THE END OF THE WORLD IS JUST THE BEGINNING

Mapping the Collapse of Globalization

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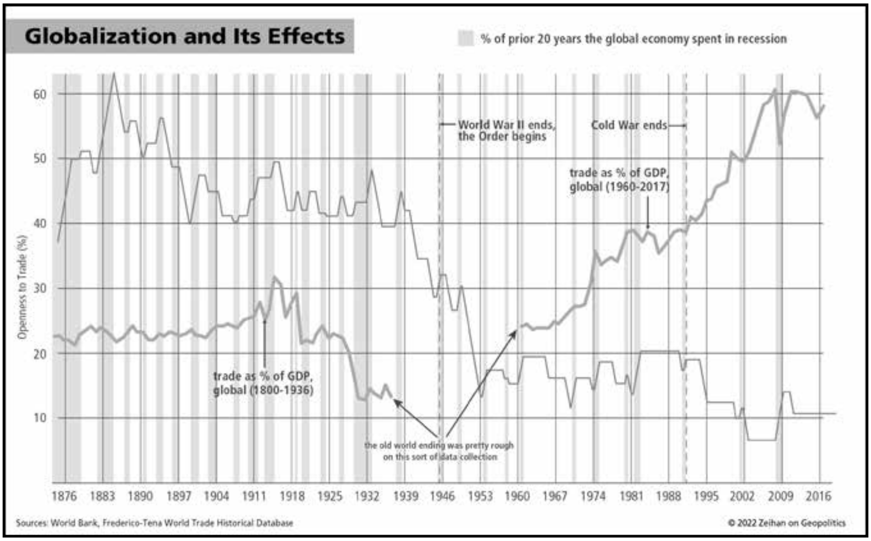
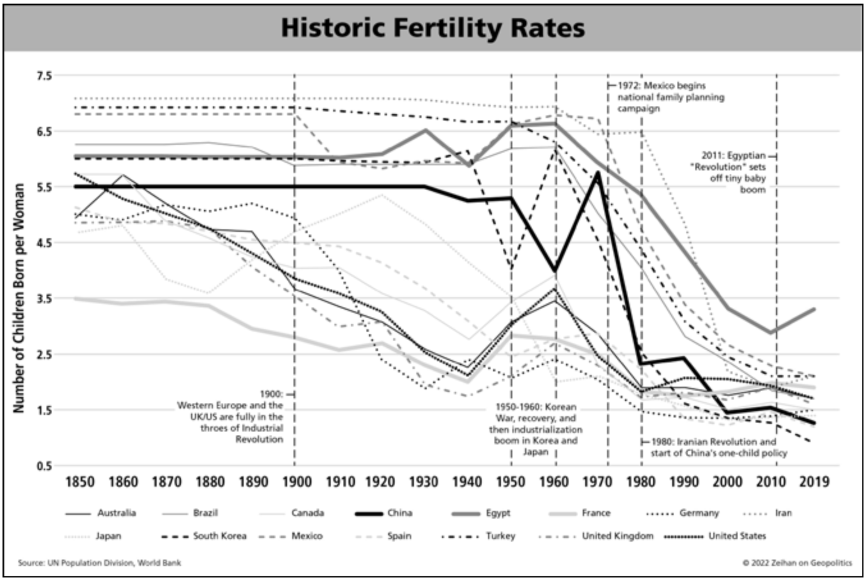
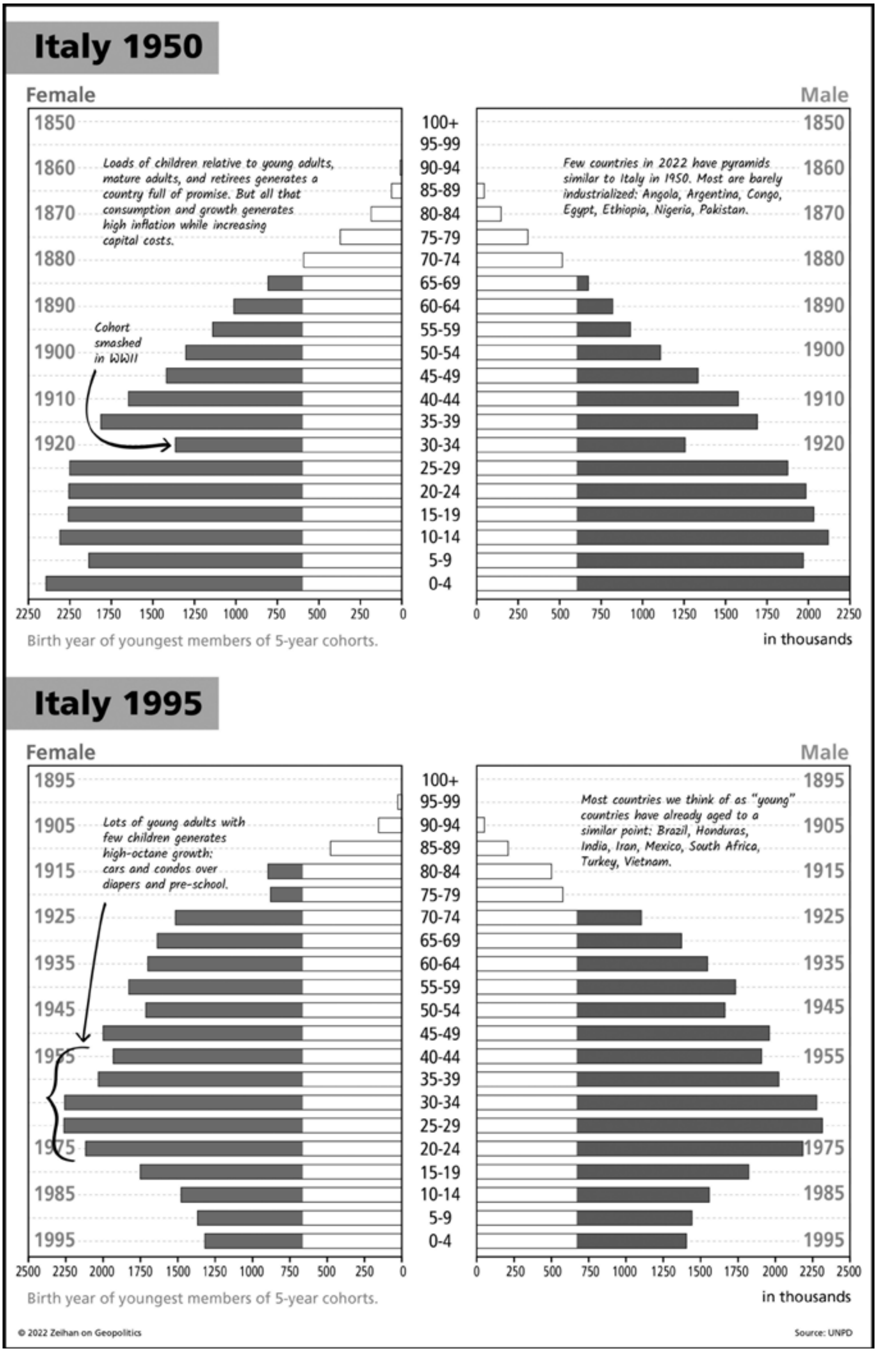
AND NOW FOR SOMETHING COMPLETELY DIFFERENT



