#215 - Chris Keefer | Scrambling for Energy Security: Navigating Unstable Energy Supplies Amidst Global Conflict

Show Notes and Links to Learn More

00:00 – Chris Keefer
- Decouple: Podcast, Substack
- Previous TGS Episode: *Empowering the Future: from Nuclear to Podcasting*
- Canadians for Nuclear Energy

03:10 – 2026 Iran war
03:30 – Israel strikes on major Iranian gas field and Iran retaliation on Qatar's gas fields
04:00 – Nuclear power: pros, cons, and energy-security tradeoffs
04:35 – Maslow's hierarchy of needs
05:40 – 1970s energy crisis caused large state-led energy transition in Europe
06:05 – France's rapid nuclear buildout: 37 of the 57 nuclear reactors were built in the 1970s*; Electrification project and subsequent policies
06:30 – UK and Norway North Sea oil and gas expansion during the 1970s and present
06:40 – West Germany's long-term Soviet gas imports via Cold War diplomacy
06:50 – U.S. energy shift from oil-fired electricity toward domestic coal after the 1970s shocks
07:03 – International Energy Outlook 2000
07:25 – The Oxford Institute for Energy Studies: *Fossil fuel shocks and European electricity prices since the 1970s: what can we learn?*
07:35 – Europe's oil and gas reserves, Import dependence, and exposure to Strait of Hormuz closure
08:05 – Oil disruptions and the Strait of Hormuz
08:27 – Natural gas as ~20% of global primary energy; LNG as ~3–4%
08:45 – Ras Laffan Industrial City
09:20 – Technology that densifies natural gas ~600x into LNG
10:00 – Energy retuned on energy invested (EROI) – Nate's Frankly on EROI, EROI for nuclear
10:05 – LNG export terminals ("trains"): massive capital intensity
10:10 – Qatar's LNG buildout and expansion from ~77 to ~140 million tons per year by ~2030
10:25 – Expected global LNG glut/oversupply and the role of new Qatari and U.S. production

10:40 – LNG as an energy-security fuel for import-dependent and resource-poor economies: Pakistan, Japan, South Korea, Thailand, Taiwan, and parts of Latin America
10:47 – Qatar declared force majeure and halted LNG shipments (Force majeure definition)
11:02 – Japan's financial role in scaling the global LNG industry
11:11 – A single LNG tanker is roughly equivalent to nearly a month of output from a nuclear plant
11:40 – Energy imports and exports by country
12:20 – Europe signed long-term deals with Qatar
12:40 – What LNG is used for (besides fuel)
13:01 – Second-, third-, nth order effects
13:17 – Qatar honored long-term contracts to Pakistan, etc.
14:30 – LNG consumer storage
14:45 – LNG thermal efficiency (~60%) versus nuclear (~33%) and coal (~40% for ultra-supercritical steam)
15:10 – Combined cycle power plants are easiest non-renewable system to build
16:25 – Ukrainian drone strike on Russian LNG tanker (Arctic Metagaz), Transit through the Suez Canal
16:37 – Current LNG markets
17:10 – Pakistan's domestic power sources cushion LNG supply risk
17:20 – Baseload vs. Intermittent power
17:55 – Wet, lignite coal
18:12 – Rankine cycle
18:19 – Nuclear power in Pakistan
18:50 – Europe replacing much of its lost Russian pipeline gas with LNG, including long-term deals with Qatar and the United States
19:19 – Europe consuming ~38 EJ of hydrocarbons while producing only ~5* EJ
19:21 – North Sea Granat prospect
19:50 – Europe continued Russian LNG imports
20:00 – Europe's dependence on U.S. LNG
20:05 – Trump and Greenland
20:10 – Europe's shift away from Russian pipeline gas increasing global competition for LNG cargoes
20:20 – Natural-gas strip futures: Europe still above $20/MMBtu 18 months out versus ~$3 in the U.S. and negative gas pricing in the Permian
20:25 – Firm long-term LNG contracts versus flexible market-linked supply exposed by the energy crisis
20:40 – Flaring, dumping, and associated gas oversupply in oil-heavy basins
20:47 – Marcellus natural gas trend

