Morgan Lewis

REACHING NET ZERO TOGETHER

Innovation and IP

C. Erik Hawes, Jeffrey G. Killian, Ph.D., and Sujohn Das

April 21, 2022

© 2022 Morgan, Lewis & Bockius LLP

Presenters

C. Erik Hawes
Houston, TX

Jeffrey G. Killian, Ph.D.
Washington, DC

Sujohn Das
Houston, TX

Morgan Lewis

Recent Developments Affecting the Energy Transition

Morgan Lewis

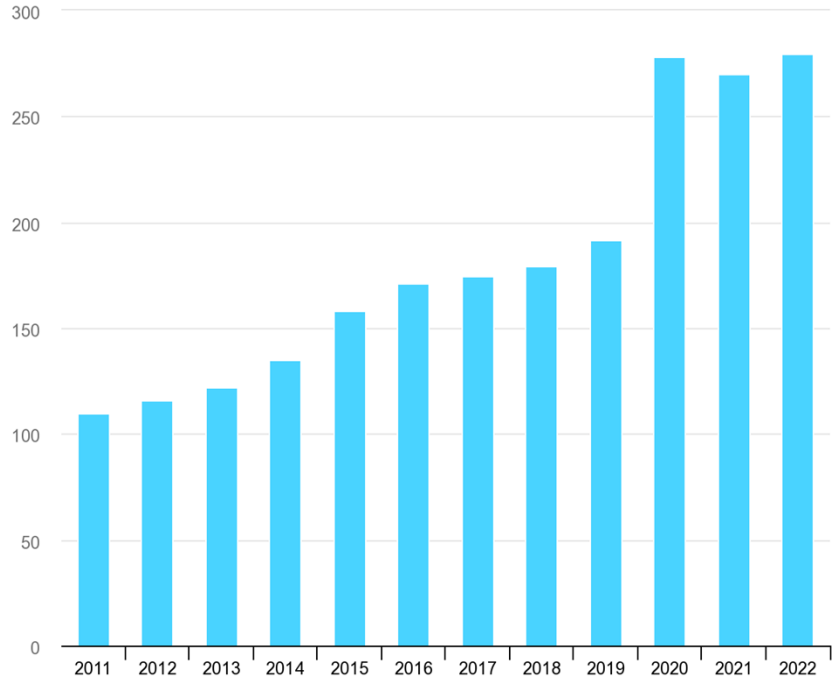
Ongoing Efforts to Promote Renewable Energy

- Feed-In Tariffs
- Production Tax Credits
- New vehicle efficiency and emission standards
- "Zero emission" corporate pledges
- Policy deadlines
- Acceptance of clean energy tax breaks

US Renewable Tax Credit Changes

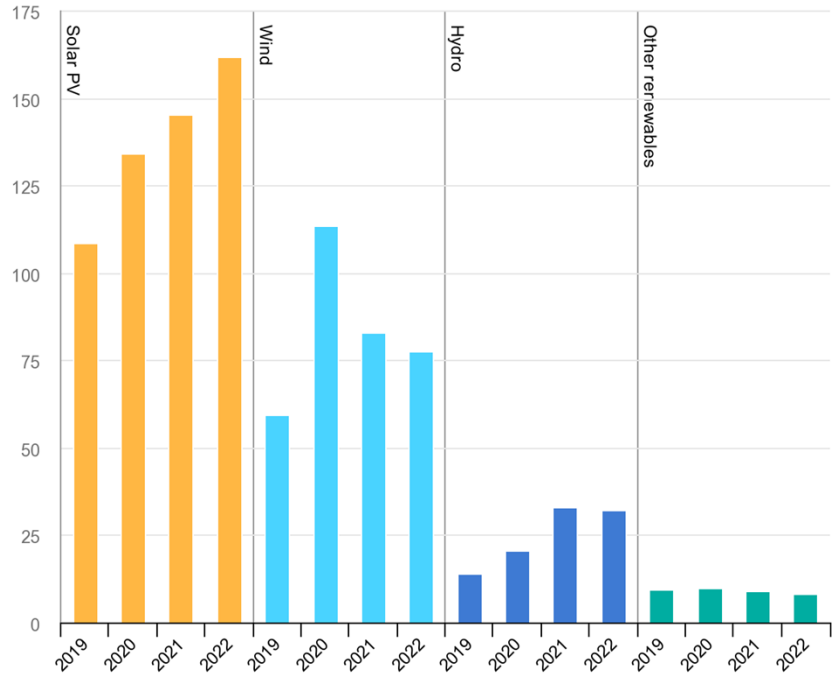
- Onshore Wind and Solar PV Tax Credits
  - Onshore Wind: 18$/MWh production tax credit extended to 2027
  - Solar PV: 26% investment tax credit extended to 2027
- "Direct-pay" for renewable tax credit
  - Has historically boosted renewable energy capacity