HISTORY SPEEDS UP




Italy 1950
Female
Male
Loads of children relative to young adults, mature adults, and retirees generates a country full of promise. But all that consumption and growth generates high inflation while increasing capital costs.
Few countries in 2022 have pyramids similar to Italy in 1950. Most are barely industrialized: Angola, Argentina, Congo, Egypt, Ethiopia, Nigeria, Pakistan.
Cohort smashed in WWII
100+
95-99
90-94
85-89
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
1850
1860
1870
1880
1890
1900
1910
1920
Birth year of youngest members of 5-year cohorts.
in thousands
Italy 1995
Female
Male
Lots of young adults with few children generates high-octane growth: cars and condos over diapers and pre-school.
Most countries we think of as "young" countries have already aged to a similar point: Brazil, Honduras, India, Iran, Mexico, South Africa, Turkey, Vietnam.
1895
1905
1915
1925
1935
1945
1955
1975
1985
1995
Birth year of youngest members of 5-year cohorts.
in thousands
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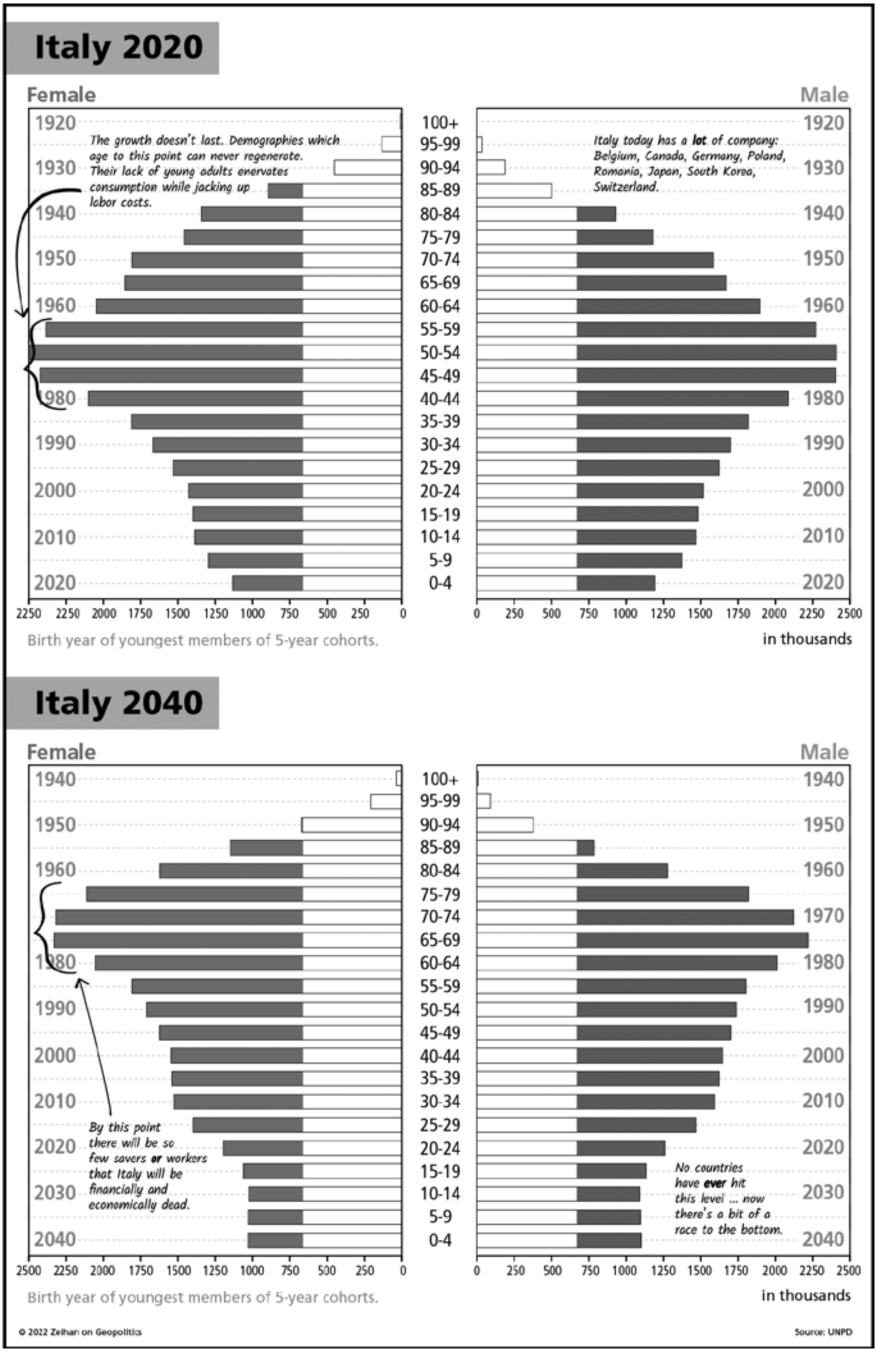
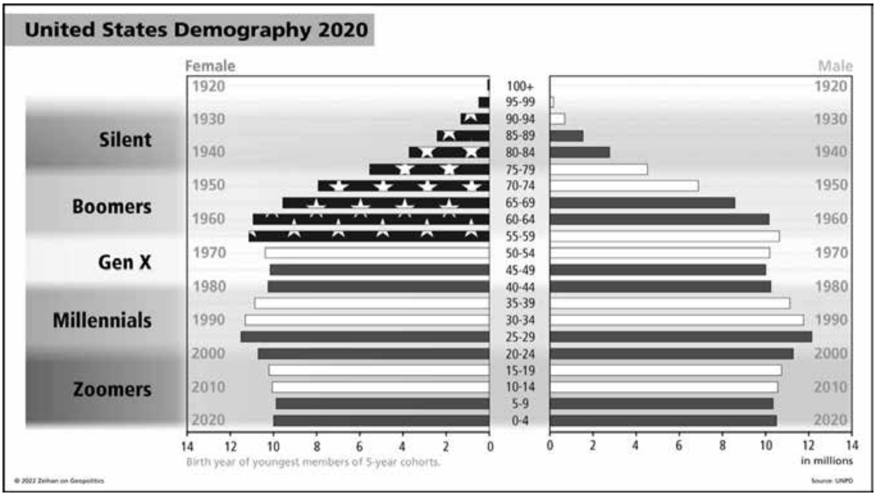
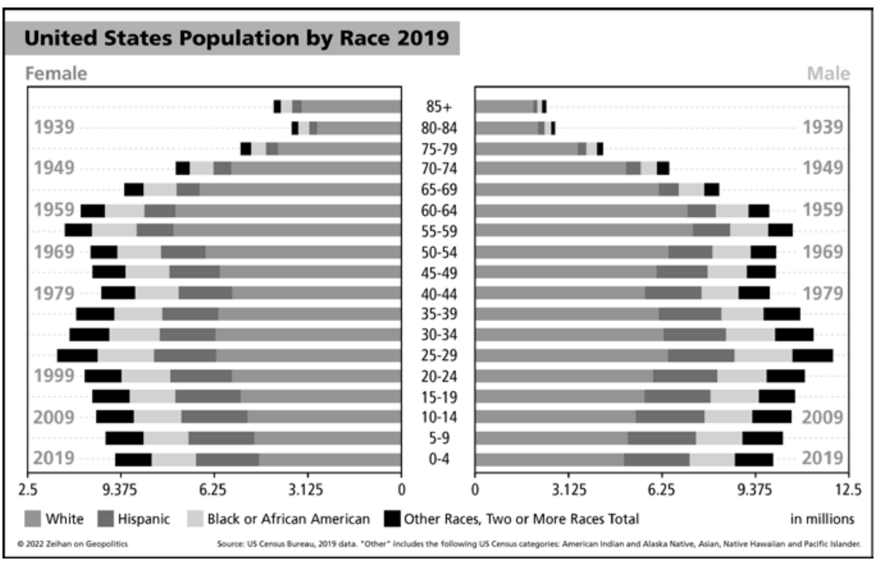
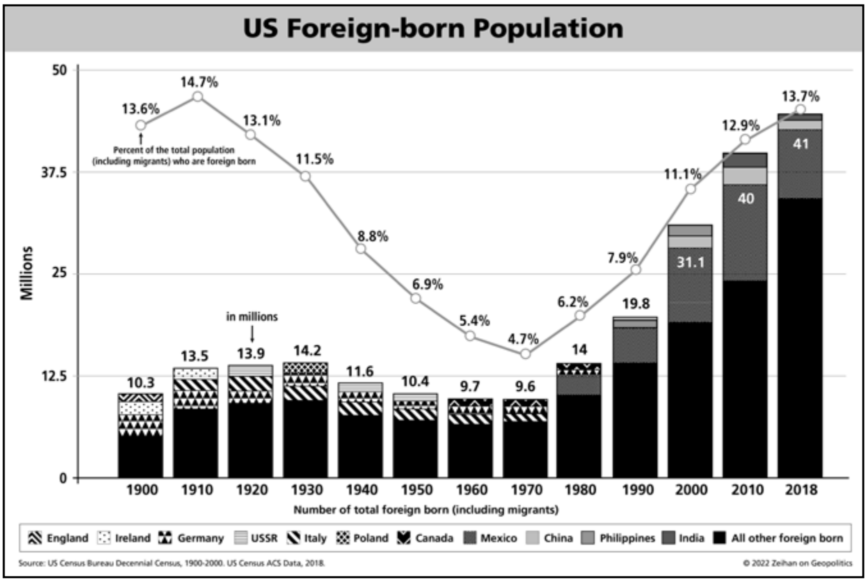
Source: UNPD


Italy 2020
Female
Male
The growth doesn't last. Demographies which age to this point can never regenerate. Their lack of young adults enervates consumption while jacking up labor costs.
Italy today has a lot of company: Belgium, Canada, Germany, Poland, Romania, Japan, South Korea, Switzerland.
Birth year of youngest members of 5-year cohorts.
in thousands
Italy 2040
Female
Male
By this point there will be so few savers or workers that Italy will be financially and economically dead.
No countries have ever hit this level ... now there's a bit of a race to the bottom.
Birth year of youngest members of 5-year cohorts.
in thousands
© 2022 Zeihan on Geopolitics
Source: UNPD

THE LAST BITS OF MORE






US Foreign-born Population
Millions
50
37.5
25
12.5
0
13.6%
14.7%
13.1%
11.5%
8.8%
6.9%
5.4%
4.7%
6.2%
7.9%
11.1%
12.9%
13.7%
Percent of the total population (including migrants) who are foreign born
in millions
10.3
13.5
13.9
14.2
11.6
10.4
9.7
9.6
14
19.8
31.1
40
41
1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2018
Number of total foreign born (including migrants)
England Ireland Germany USSR Italy Poland Canada Mexico China Philippines India All other foreign born
Source: US Census Bureau Decennial Census, 1900-2000. US Census ACS Data, 2018.
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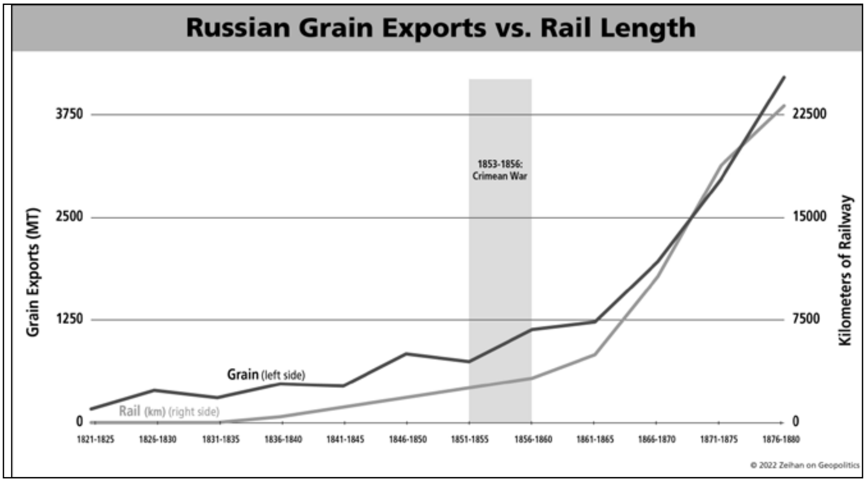
BREAKING FREE

INDUSTRIALIZING TRANSPORT



THE AMERICANIZATION OF TRADE

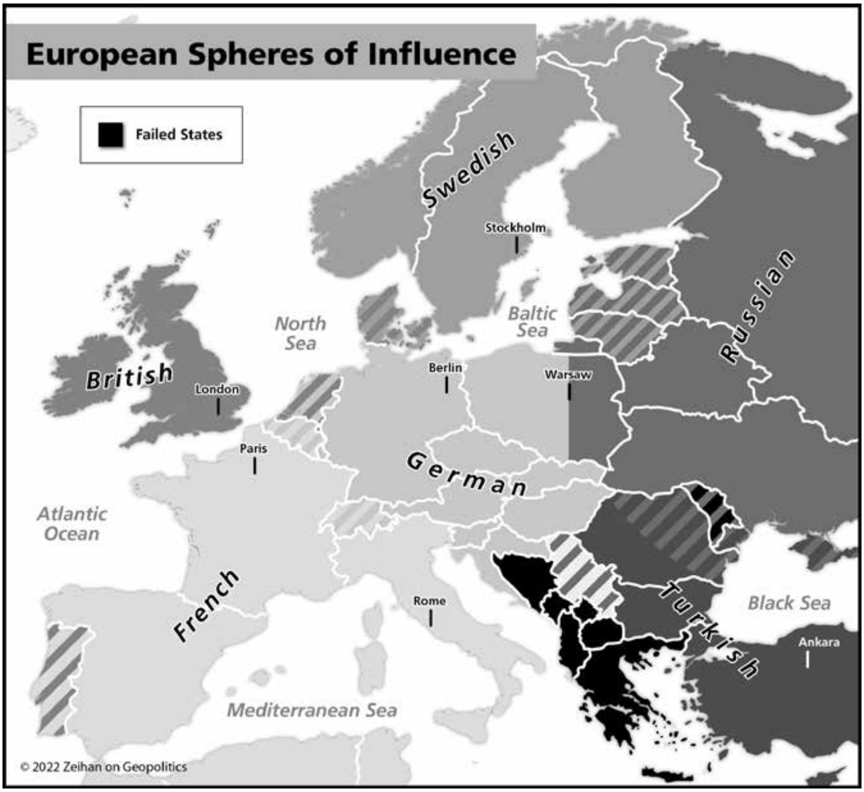
War Risk Insurance Cost Estimates in a High Risk Environment

Ship Type	Maximum Carrying Capacity (Units)	million USD: Appx Secondhand Value*	Typical Cargo Value**	2.5% Normal Annual Hull Insurance Cost	5% Hull War Risk Premium for Seven Days	0.375% Additional Cargo Risk Premium for Duration at 80% Insured	Additional insurance cost per unit per seven days in high risk zone (USD)	Approximate Ship Dimensions - Length, Beam, Depth in Meters
Maersk Triple E	18,000 TEU	$180	$630	$4.50	$9.00	$1.89	$605 / container	400x59x15
Panamax Container (post-expansion)	12,500 TEU	$130	$438	$3.25	$6.50	$1.31	$625 / container	366x49x15
Panamax Container (pre-expansion)	5,000 TEU	$7.0	$175	$0.18	$0.35	$0.53	$175 / container	290x32x13
Very Large Crude Carrier	2,000,000 barrels	$62	$200	$1.55	$3.10	$0.60	$1.85 / barrel	330x58x31
Aframax Tanker	800,000 barrels	$18	$80	$0.45	$0.90	$0.24	$1.43 / barrel	245x34x20
Capesize Bulk Ship	196,000 metric tons	$33	$16	$0.83	$1.65	$0.05	$8.66 / metric ton	280x45x24
Panamax Bulk Ship (pre-expansion)	83,000 metric tons	$20	$7	$0.50	$1.00	$0.02	$12.29 / metric ton	225x32x14
Handymax Bulk Ship (feeder)	59,000 metric tons	$12	$5	$0.30	$0.60	$0.01	$10.41 / metric ton	190x32x11

