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INVESTMENTS, ARTIFICIAL INTELLIGENCE
AND SUSTAINABILITY
CONFERENCE 2024

Power grid supply chain challenges: US dependence on foreign manufacturers

Alberto R. Sigüenza
Erhardt Projects

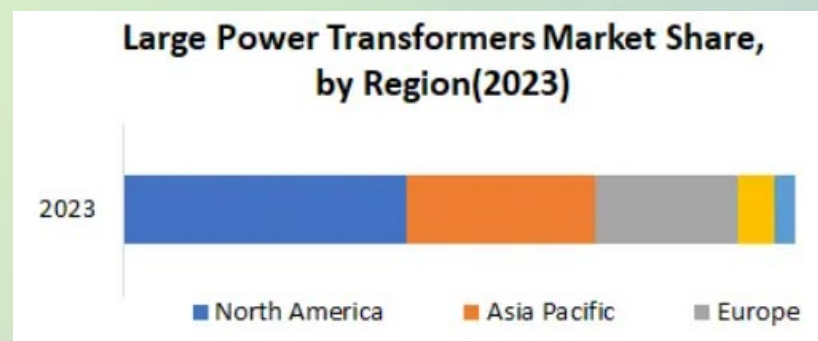




The US Market 2020-2027

The US is expected to represent 17% of the total global LPT market.

The estimated US market value for LPTs in 2027 is USD 4 billion, while the global market value is around 24 billion.



Major drivers for the transformer market growth include:

(1) Upgrading Power Grid due to Aging infrastructure:

The average age of installed LPTs in the United States is approximately 38 to 40 years, and the suggested lifespan of a transformer is 20-25 years. Currently, more than 70% of U.S. LPTs are aged more than 25 years.





The US Market 2020-2027

GRIP Program: ttl \$ 10.5 billion

- Grid Resilience Utility and Industry grants
- Smart Grid Grants
- Grid Innovation Program

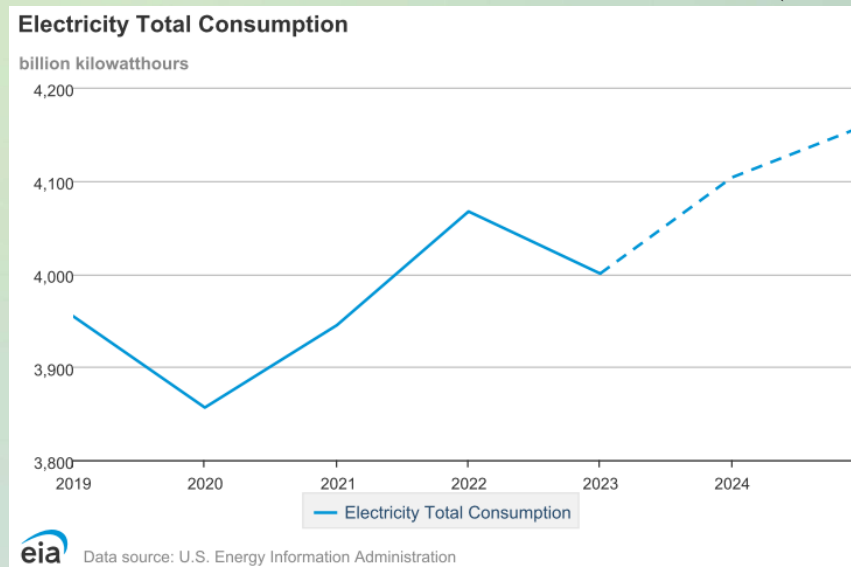


Transmission Facilitation Program: ttl 2.5 billion

- Tax credits for ramp up LPTs domestic manufacturing
- Nearshoring program

(2) Increasing demand in energy consumption – (EV – Growing economy)