20:57 – The Carbon Pulse, Possible future shapes of the Carbon Pulse, Future growth scenarios
21:05 – Uneven geography of energy abundance and scarcity
21:50 – Europe's long-term deindustrialization (Europe energy constraints and imports) accelerated after Russia's invasion of Ukraine
22:00 – Germany's relative success in preserving heavy industry
22:35 – England closed its last primary steel plant
23:25 – Europe's hydrocarbon import dependency rising from ~20% in 1995 to ~80% today
23:35 – Jean-Marc Jancovici's framing: efficiency, sobriety, or poverty, TGS Episodes #84 & #175
24:25 – The Great Simplification
24:30 – European hydrocarbon use peaking around 2005 at ~46 EJ
25:15 – Vaclav Smil's "four pillars of civilization": steel, cement, ammonia/fertilizer, and petrochemicals/plastics
25:27 – Trump's framing: if you don't have steel, you don't have a country
26:05 – Strait of Hormuz disruptions and their implications for nuclear and LNG
26:15 – Global nuclear fleet by country: ~440 reactors, close to 400 GW, with roughly two-thirds built in the 1970s and 1980s
26:35 – *Stop Calling Nuclear Rectors "Aging"*
27:15 – New European Pressurized Reactors: cost, delay, and examples such as Hinkley Point C, Flamanville, and Olkiluoto
27:40 – Germany's closed nuclear facilities and restart debates
28:31 – China restricting titanium exports, Broader supply-chain constraints
29:10 – Chinese grid/economic growth
29:15 – U.S. grid growth of ~8% per year in the mid-20th century versus ~1% or stagnation today
30:15 – China building large reactors quickly, Russia as well
30:30 – Nuclear power plant construction time
30:50 – Nimbyism
31:05 – Ontario as the only active new nuclear construction site in North America
31:35 – No major conventional nuclear plants under active construction in the U.S. despite media hype
31:55 – U.S. struggles with megaproject delivery, even as they install large volumes of Chinese solar and build LNG export terminals – Nuclear's core bottleneck as project delivery in the West
32:50 – Chris Keefer's "nuclear has CCGT envy" argument
33:30 – Light-water and heavy-water reactors
33:40 – Financing nuclear energy

34:10 – AI/data-center growth and "all of the above" energy strategy reviving nuclear enthusiasm
35:10 – Taiwan's former ~5* GW nuclear fleet supplying ~21% of its grid
35:20 – Two ~1.3 GW reactors in Taiwan built but never fueled; referendum politics and restart debate
35:30 – Taiwan replacing lost nuclear generation with LNG imports; Qatar supplying ~35% of Taiwan's power-sector LNG; Taiwan's grid now ~50% LNG-fired, Referendum to turn them back on, UPDATE: Taiwan has now decided to reopen at least one nuclear power plant
36:45 – $E = mc^2$ as the core frame for nuclear energy density
37:00 – Uranium is the heaviest naturally occuring element
37:07 – A 1 GW nuclear plant requiring ~150* tonnes of uranium fuel – roughly a 2.5–3 meter sphere fitting in less than one shipping container – lasting ~12 months
38:00 – How a nuclear reactor works, Nuclear fission
39:40 – A 1 GW nuclear plant is producing ~25 GWh/day
40:00 – Fossil fuels caused industrial civilization as we know it
40:45 – *Energy and Permaculture*
40:57 – Nuclear's main advantages: extreme energy density, low operational emissions, and air-quality benefits
41:20 – Nuclear reactors as sources of medical isotopes; Canadian reactors sterilizing ~40% of the world's single-use medical devices via cobalt isotopes
41:30 – Other medical device sterilization methods: autoclaves and phosphine* gas
42:20 – Nuclear as a source of long-duration, intergenerational employment, analogous to legacy auto plants in Detroit
42:35 – Narrow-boundary view of jobs
43:15 – Nuclear LCOE dominated by upfront construction cost (~70%)
44:15 – Wind and solar as even more CapEx-heavy but far lower-risk to build; gas plants as cheap to build but highly fuel-cost exposed
44:45 – How neo-liberal economics has held back new nuclear build (Government vs. corporate financing)
45:10 – China, Russia, and Korea as better positioned for nuclear due to stronger state capacity
45:30 – "MAGA industrial socialism"
45:37 – Possible U.S. government involvement in Westinghouse and Mountain Pass
45:52 – Ricardian economics
46:00 – Piracy surges and continual shipping transportation bombings
46:40 – Relicensing existing nuclear plants toward 80–90 year lifetimes
47:00 – Reactor pressure vessel aging: neutron bombardment, embrittlement, corrosion, and Russian annealing efforts