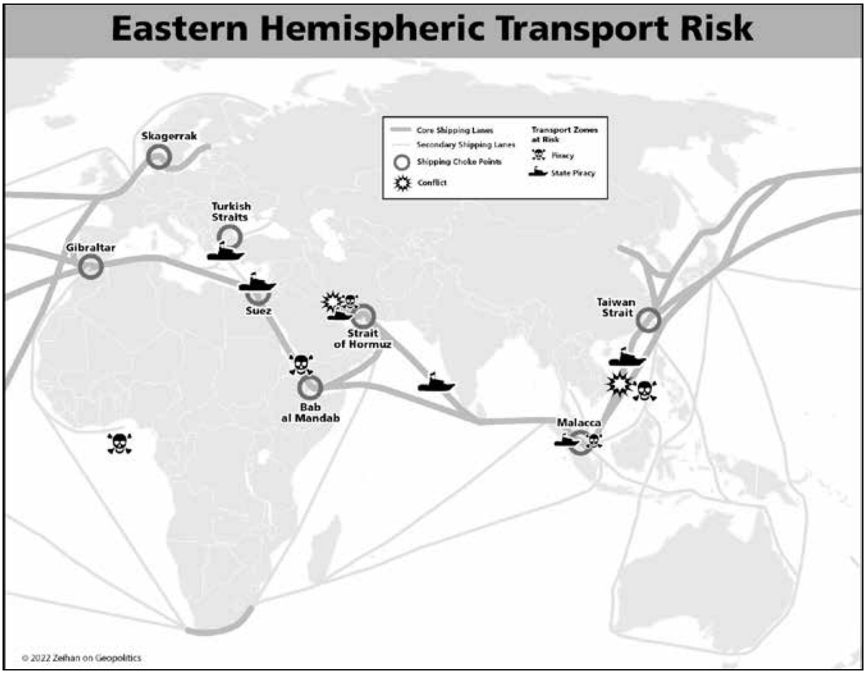
* Values are based 5-year-old ships except for Handymax and Aframax where data was only available for 10-year-old ships and the Triple E class which are newbuilds.
Prices are approximate based on reports from March 2017.
** With oil priced $100/barrel, coal $80/metric ton, clothing $35,000/TEU