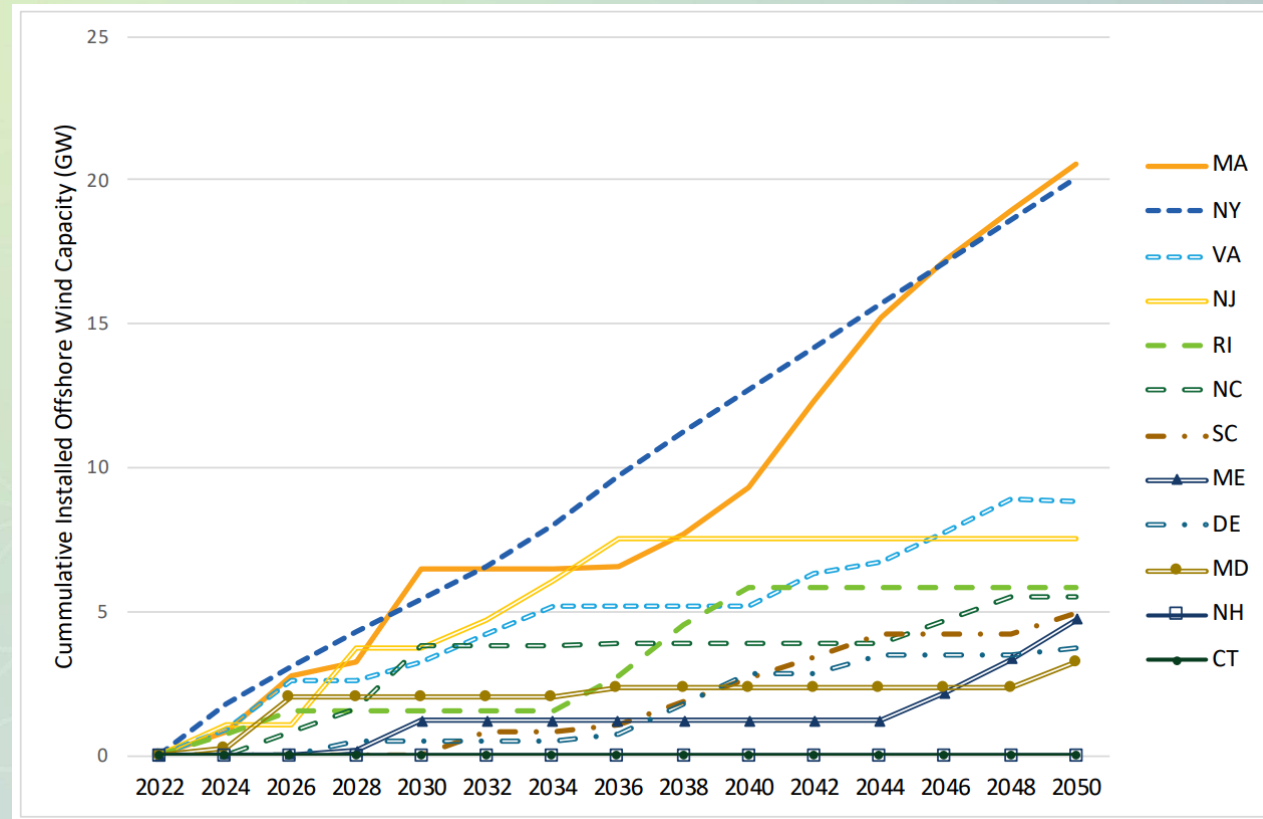
EIA projected power demand will rise to 4,112 billion kilowatt-hours (kWh) in 2024 and 4,123 billion kWh in 2025.



The US Market 2020-2027

(3) Increased penetration of renewable energy (HVDC)

New large offshore wind projects in the East Coast





The US Market 2020-2027

As a result, forecast for U.S. demand for LPT based on this power rating will reach **~900 units** in 2027.

But can the US meet the growing demand for new LPTs??