Net Renewable Capacity Additions, 2011-2022



IEA, *Net renewable capacity additions, 2011-2022*, IEA, Paris https://www.iea.org/data-and-statistics/charts/net-renewable-capacity-additions-2011-2022

Net Renewable Capacity Additions by Technology, 2020-2022



IEA, Net renewable capacity additions by technology, 2020-2022, IEA, Paris https://www.iea.org/data-and-statistics/charts/net-renewable-capacity-additions-by-technology-2020-2022

Oil and Gas in View of Renewables

- Obstacles to increased domestic exploration and production
  - Federal and state restrictions on leasing and drilling activity
  - Regulations increasing the costs associated with E&P operations
- Decreasing consumption subsidies and reversal
- Disruption in trends
  - Economic uncertainty
  - Sanctions against Russia

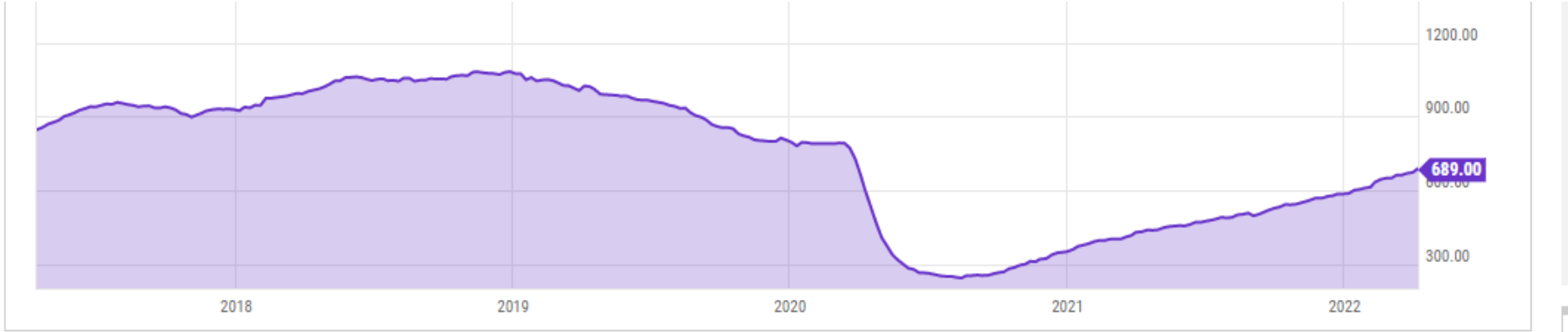
Disruptions and Increased Demand for Oil and Gas

- International sanctions against Russia and surging commodity prices
  - 3 million barrels/day of Russian oil output could be shut in
- Increased domestic demand to offset Russian shortfall
  - Dynamics of increased demand: "At a time of record profits, Big Oil is refusing to increase production to provide the American people some much needed relief at the gas pump." - Rep. Frank Pallone, D-N.J., chairman of the House Energy and Commerce Committee.

Disruptions and Increased Demand for Oil and Gas

- Emergency release from US Strategic Petroleum Reserves
  - 1 million barrels/day (180 million barrels over 6 month period)
- Resume selling new oil and gas leases on US public lands
  - Increased federal royalties
- US and partners to supply Europe with 15 billion cubic meters of liquified natural gas in 2022
  - Europe to end all Russian fossil fuel imports by 2027