Sources: Athenian, Clarkson, Maersk, ZoG Research

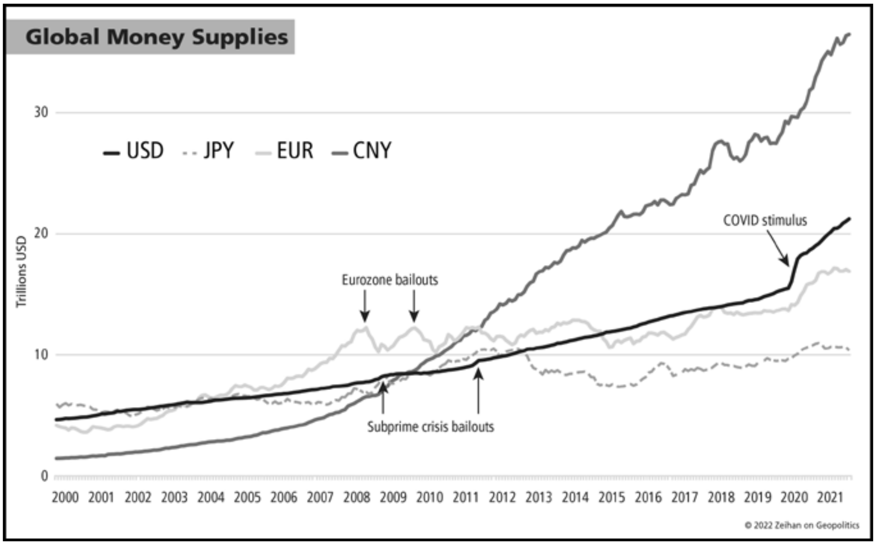
THE GREAT *UN*MAKING



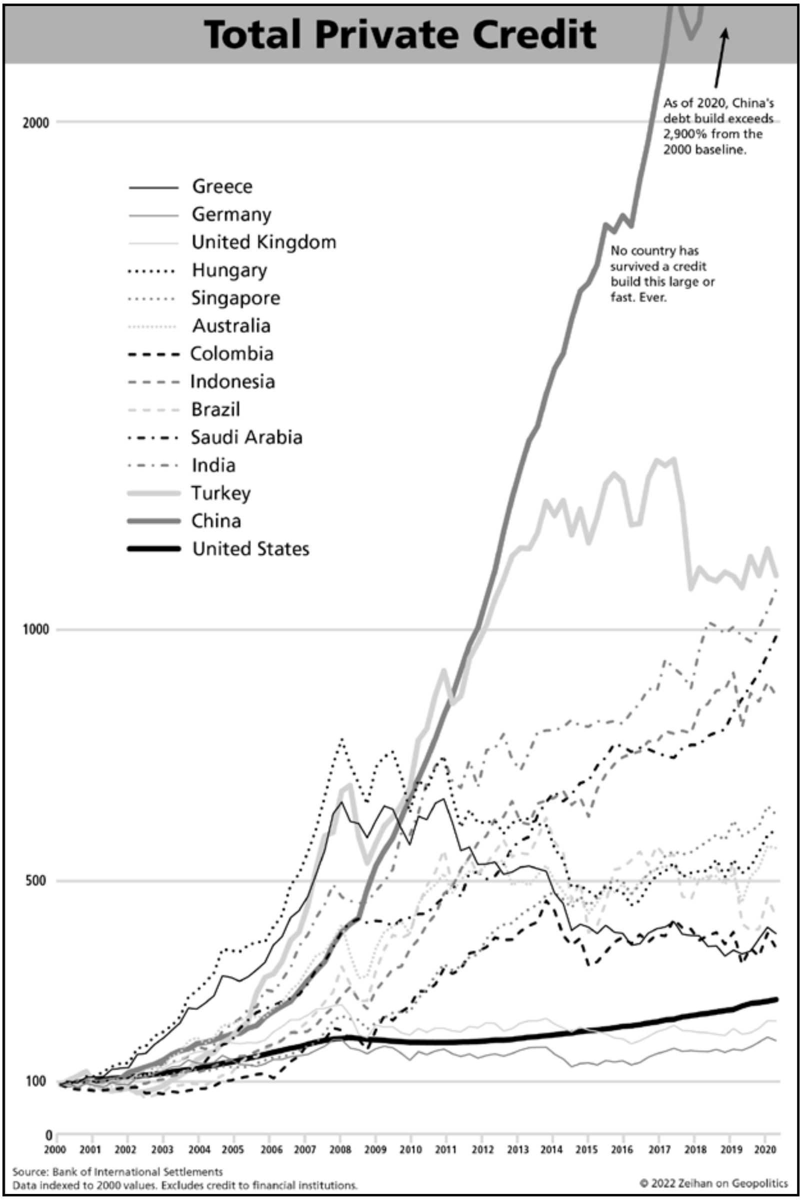
HARBORS IN THE STORM



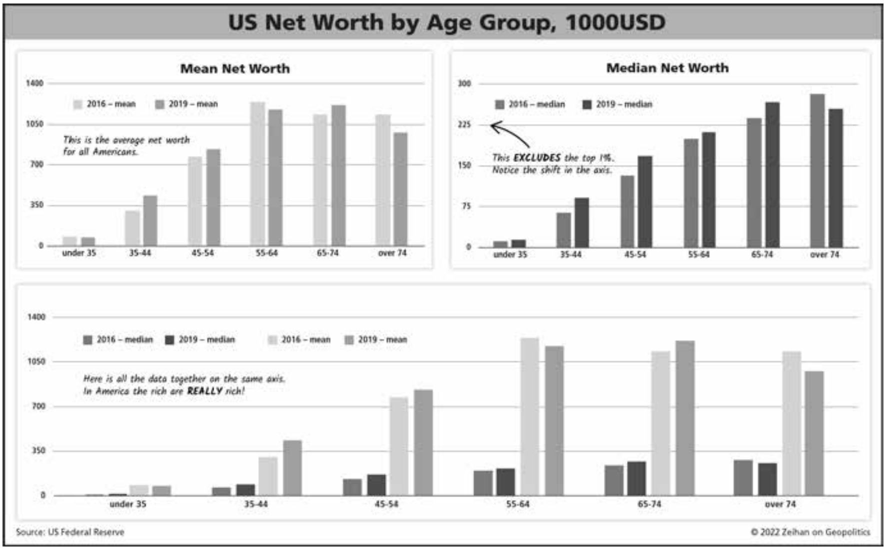
DISASTER IS RELATIVE



A CREDIT COMPENDIUM

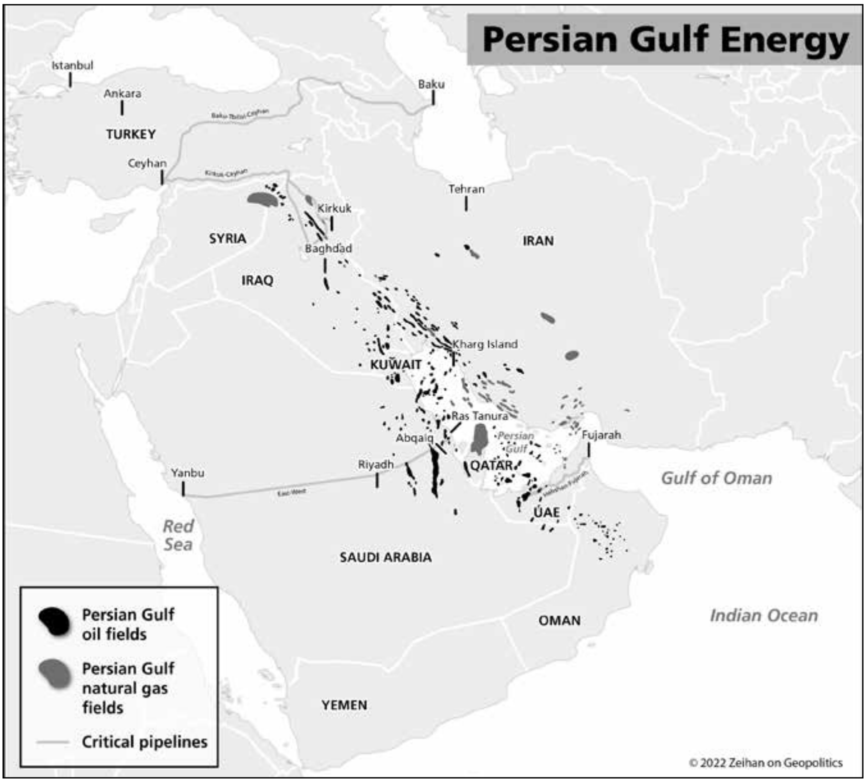


FINAGLING FUTURE FINANCING FAILURES



THE MAP OF OIL

CONTEMPORARY EDITION




Russian Energy
Yamal Peninsula
Varandey
Timano-Pechora basin
RUSSIA
Gulf of Bothnia
SWEDEN
North Sea
Primorsk
Nord Stream
Ventspils
Greifswald
Baltic Sea
Gdansk
Prague
POLAND
Volga-Urals basin
Samara
KAZAKHSTAN
Omisalj
Adriatic Sea
Odessa
Atyrau
Tengiz
Novorossiysk
Tuapse
Black Sea
Caspian Sea
Istanbul
Samsun
Supsa
Baku
TURKEY
Ceyhan
Mediterranean Sea
Gas pipeline
Oil pipeline
Tanker Terminal
Production Field
Only currently completed and operational FSU export pipelines are shown.
State of Texas shown for scale distance comparison.
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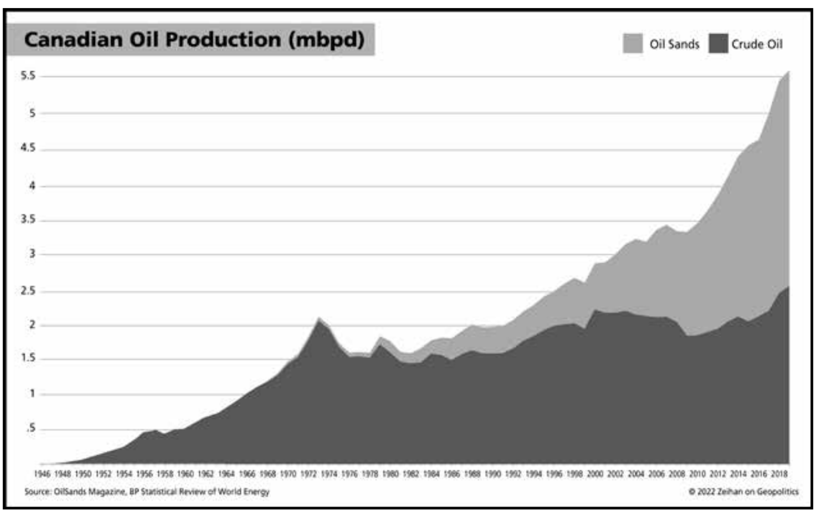
Canadian Oil Production (mbpd)
Oil Sands
Crude Oil
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
.5
1946 1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Source: OilSands Magazine, BP Statistical Review of World Energy
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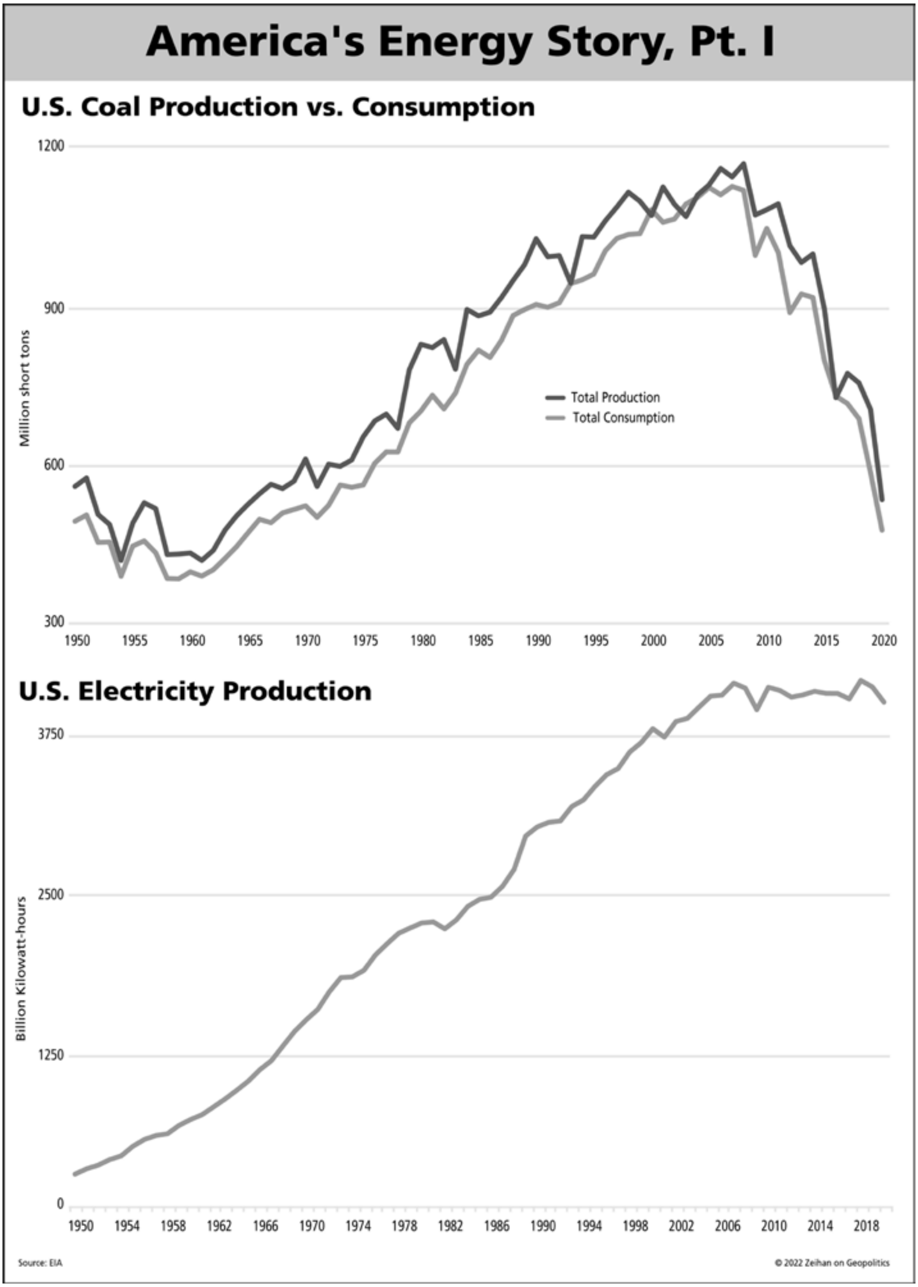
America's Energy Story, Pt. I
U.S. Coal Production vs. Consumption
1200
900
600
300
Million short tons
Total Production
Total Consumption
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
U.S. Electricity Production
3750
2500
1250
0
Billion Kilowatt-hours
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
2018
Source: EIA
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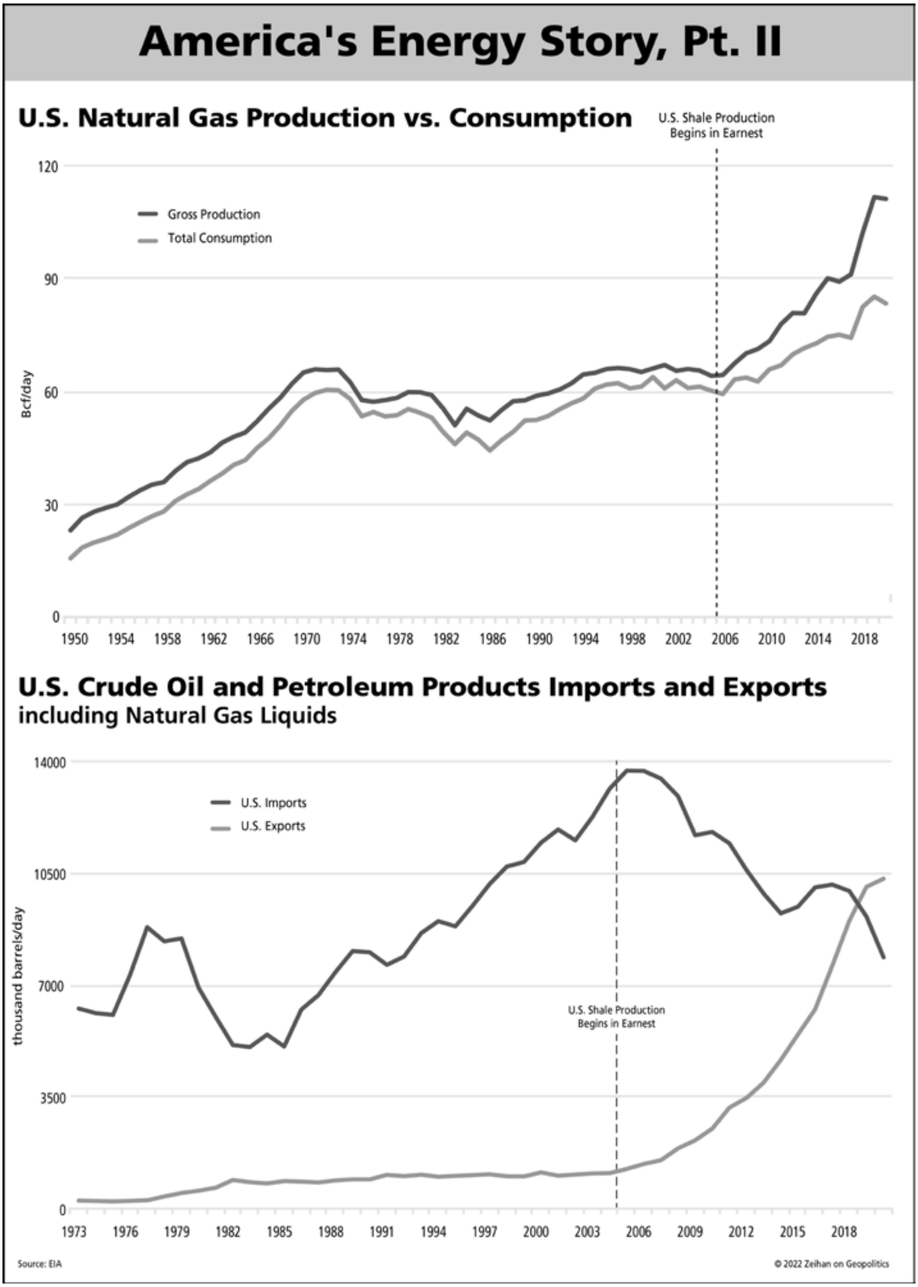
America's Energy Story, Pt. II
U.S. Natural Gas Production vs. Consumption
U.S. Shale Production Begins in Earnest
Gross Production
Total Consumption
Bcf/day
120
90
60
30
0
1950 1954 1958 1962 1966 1970 1974 1978 1982 1986 1990 1994 1998 2002 2006 2010 2014 2018
U.S. Crude Oil and Petroleum Products Imports and Exports
including Natural Gas Liquids
U.S. Imports
U.S. Exports
thousand barrels/day
14000
10500
7000
3500
0
U.S. Shale Production Begins in Earnest
1973 1976 1979 1982 1985 1988 1991 1994 1997 2000 2003 2006 2009 2012 2015 2018
Source: EIA
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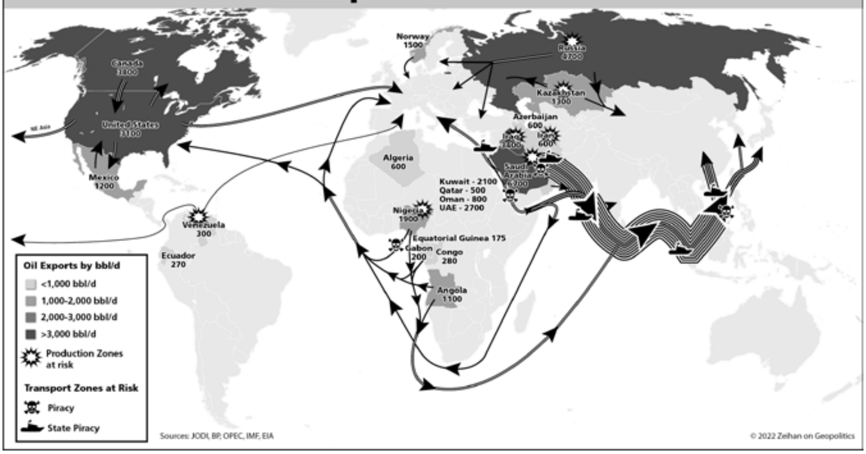
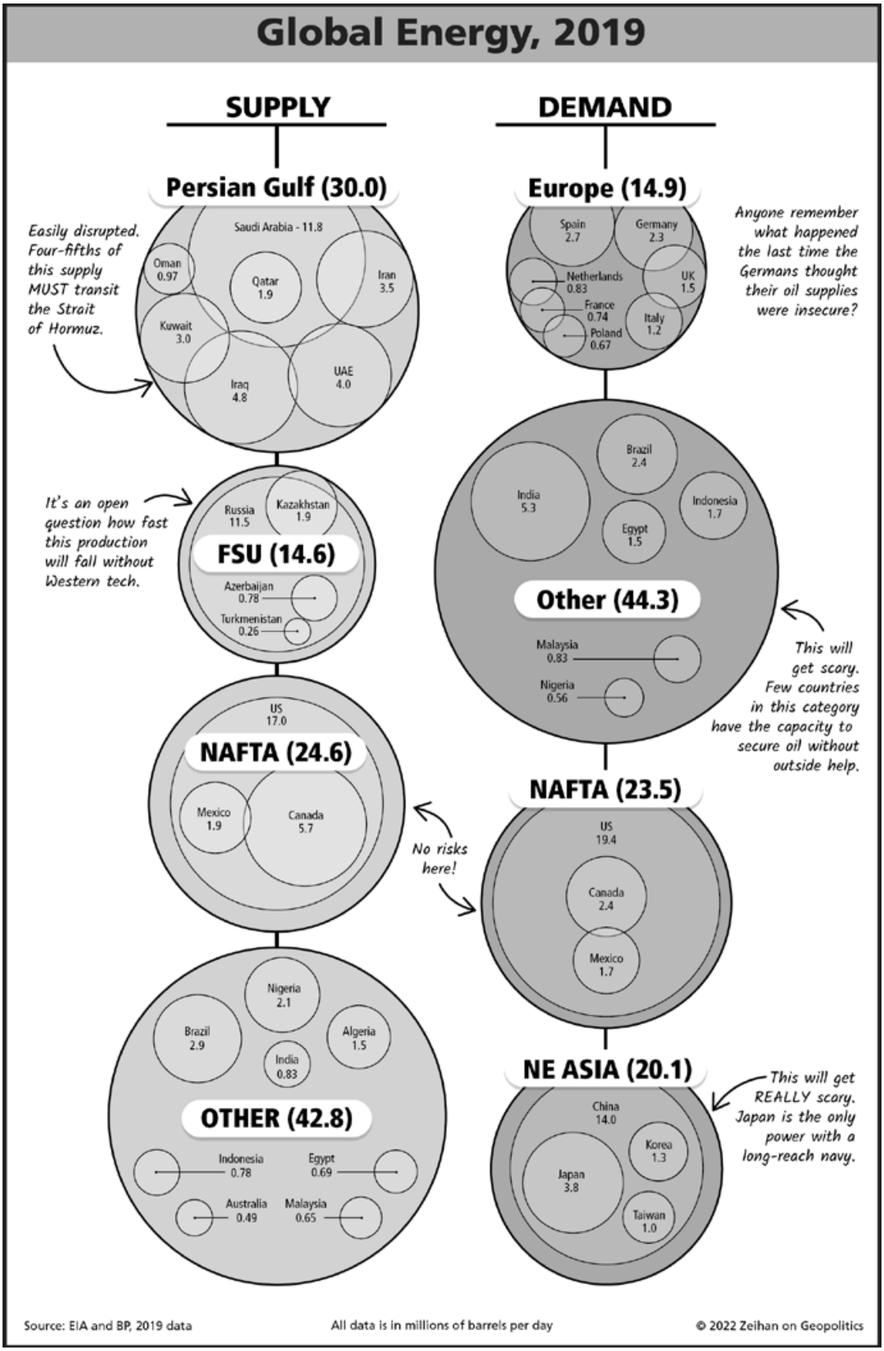
Global Oil Exports and Future Risks