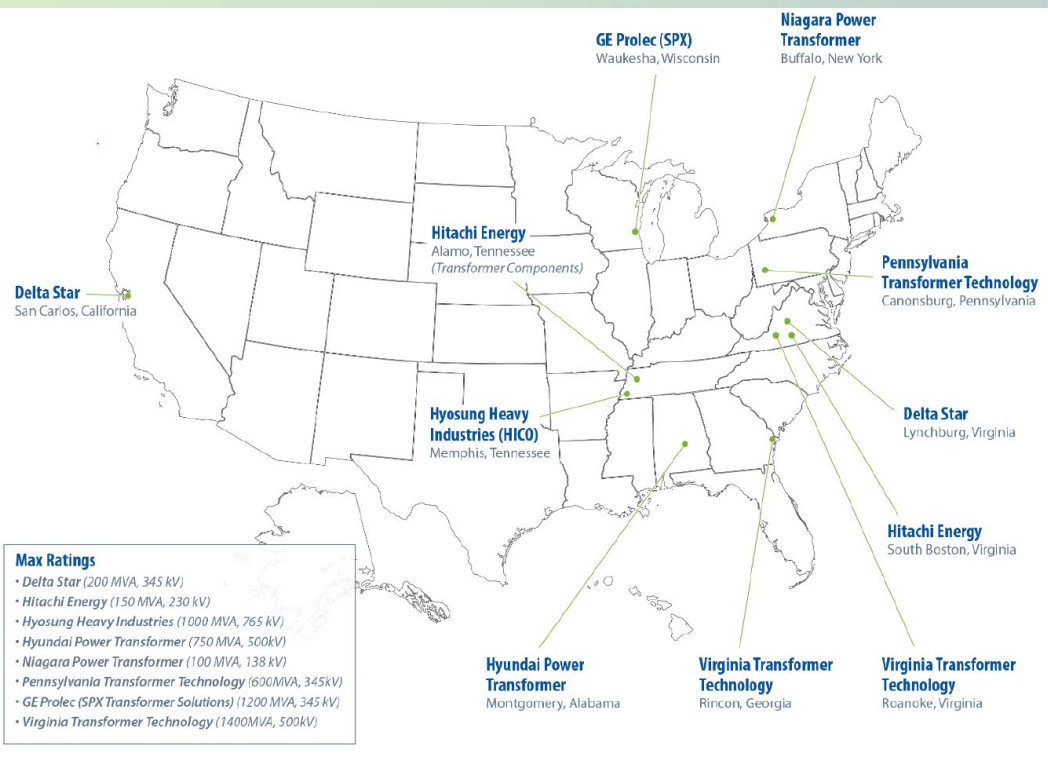




DOE 2022 REPORT – LPT Supply chain challenges

On Feb 2022, DOE Issued the Electric Grid Supply Chain Review: Large Power Transformers and High Voltage Direct Current Systems with the Analysis on the current US Power Grid and LPT market:

Lack of domestic LPT production capabilities: 80% of LPTs used in the US were imported