US Rig Count



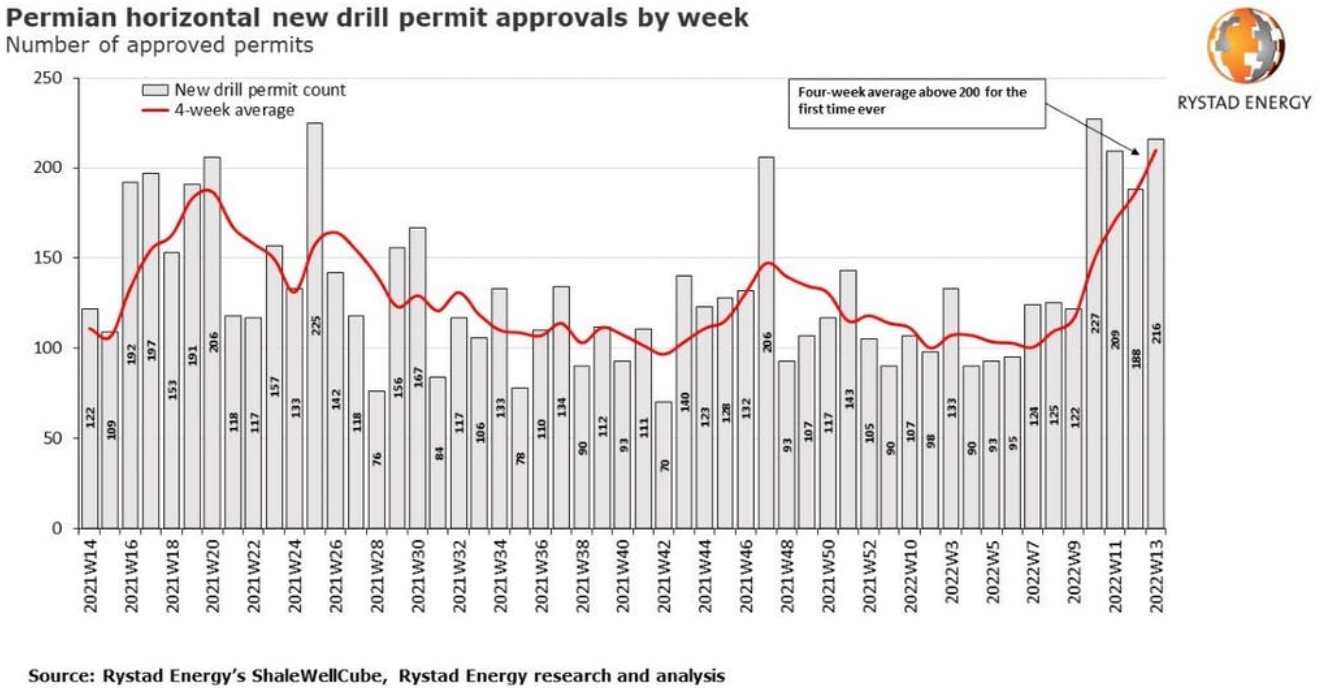
https://ycharts.com/indicators/us_rotary_rigs