47:55 – Countries that are slowing, reversing, or reconsidering phaseouts; Belgium, France, Taiwan, and Japan
48:35 – China as the likely long-term winner in nuclear buildout
48:45 – China's ~60 GW nuclear fleet today, about 5% of installed capacity, standardized around two reactor designs (CAP1000 and HPR1000) and projected to reach ~200–250 GW by 2040–2050
49:10 – Current global nuclear capacity at roughly 390 GW
49:20 – Energy race between U.S. and China (Per capita electricity generation, 2025), The AGI Race, Energy demand from AI
50:15 – China and the Malacca dilemma
51:10 – China's electrification push as energy-security strategy more than climate strategy
51:15 – China's still ~60% coal
51:20 – China's "energy bases"
52:05 – Coal-to-fertilizer and coal-to-plastics pathways
52:40 – Energy blindness
53:05 – Western electricity-market deregulation: Weak on reliability, slack, and energy security
53:55 – In-fighting on the left, Modern environmentalism drifting into virtue signaling
54:30 – Rising energy bills are rewiring American politics
56:40 – SMRs as economically weak because inherent nuclear costs do not scale down well
56:50 – "Advanced reactors": Molten-salt, High-temperature gas-cooled, Sodium-cooled fast
57:15 – Bill Gates recent nuclear project
57:20 – EBR-I and EBR-II
57:35 – Fuel breeding in sodium fast reactors
57:50 – Startup and VC culture treating nuclear like software
59:30 – Acute radiation syndrome
59:40 – No civilian deaths from handling spent nuclear fuel/radiation in normal operations
1:00:05 – Safer storage of spent nuclear fuel, Coated cladding
1:00:25 – How dangerous is high-level radioactive waste?
1:01:00 – Nuclear waste storage and why it is easier to manage than coal ash and $PM_{2.5}$
1:02:05 – Coal ash ponds and broader pollution risks
1:02:30 – U.S. presidential rhetoric about attacking Iranian power infrastructure
1:02:50 – Iran's list of potential retaliatory targets if its infrastructure is attacked
1:03:00 – Barakah nuclear power station in the UAE
1:03:20 – Chernobyl accident
1:03:30 – RBMK reactors are fundamentally different from Western light-water designs

1:03:50 – Accidents in graphite-moderated reactors
1:04:10 – Chernobyl fallout detected in Sweden
1:04:30 – Chernobyl health debates: Greenpeace, EU Green parties, and politically contested casualty estimates
1:04:50 – UN Chernobyl Forum estimate of ~30 direct deaths, including 28 from acute radiation syndrome
1:05:50 – Roughly 40% of humans get cancer over a lifetime
1:06:10 – Chernobyl health effects: Iodine-131 exposure led to 5,000 thyroid cancer cases in children, Additional 15,000 projected excess thyroid cancer cases
1:07:07 – Thyroid cancer as relatively treatable, including with radioactive iodine
1:07:33 – Cesium-137 exposure outside the Chernobyl exclusion zone
1:08:05 – Destruction of Gulf desalination infrastructure as a public-health disaster
1:09:00 – Nate's paper: *Economics for the future – Beyond the superorganism*
1:09:50 – CANDU reactors as design choices that avoided some fuel-cycle and heavy-forging bottlenecks
1:10:40 – Ultra-high-purity quartz from Spruce Pine in North Carolina is a critical semiconductor chokepoint
1:10:55 – The complexity of manufacturing and installing solar panels
1:11:20 – *Material World* by Edmund Conway (TGS Episode)
1:12:07 – Existential risks, TGS Episode on such
1:12:17 – Marxist-Leninist ideology
1:14:10 – Oklo as a "nuclear meme stock": Sam Altman, Y Combinator, SPAC dynamics, NRC rejection
1:16:05 – Theranos case
1:17:35 – Hype around AI solving nuclear fusion
1:19:20 – CORRECTION: "If you're paying them $130 a megawatt hour, you're generating about $13 ~~million~~ hundred*."
1:20:07 – Army microreactor history in Greenland and the Panama Canal
1:21:00 – Terror Management Theory (TMT) (More info), TGS episode on such
1:23:50 – ASI Existential Risk, Advanced AI Extinction Risk & Risk Analysis, TGS Episode on such