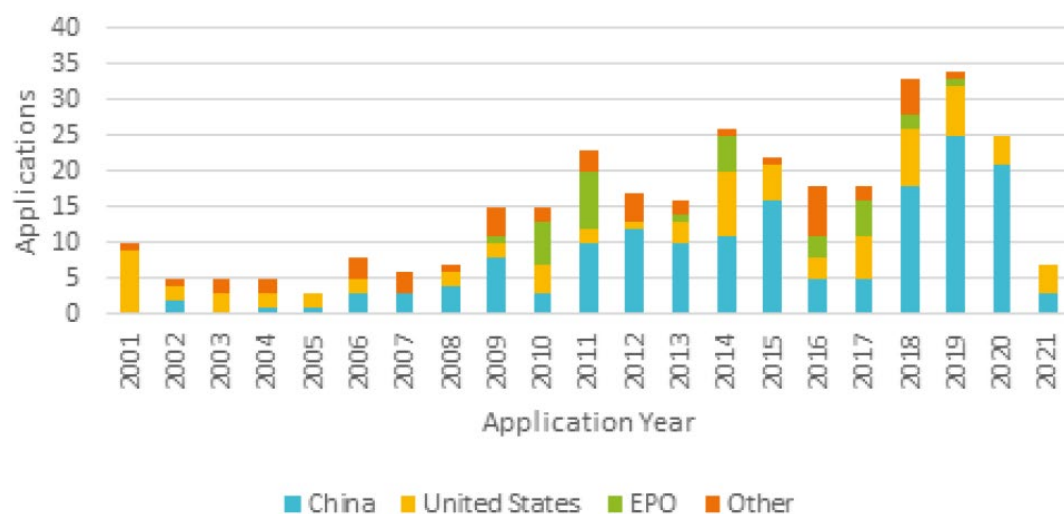




DOE 2022 REPORT – LPT Supply chain challenges

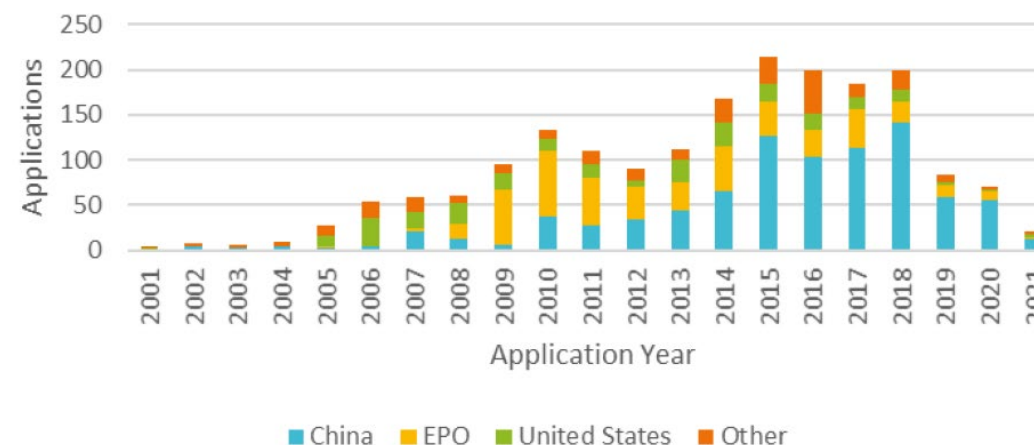
LPT Patent Application Trend by Origin

Total Publications: 318



HVDC Converter Patent Application Trend by Origin

Total Publications: 1,909



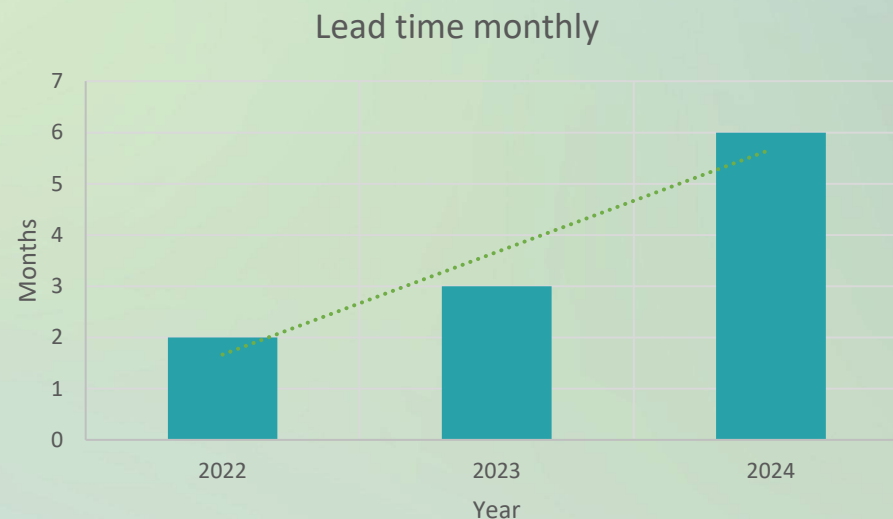


DOE 2022 REPORT – LPT Supply chain challenges



Over the past 3 years, the time between ordering a transformer and receiving it (lead time) has lengthened significantly, in some cases doubling or more.

Industry officials even reported that some manufacturers have stopped taking new orders entirely due to the existing backlog and corresponding delays.





DOE 2022 REPORT – LPT Supply chain challenges

DOE concludes that Distribution Transformers, LPTs and HVDC Require either further or Significant investment to meet the immediate US Power Grid demands for the period 2022-2027.

Therefore, DOE determines that in the short term, relying on foreign LPTs is unavoidable.

Therefore, **Logistic Challenges** will play a key factor for the coming years in the supply of LPTs.