Rig Count Overview & Summary Count

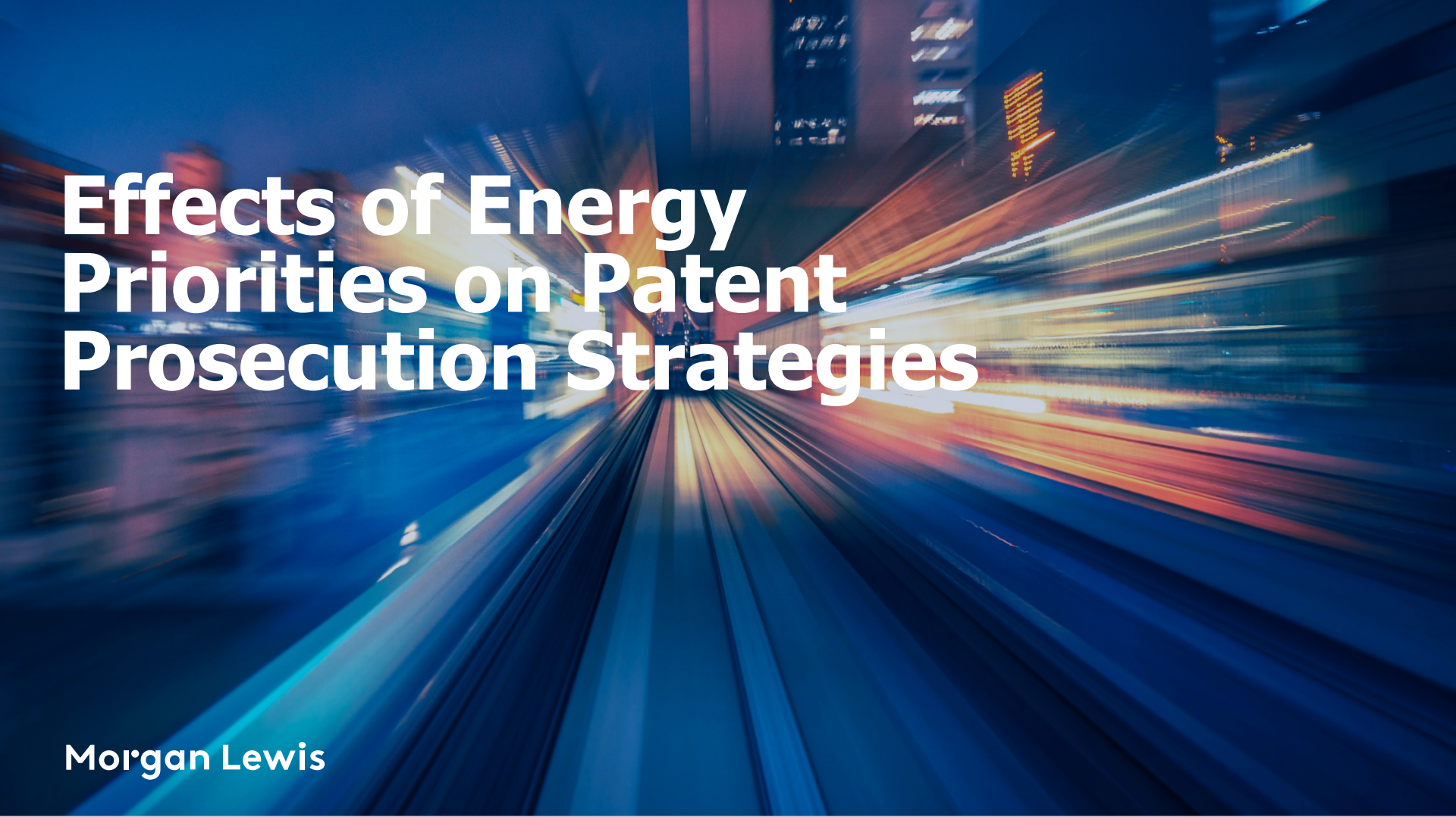
Area	Last Count	Count	Change from Prior Count	Date of Prior Count	Change from Last Year	Date of Last Year's Count
U.S.	08 Apr 2022	689	+16	01 Apr 2022	+257	08 Apr 2021
Canada	08 Apr 2022	111	-13	01 Apr 2022	+53	08 Apr 2021
International	Mar 2022	815	+2	Feb 2021	+100	Mar 2021

https://rigcount.bakerhughes.com/

Drilling Permits in Permian Basin



Source: Rystad Energy's ShaleWellCube, Rystad Energy research and analysis



Effects of Energy Priorities on Patent Prosecution Strategies

Morgan Lewis

Need for Expedited Patent Protection

- Market forces and government incentives expedite R&D efforts
  - Renewable energy technology
  - Oilfield technology to facilitate rapid and increased production
- Patent protection is more relevant earlier in a product lifecycle
  - Obtaining enforceable patents earlier provides protection in an evolving market

Strategies to Protect Evolving Technologies

- Expedited Examination Pathways
  - Final disposition in 12 months
  - Prioritized Examination (Track One Examination)
    - Larger fee ($4800 + normal filing fees)
  - Accelerated Examination
    - Requires a patentability search
    - Significantly smaller fee ($140)
      - Fee can be waived "if the basis for the petition is . . . [t]hat the invention will **materially**: (i) Enhance the quality of the environment; [or] (ii) Contribute to the *development or conservation* of energy resources. . ."