Global Energy, 2019
SUPPLY
DEMAND
Persian Gulf (30.0)
Saudi Arabia - 11.8
Oman 0.97
Qatar 1.9
Iran 3.5
Kuwait 3.0
Iraq 4.8
UAE 4.0
Easily disrupted. Four-fifths of this supply MUST transit the Strait of Hormuz.
FSU (14.6)
Russia 11.5
Kazakhstan 1.9
Azerbaijan 0.78
Turkmenistan 0.26
It's an open question how fast this production will fall without Western tech.
NAFTA (24.6)
US 17.0
Mexico 1.9
Canada 5.7
No risks here!
OTHER (42.8)
Nigeria 2.1
Brazil 2.9
Algeria 1.5
India 0.83
Indonesia 0.78
Egypt 0.69
Australia 0.49
Malaysia 0.65
Europe (14.9)
Spain 2.7
Germany 2.3
Netherlands 0.83
UK 1.5
France 0.74
Italy 1.2
Poland 0.67
Anyone remember what happened the last time the Germans thought their oil supplies were insecure?
Other (44.3)
Brazil 2.4
India 5.3
Indonesia 1.7
Egypt 1.5
Malaysia 0.83
Nigeria 0.56
This will get scary. Few countries in this category have the capacity to secure oil without outside help.
NAFTA (23.5)
US 19.4
Canada 2.4
Mexico 1.7
NE ASIA (20.1)
China 14.0
Korea 1.3
Japan 3.8
Taiwan 1.0
This will get REALLY scary. Japan is the only power with a long-reach navy.
Source: EIA and BP, 2019 data
All data is in millions of barrels per day
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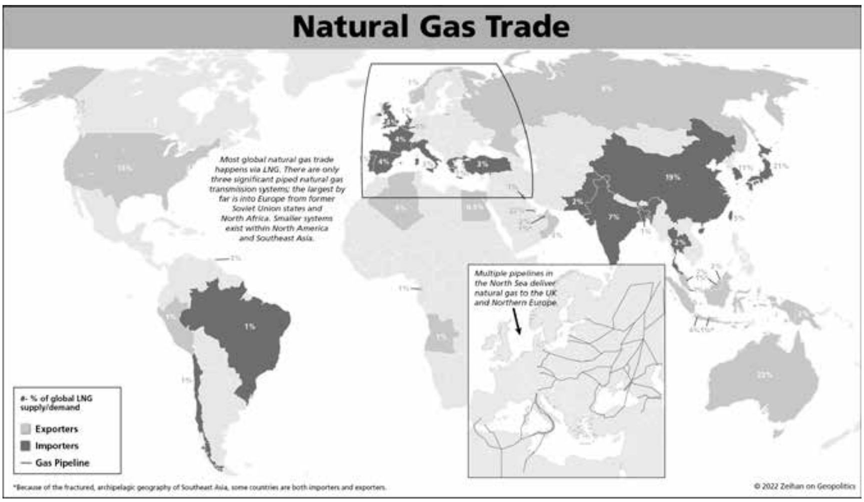
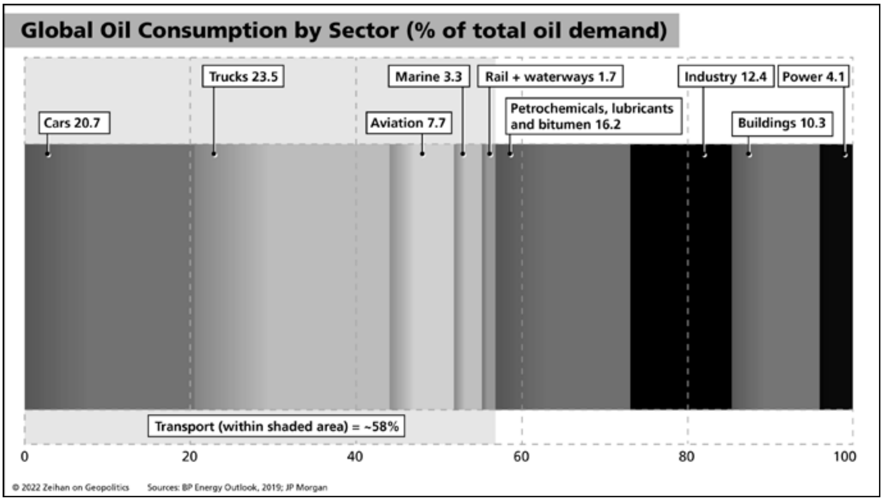
THERE'S MORE TO OIL THAN OIL




Global Oil Consumption by Sector (% of total oil demand)
Cars 20.7
Trucks 23.5
Aviation 7.7
Marine 3.3
Rail + waterways 1.7
Petrochemicals, lubricants and bitumen 16.2
Industry 12.4
Buildings 10.3
Power 4.1
Transport (within shaded area) = ~58%
0
20
40
60
80
100
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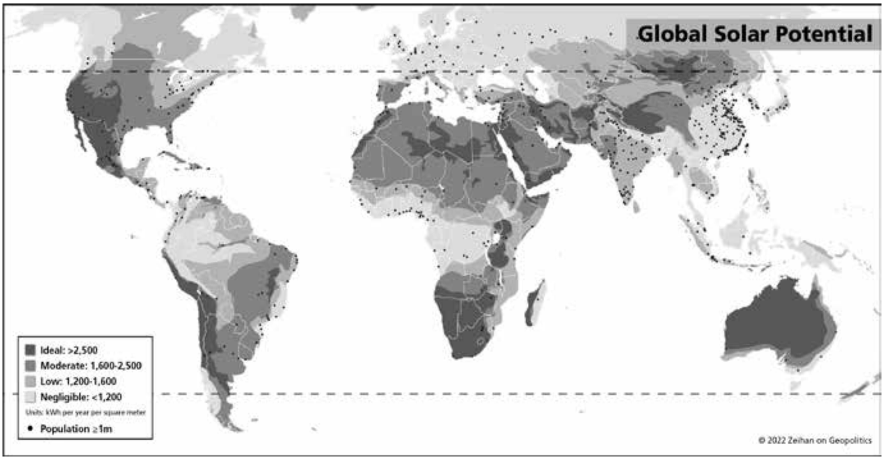
Sources: BP Energy Outlook, 2019; JP Morgan