LPT Supply chain challenges



LPTs main Export countries to the US



≈11% of LPTs



≈7% of LPTs



≈16% of LPTs

Shipping transit times

12-21 days

11-16 days

3-6 days





LPT Supply chain challenges



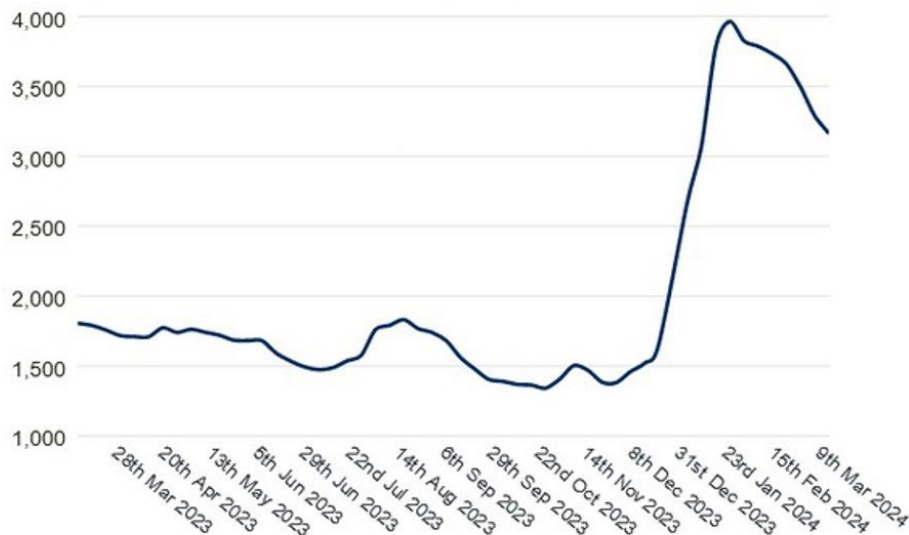
Logistical
challenges

Maritime transport of LPTs: vessels, routes and costs

An LPT's weight is a key factor for transport cost

RoRo Vessels / Container Vessels (LPTs weighing 40MT – 150MT)

Drewry World Container Index (WCI) - 14 Mar 24 (US\$/40ft)





LPT Supply chain challenges



Logistical
challenges

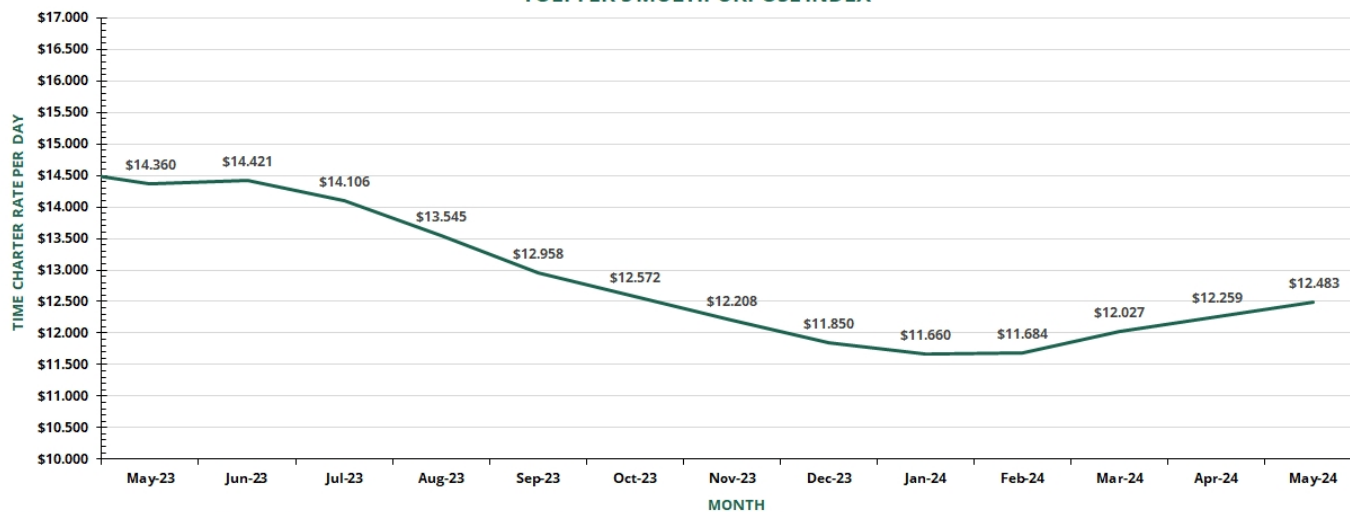
Maritime transport of LPTs: vessels, routes and costs.

Multi Purpose Vessels (Heavy Lift Vessels) – LPTs weighting from 150MT to >400MT

MPP Index has climbed for the fourth month in a row, landing at \$12,483 per day in May 2024.

This represents a rise of 1.83 per cent month-on-month. The May 2024 figure was 13 per cent below the Index figure in May 2023.