Strategies to Protect Evolving Technologies

- Other Expedited Prosecution Pathways
  - Fast Track Appeals
  - Patent Prosecution Highway (International filings)
- Continuation Practice

IP Issues Relating to Reduction of Carbon Impact from Oil & Gas Exploration and Production

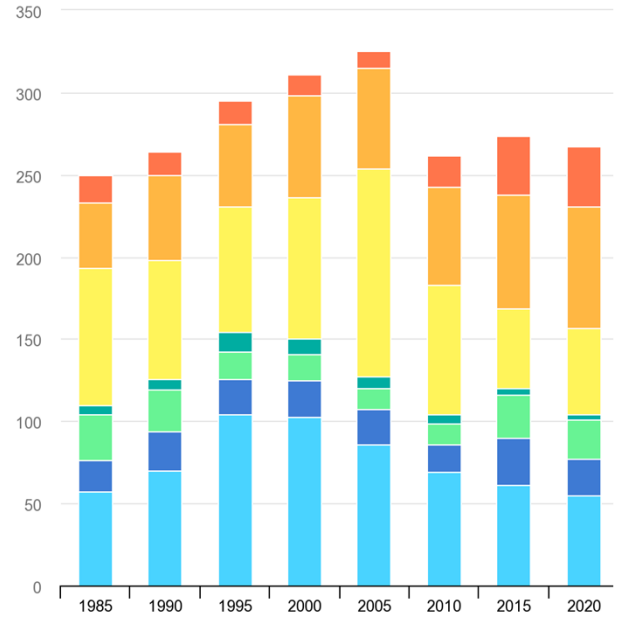
Morgan Lewis

Electrification of the Oilfield

- Commitments to reduce greenhouse gas footprint of oil and gas infrastructure
  - Clean energy to power onsite operations
- All-electric fracturing operations
  - Increased power and torque
  - Quieter operation
  - Remote management
  - Reduced downtime

Reductions in Flaring

- **Onsite direct use or energy conversion.**
  - Gas that would otherwise be flared is captured and turned into other useable products or electrical power that can be used onsite or sold back to an electricity grid.
- **Portable CNG or mini-LNG facilities to treat gas onsite**.
  - The CNG process compresses gas at the wellhead so that it can be trucked short distances for in-field fuel use or to nearby gas processing facilities.
- **Small-scale gas-to-methanol or gas-to-liquids conversion plants.**
  - Several options are being explored, including multifunctional catalysts to develop products from associated gas streams, with a focus on modular conversion equipment.



IEA, Upstream flaring CO2 emissions by region in the Net Zero Scenario, 1985-2030, IEA, Paris https://www.iea.org/data-and-statistics/charts/upstream-flaring-co2-emissions-by-region-in-the-net-zero-scenario-1985-2030

Maximizing Output from Existing Wells

- Enhanced oil recovery
  - Gas/fluid injection
  - Thermal injection
  - Chemical injection
- Refracs
- Artificial Lift

Maximizing Output from Uncompleted Wells

- Drilled but Uncompleted Wells (DUCs)
  - Perforating
  - Fracturing
- New wells
  - Longer laterals
  - Multi-well pads
  - Fracture geometry/topology

Energy Storage: Topics and Trends in Technology and IP

Morgan Lewis

Energy Storage Technologies

- Batteries – a range of electrochemical storage solutions, including advanced chemistry batteries, flow batteries, and capacitors
- Thermal – capturing excess energy (such as from solar) and storing, often in molten salt or phase change materials, for later availability
- Mechanical Storage – harness kinetic or gravitational energy to store electricity; emphasis on materials, computer control systems, and innovative designs
- Hydrogen – excess electricity generation can be converted into hydrogen via electrolysis and stored for later availability
- Reservoir Systems – creating large-scale reservoirs of energy with water/air

Batteries

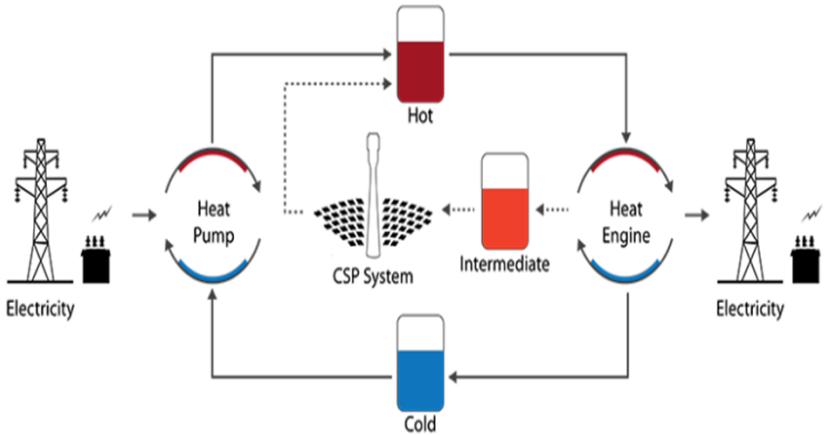
Battery Storage

- electrochemical systems
- store electricity in chemical system of battery for later use
- technologies: chemistry systems, materials, components, controls systems