Global Solar Potential
Ideal: >2,500
Moderate: 1,600-2,500
Low: 1,200-1,600
Negligible: <1,200
Units: kWh per year per square meter
Population ≥1m
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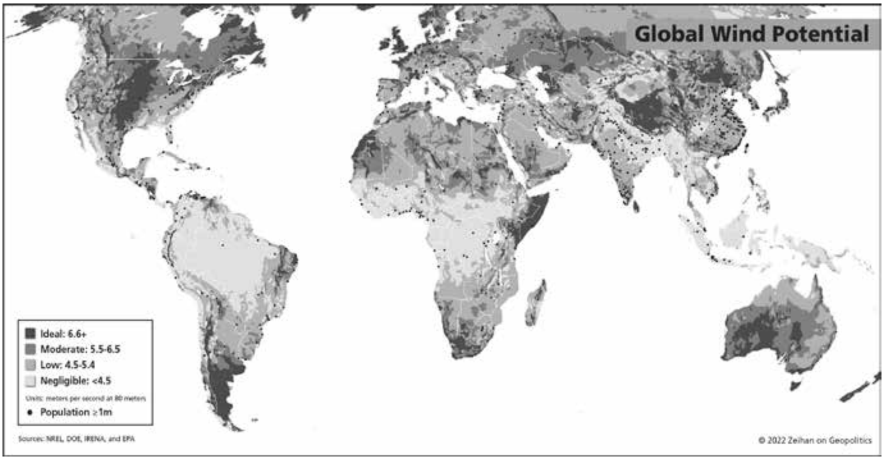
Global Wind Potential
Ideal: 6.6+
Moderate: 5.5-6.5
Low: 4.5-5.4
Negligible: <4.5
Units: meters per second at 80 meters
Population ≥1m
Sources: NREL, DOE, IRENA, and EPA
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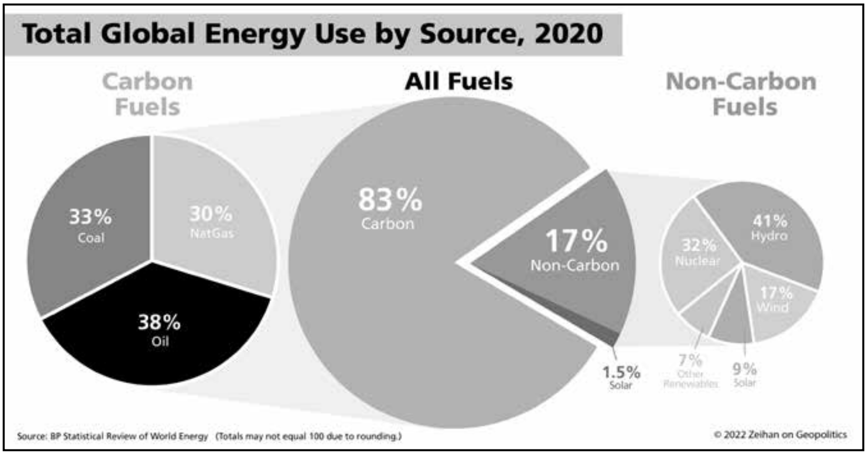
Total Global Energy Use by Source, 2020
Carbon Fuels
All Fuels
Non-Carbon Fuels
33%
Coal
30%
NatGas
38%
Oil
83%
Carbon
17%
Non-Carbon
1.5%
Solar
41%
Hydro
32%
Nuclear
17%
Wind
7%
Other Renewables
9%
Solar
Source: BP Statistical Review of World Energy (Totals may not equal 100 due to rounding.)
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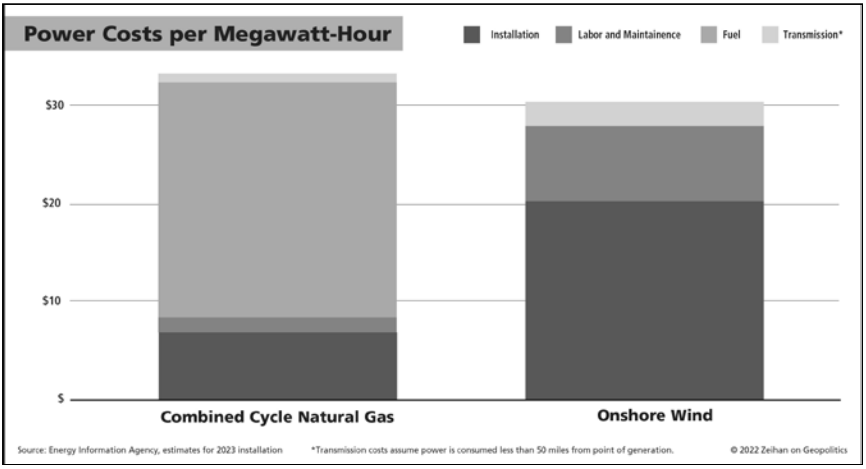
Power Costs per Megawatt-Hour
Installation
Labor and Maintainence
Fuel
Transmission*
$30
$20
$10
$
Combined Cycle Natural Gas
Onshore Wind
Source: Energy Information Agency, estimates for 2023 installation
*Transmission costs assume power is consumed less than 50 miles from point of generation.
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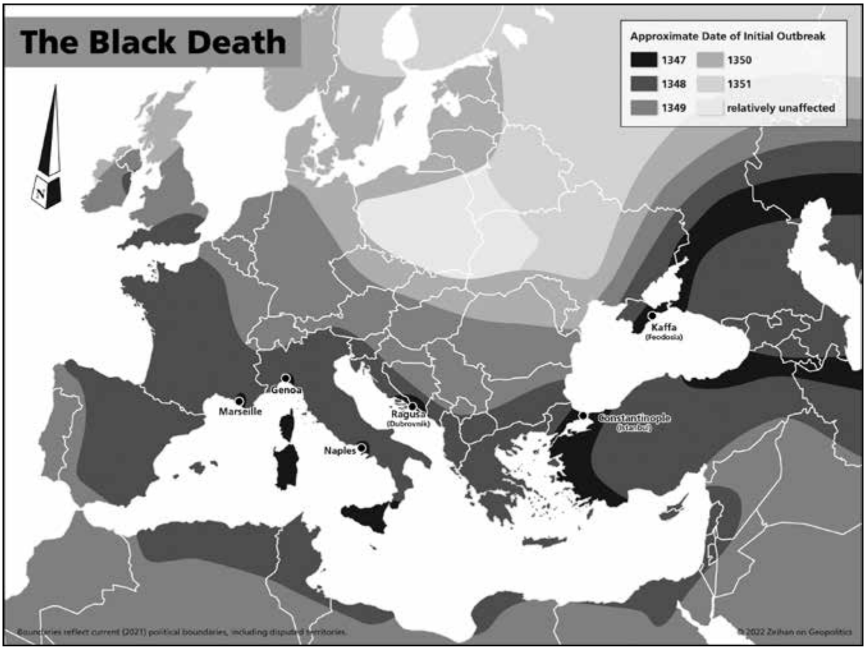
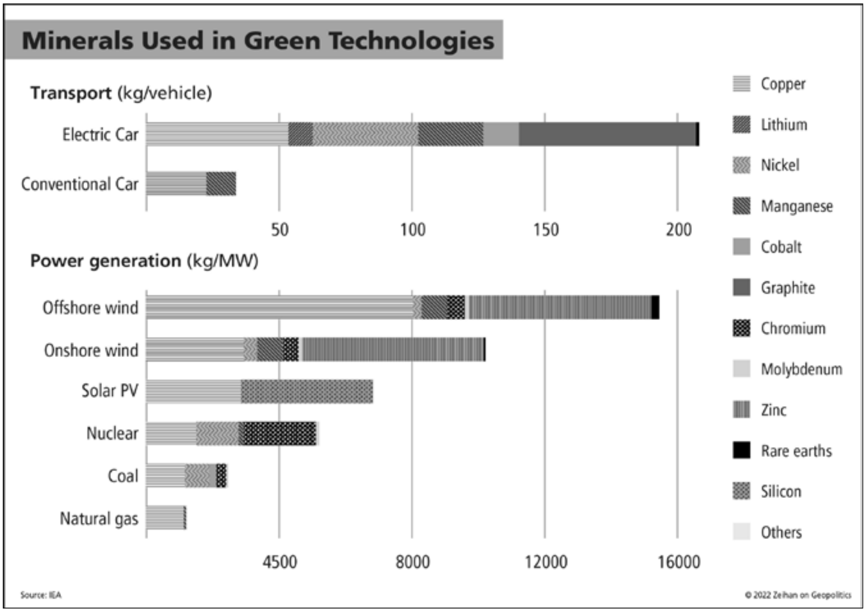
DISASSEMBLING HISTORY




Minerals Used in Green Technologies
Transport (kg/vehicle)
Electric Car
Conventional Car
50
100
150
200
Power generation (kg/MW)
Offshore wind
Onshore wind
Solar PV
Nuclear
Coal
Natural gas
4500
8000
12000
16000
Copper
Lithium
Nickel
Manganese
Cobalt
Graphite
Chromium
Molybdenum
Zinc
Rare earths
Silicon
Others
Source: IEA
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THE RELIABLE MATERIALS

Industrial Materials

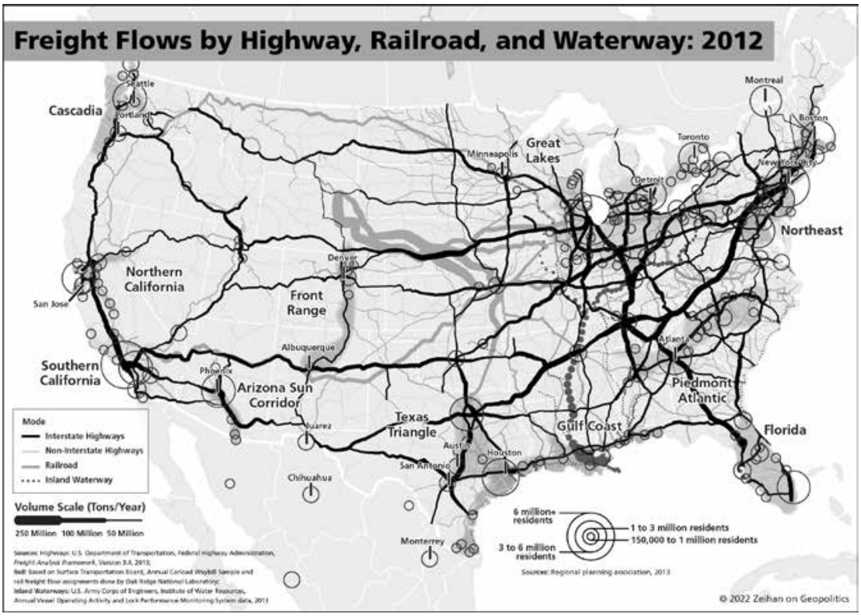
Material	Value of Production (Million USD)	Primary Uses	Primary Sources	Primary Consumers*
Iron Ore	$280,375	Steel	Australia (38%), Brazil (17%)	China (73%), Japan (6%), Korea (5%)
Bauxite	$4,160	Aluminum	Australia (30%), Guinea (22%), China (16%), Brazil (9%)	China (74%), Ireland (3%), Ukraine (3%), Spain (3%)
Copper	$120,000	Wiring, electronics, plumbing	Chile (29%), Peru (11%), China (9%), DR Congo (7%), United States (6%)	China (56%), Japan (15%), Korea (7%)
Cobalt	$4,200	Batteries, alloys, industrial uses	DR Congo (68%), Russia (5%), Australia (4%)	China (56%), United States (8%), Japan (7%), United Kingdom (4%), Germany (3%)
Lithium	$5,390	Batteries	Australia (49%), Chile (22%), China (17%)	Korea (46%), Japan (41%)
Silver	$14,985	Jewelry, alloys, electronics, industrial uses	Mexico (22%), Peru (14%), China (13%), Russia (7%), Chile (5%)	China (62%), Korea (11.2%)
Gold	$148,500	Jewelry, alloys, non-corrosive and highly-conductive coatings	China (12%), Australia (10%), Russia (9%), United States (6%), Canada (5%), Chile (4%)	Switzerland (34%), United States (12%), China (12%) Turkey (10%), India (9%),
Lead	$10,440	Batteries, alloys, industrial uses	China (43%), Australia (11%), United States (7%), Mexico (5%), Peru (5%)	Korea (36%), China (30%), Netherlands (6%), Germany (6%)
Molybdenum	$7,540	Hardened steel alloys, industrial lubricants	China (40%), Chile (19%), United States (16%)	China (22%), Korea (11%), Japan (10%)
Platinum-group Metals	$20,718	Electronics, metal plating, catalysts	South Africa (50%), Russia (30%)	United States (18%), United Kingdom (15%), China (13%), Japan (11%), Germany (11%)
Rare Earths	$210	Consumer goods and electronics incl. flat panels, smart phones, rechargeable batteries	China (58%), United States (16%), Myanmar (13%)	Japan (49%), Malaysia (17%), Thailand (5%)
Nickel	$29,700	Alloys (stainless steel), metal plating	Indonesia (30%), Philippines (13%), Russia (11%)	China (74%), Canada (6%), Finland (6%)
Silicon	$18,502	Glass, silicone materials, ceramics, coatings, semiconductors, photovoltaic cells	China (68%), Russia (7%), Brazil (4%)	China (34%), Japan (21%), Taiwan (10%), Korea (8%)
Uranium	$2,565	Fuel, weapons, research	Kazakhstan (41%), Australia (31%), Namibia (11%), Canada (8%)	**
Zinc	$35,100	Non-corrosive alloys, pigments, sun screen	China (35%), Peru (11%), Australia (10%)	China (27%), Korea (15%), Belgium (10%), Canada (7%)

* Figures represent end users of refined product. In the case of lithium and rare earths, for example, China is a primary consumer of ores but exports processed and refined materials to other countries that manufacture finished goods.