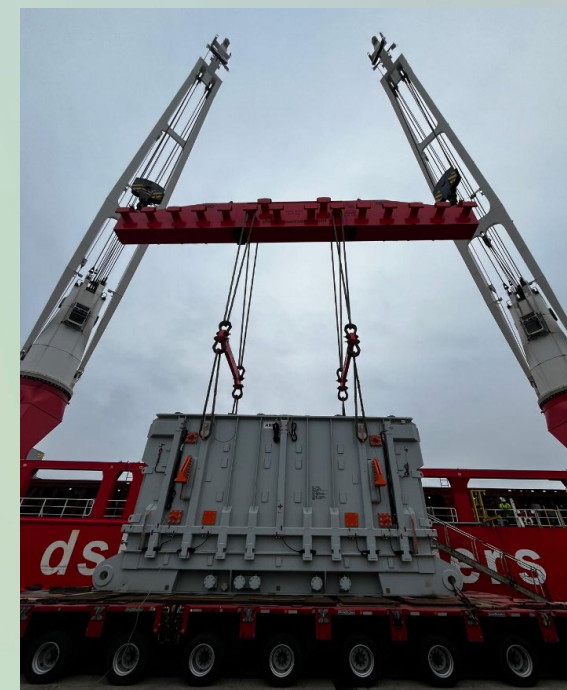
- TMI -
TOEPFER'S MULTIPURPOSE INDEX



This Index (TMI) represents the monthly average timecharter rate assessment established by a panel of Operators, Owners and Brokers for a 6 - 12 months timecharter for a 12,500 tons deadweight MPP / HL "F-Type" vessel.

Source: TOEPFER TRANSPORT GMBH
research@toepfer-transport.com

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LPT Supply chain challenges



MPP Vessels	RoRo Vessels	Container vessels
Worldwide service	Fixed routes and schedules	Fixed routes and schedules
No weight limit for LPTs	Weight limited to ramp	Weight subject to flat rack
Higher freight rates	Low freight rates	Low freight rates
Shipper to nominate POL/POD	Fixed POL/POD as per schedule	Fixed POL/POD as per schedule
2-3 months prenotice required	1 month pre-notice for liner	1-2 months pre-notice required



