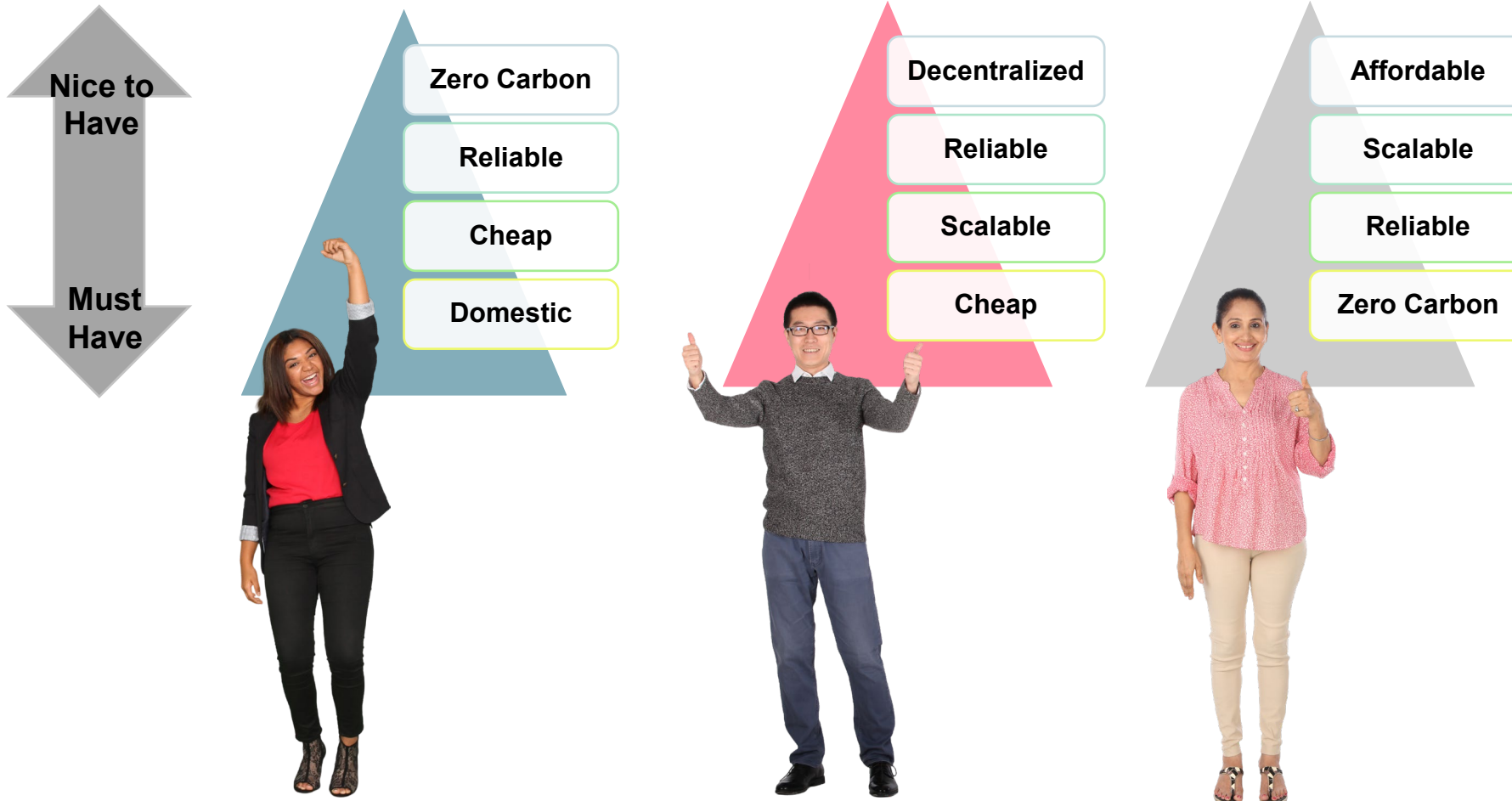


Source: S&P Global

Security Is Important, But Energy Necessitates Trade-offs



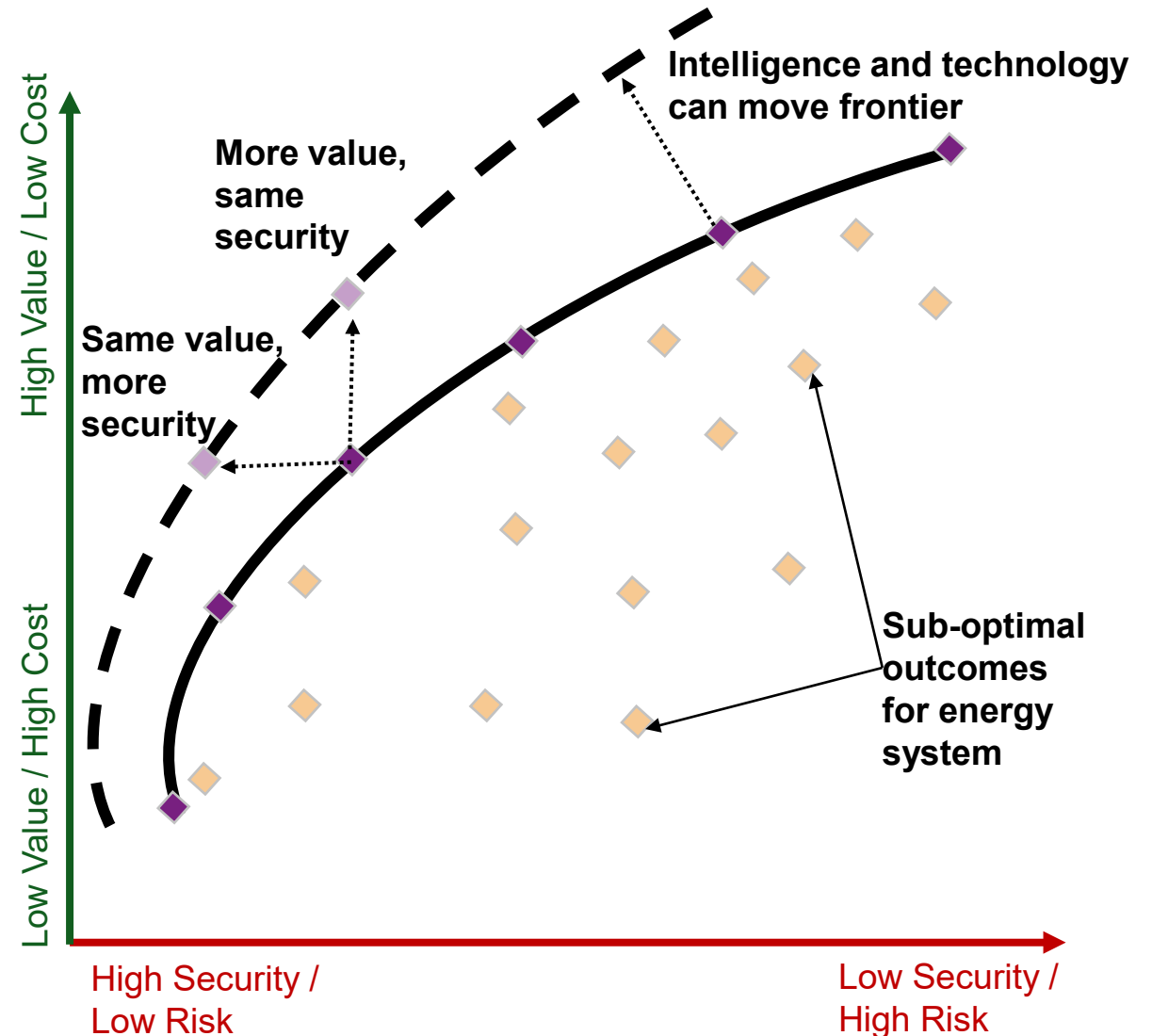
Crises reveal “revealed preferences.” Everyone has a hierarchy.





Balancing Energy Security with Efficiency

- Any system engineered for maximum efficiency is, by definition, **fragile** to volatility and unexpected events.
- Optionality **always** has a cost.
- Finding the right balance is tricky.
 - Humans are **not good at assessing risk**, especially over time.
 - Total security is **not the right answer**, and correct decisions can have bad outcomes.
 - Expect **Monday-morning quarterbacks**.
- How does this impact you?
 - Executives: **choose a position** on the efficient frontier, then adapt the company structures and risk mitigation to that point.
 - Innovators: **push the efficient frontier outward**: deliver more value and/or more security at any tradeoff.



Thank You.