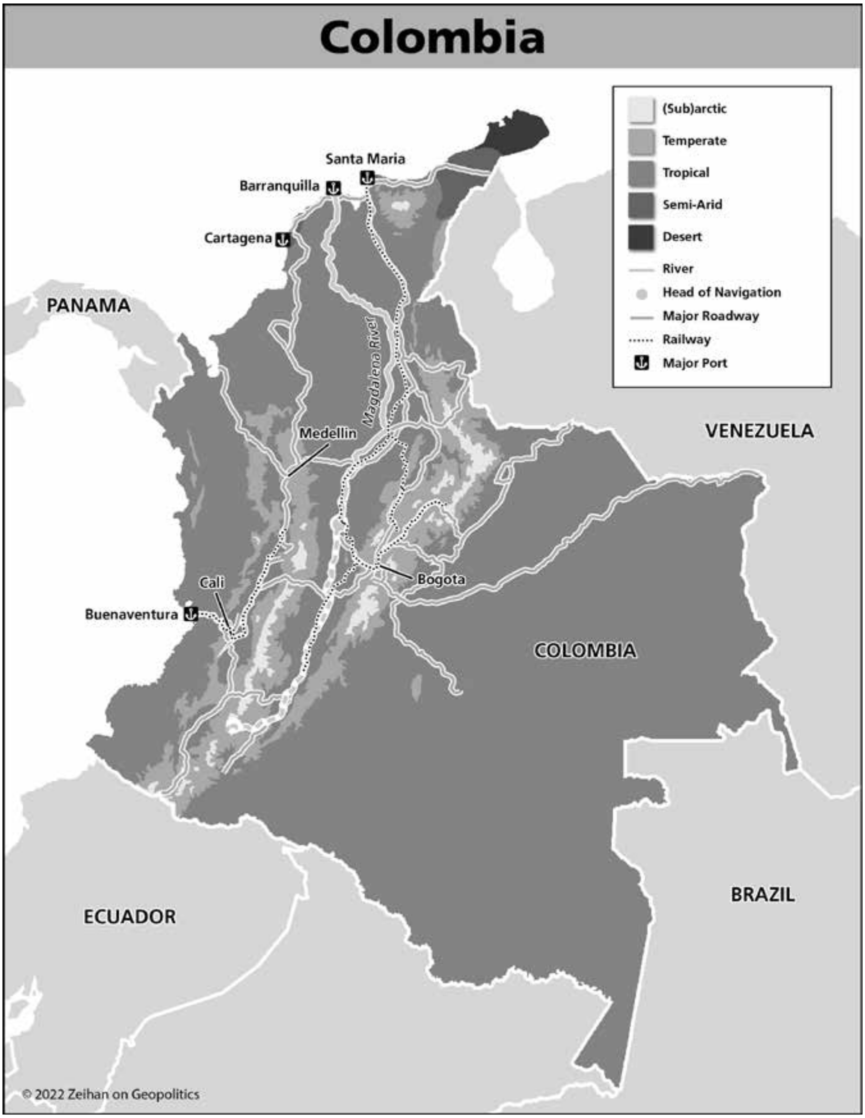
** Due to the sensitive and strategic nature of uranium usage, publicly reported data does not accurately reflect global consumption

Sources: USGS, OEC, UNCTAD, World Nuclear Association

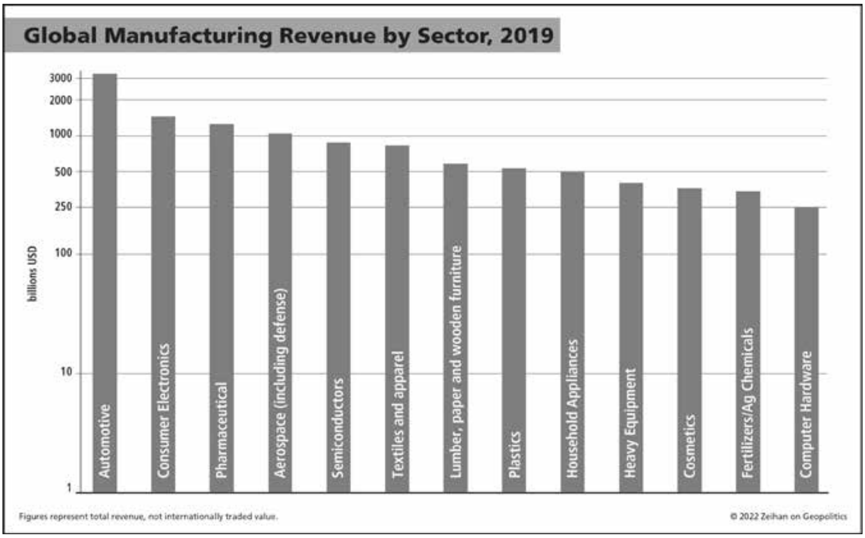
THE MAP OF THE PRESENT



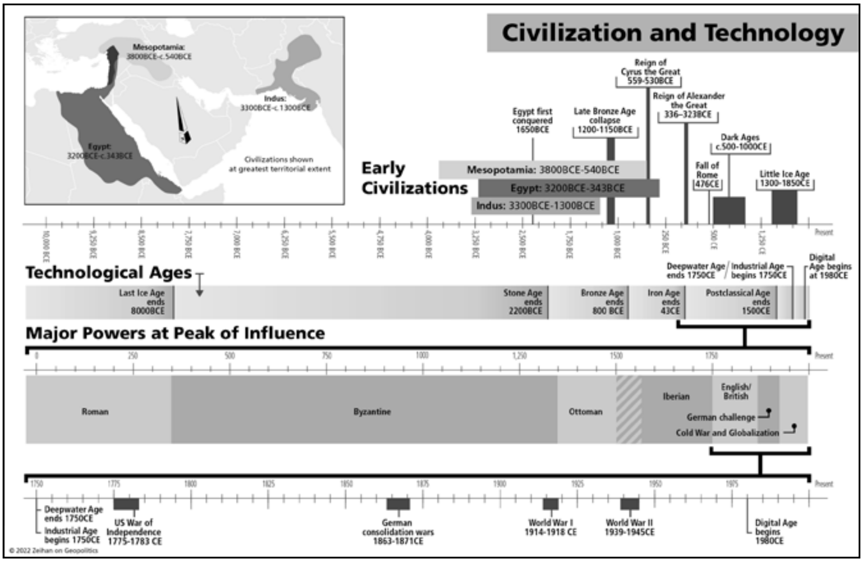
THE MAP OF THE FUTURE

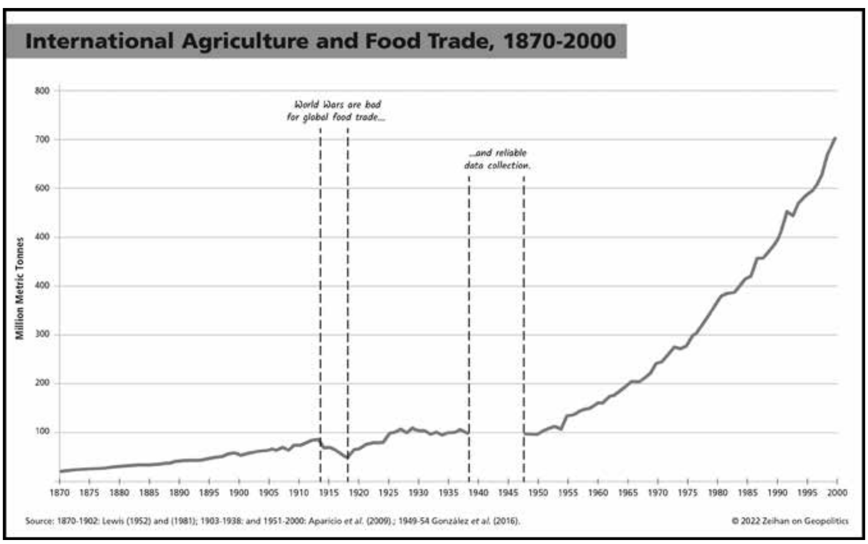


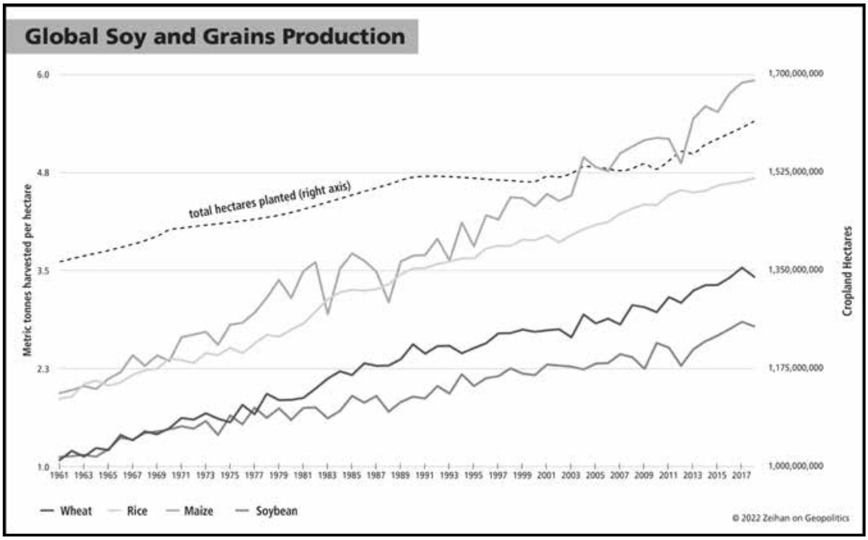
MANUFACTURING A NEW WORLD



WHAT'S AT STAKE






Global Soy and Grains Production
total hectares planted (right axis)
Metric tonnes harvested per hectare
Cropland Hectares
6.0
4.8
3.5
2.3
1.0
1,700,000,000
1,525,000,000
1,350,000,000
1,175,000,000
1,000,000,000
1961 1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Wheat
Rice
Maize
Soybean
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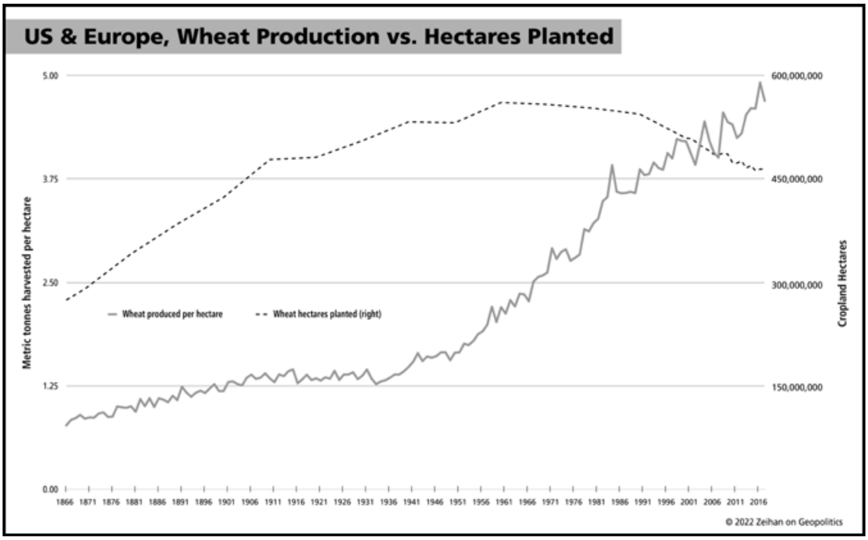
US & Europe, Wheat Production vs. Hectares Planted
Metric tonnes harvested per hectare
Cropland Hectares
5.00
3.75
2.50
1.25
0.00
600,000,000
450,000,000
300,000,000
150,000,000
Wheat produced per hectare
Wheat hectares planted (right)
1866 1871 1876 1881 1886 1891 1896 1901 1906 1911 1916 1921 1926 1931 1936 1941 1946 1951 1956 1961 1966 1971 1976 1981 1986 1991 1996 2001 2006 2011 2016
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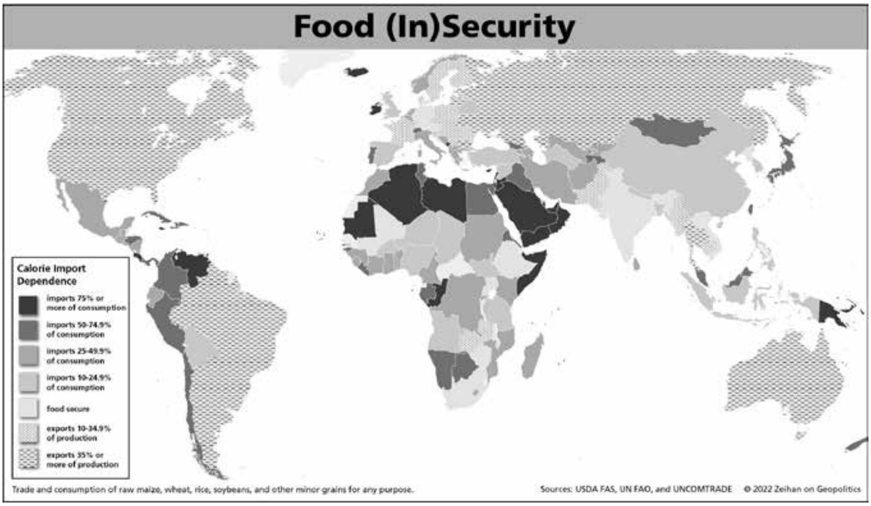
THE GEOPOLITICS OF VULNERABILITY