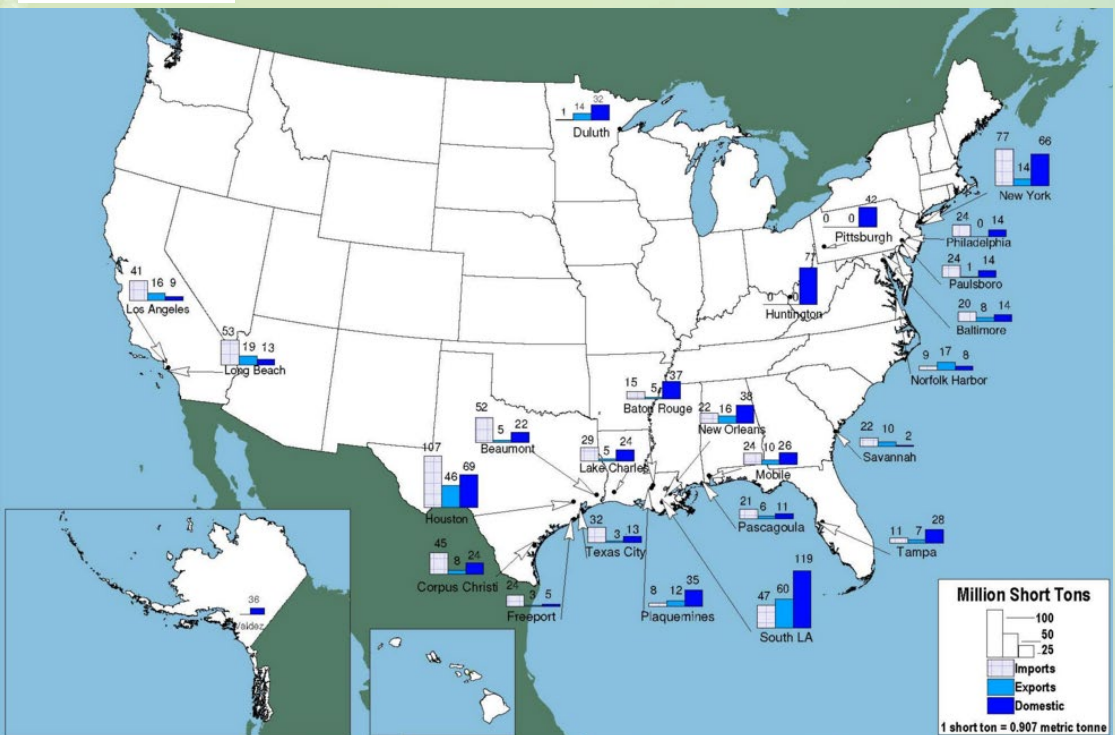


LPT Supply chain challenges



Logistical
challenges

Onshore transport in the US: Ports of Entrance



Main ports for LPTs	Rail	Ro-Ro	River barge	Limits
Newark, NJ	X	X		Width – Rail
Baltimore, MD	X	X		Weight - Road
Charleston, SC	X	X		Weight - Terminal
Brunswick, GA	X	X		Weight - Rail
New Orleans, LA	X		X	Height - Rail
Galveston, TX	X	X	X	Weight - Terminal
Houston, TX	X	X		Height – Rail West
Long Beach, CA	X			Weight - Rail
Port Hueneme, CA		X		Weight - Road



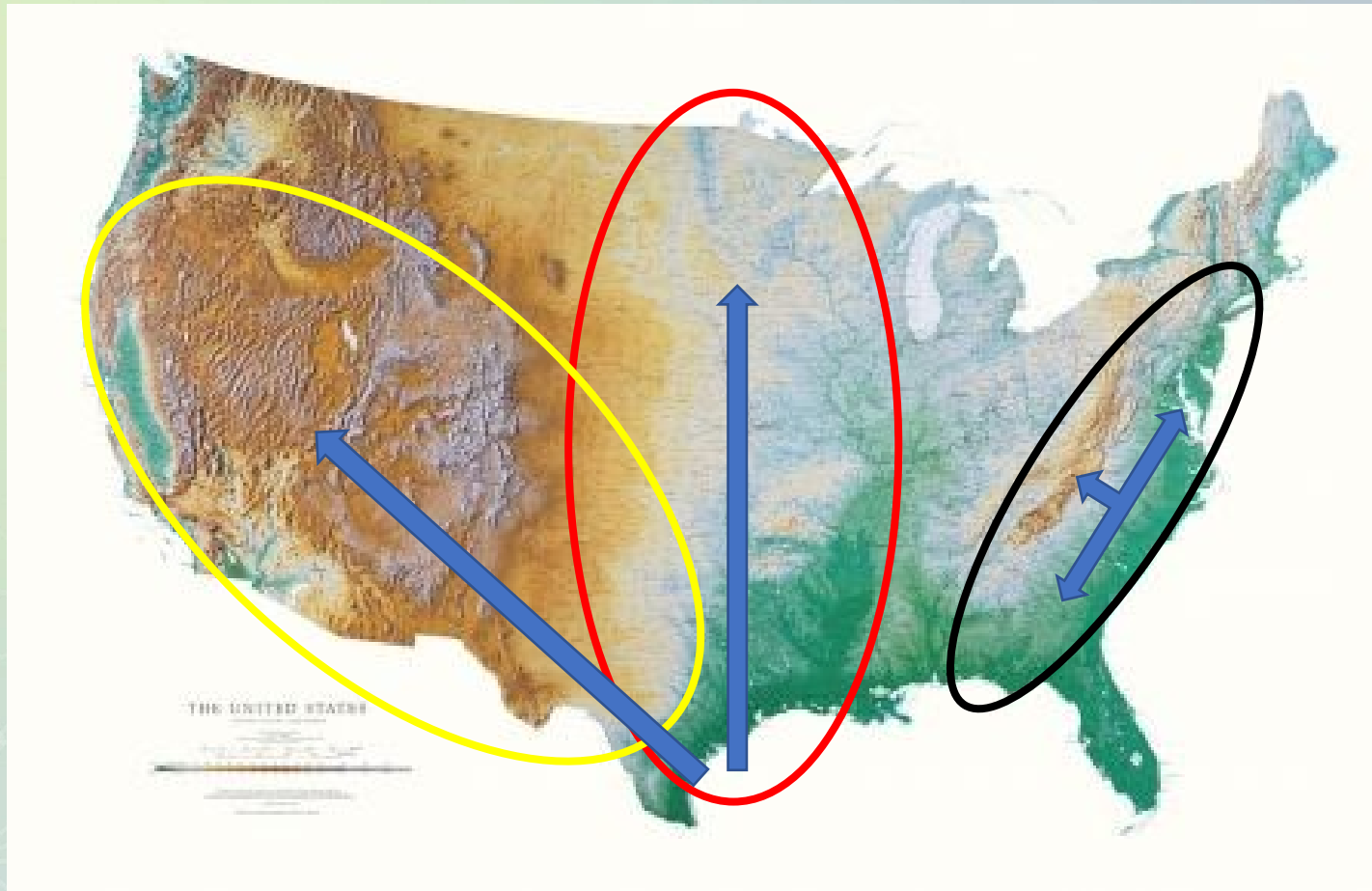


LPT Supply chain challenges



Logistical
challenges

Onshore transport in the US: Ports + Rail routes





LPT Supply chain challenges

Onshore transport in the US: Rail



Logistical
challenges

Rail transport constraints:



Less switching yards – longer trains = Longer transit times



Shortlines with limited weight capacity for heavy transformers



Shortage of heavy-duty railcars for transformers > 280MT



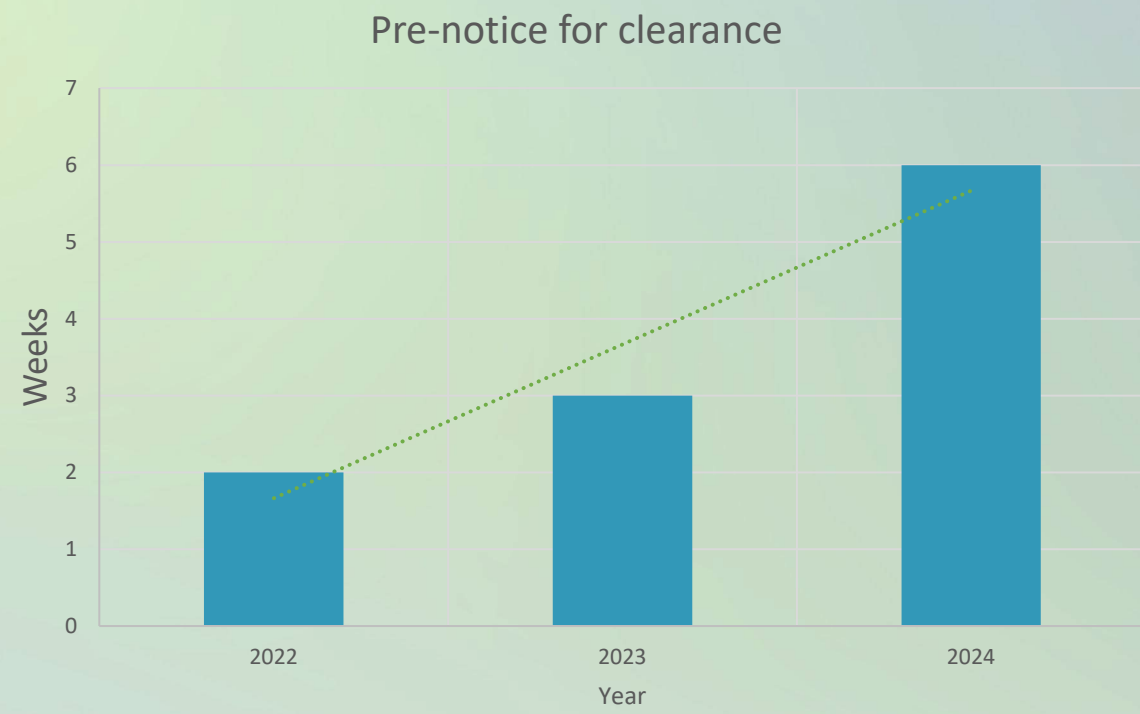


LPT Supply chain challenges



Onshore transport in the US: Rail

Rail clearance pre-notice required by major US railroads:





LPT Supply chain challenges



Logistical
challenges

MVA Rating	Weight and Dim	Vessel type	Port constraints	Rail constraints
150	90tons (198,400lbs) 13ft W -20ft L-15ft H	Ro-Ro	Clearance with major US ports	4-8 axles railcar no shortage
300	150tons (340,00lbs) 21ft W-27ft L-30ft H	Ro-Ro / MPP	Exceeds limits in Galveston, Hueneme	8 axles railcar no shortage
500	300tons (661,400lbs) 45ftW-25ftL-30ftH	MPP	Exceeds limits in Charleston, Galveston, Hueneme, Brunswick.	12-16 axles railcar Shortage in the market.
750	400tons(881,850lbs) 56ftW-40ftL-45ftH	MPP	Only on heavy cargo terminals and subject to GBP.	18-20 axles Schnabel cars. Only 10 available in the US.