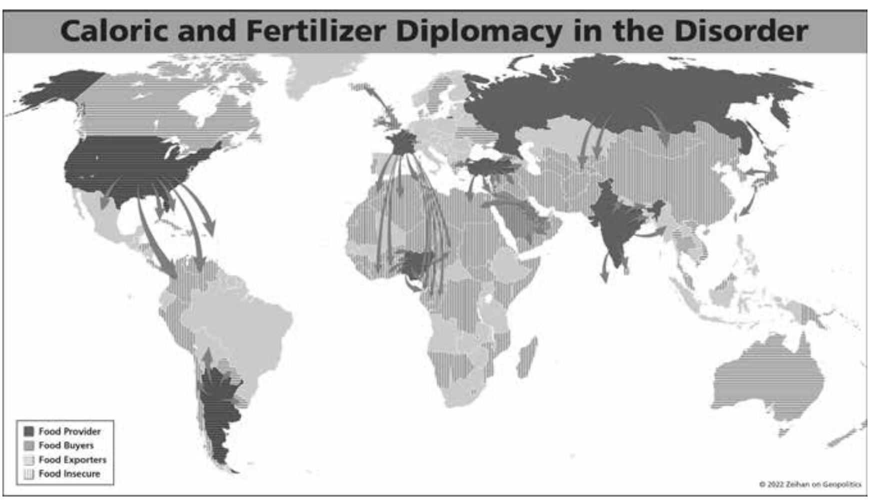
Average Productivity and Cost of Inputs by Crop

	Continuous Corn	Rotation Corn	Rotation Soybeans	Wheat	Double-Crop Soybeans
Average yield per acre (bushels)	169	180	55	77	38
Harvest Price	$3.80	$3.80	$10.10	$5.70	$10.10
Annual Revenue	$642	$684	$556	$439	$394
Less Variable Costs					
Fertilizer	120	111	47	71	35
Seed	111	111	67	44	78
Pesticides	58	58	50	30	45
Dryer Fuel	33	27	0	0	5
Machinery Fuel	12	12	8	8	5
Machinery Repairs	22	22	18	18	15
Hauling	17	18	6	8	4
Interest	12	11	7	6	6
Insurance and Miscellaneous	38	38	34	9	9
Total Variable costs	**$423**	**$408**	**$237**	**$194**	**$202**
Net profit per acre	**$219**	**$276**	**$319**	**$245**	**$192**

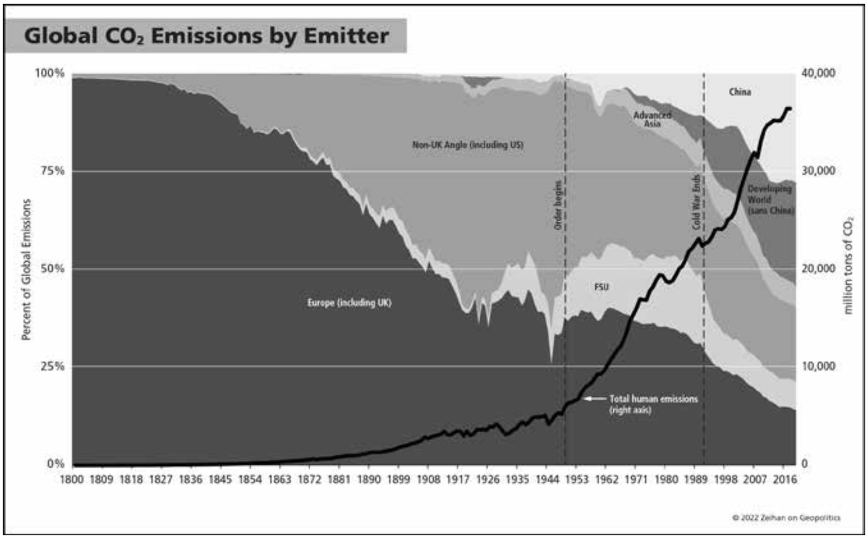
Source: Purdue Crop Cost and Return Guide, 2020 All prices in USD

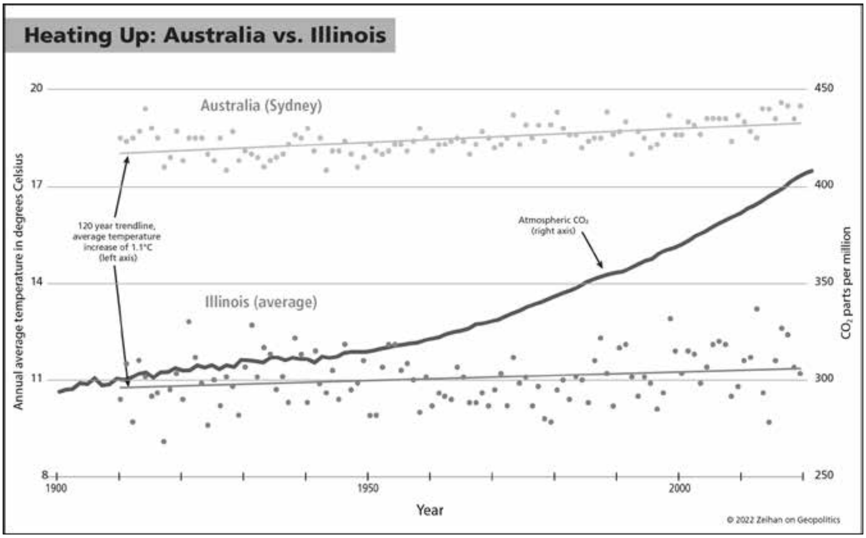
AVOIDING—OR ACCEPTING—THE WORST

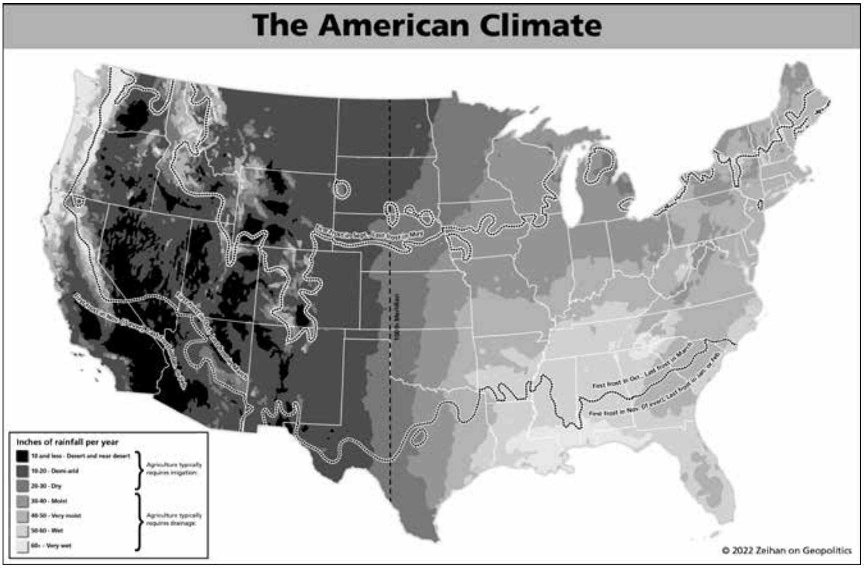




AGRICULTURE AND CLIMATE CHANGE






The American Climate
Inches of rainfall per year
10 and less - Desert and near desert
10-20 - Demi-arid
20-30 - Dry
30-40 - Moist
40-50 - Very moist
50-60 - Wet
60+ - Very wet
Agriculture typically requires irrigation.
Agriculture typically requires drainage.
100th Meridian
First frost in Oct., Last frost in March
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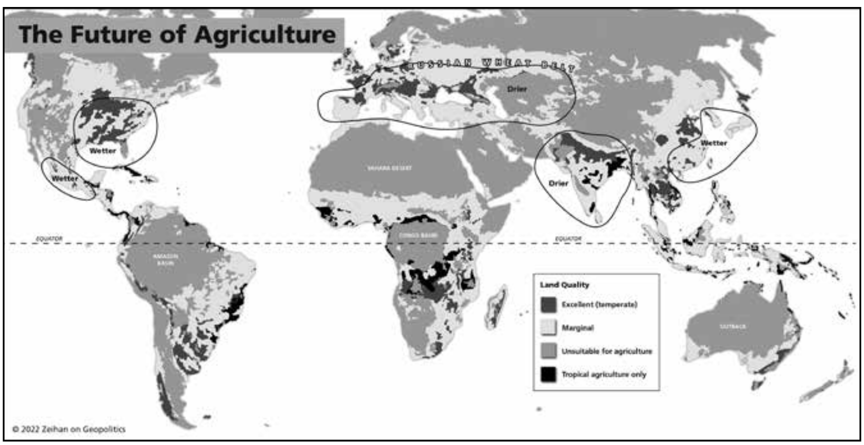
The Future of Agriculture
RUSSIAN WHEAT BELT
Drier
Wetter
Wetter
Wetter
Drier
SAHARA DESERT
EQUATOR
EQUATOR
Land Quality
Excellent (temperate)
Marginal
Unsuitable for agriculture
Tropical agriculture only
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FEEDING A NEW WORLD

Value of Primary Global Agricultural Trade, 2020

Product	Value (in billions USD)
Soybeans	64.3
Wheat	44.8
Pork	37.0
Maize (corn)	36.6
Cheese	32.8
Palm Oil	32.5
Coffee	30.4
Dairy Milk	28.9
Rice	25.5
Poultry	24.5
Beef	23.3
Sugar	23.1
Berries	19.5
Tobacco	19.2
Nuts	18.1
Citrus	16.0
Cotton	14.1
Bananas	13.7
Sunflower oil	13.4
Grapes	10.6
Apples & Pears	10.0
Cocoa beans	9.3
Canola oil	4.0

Source: UNCTAD