Thermal

Pumped Heat Electrical Storage (PHES)

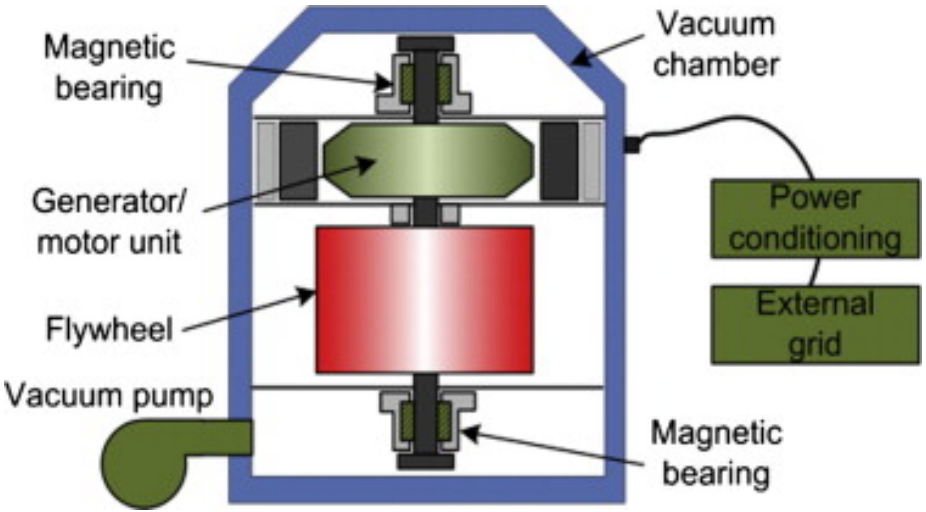
- thermal storage systems that act as energy-storing "batteries"
- use grid electricity and heat pumps to alternate between heating and cooling materials in tanks—creating stored energy that can then be used to generate power as needed
- technologies: thermal storage systems and materials, molten salts, controls systems



Mechanical

Flywheel energy storage systems (FESS)

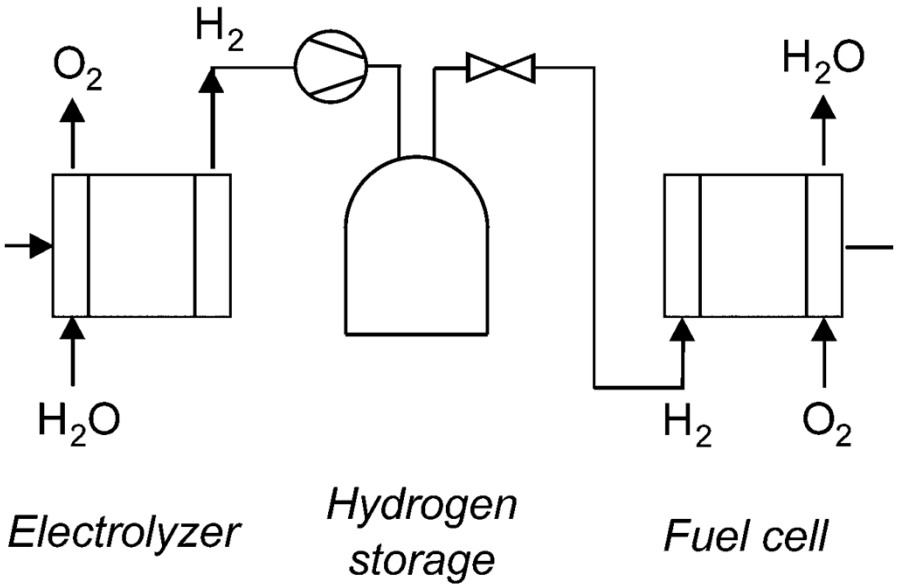
- kinetic energy stored in a rotating mass with very low frictional losses
- electric energy input accelerates the mass to speed via an integrated motor-generator. The energy is discharged by drawing down the kinetic energy using the same motor-generator
- technologies: materials, magnetics, mechanics, controls systems



Hydrogen

Hydrogen Energy Storage (HES)

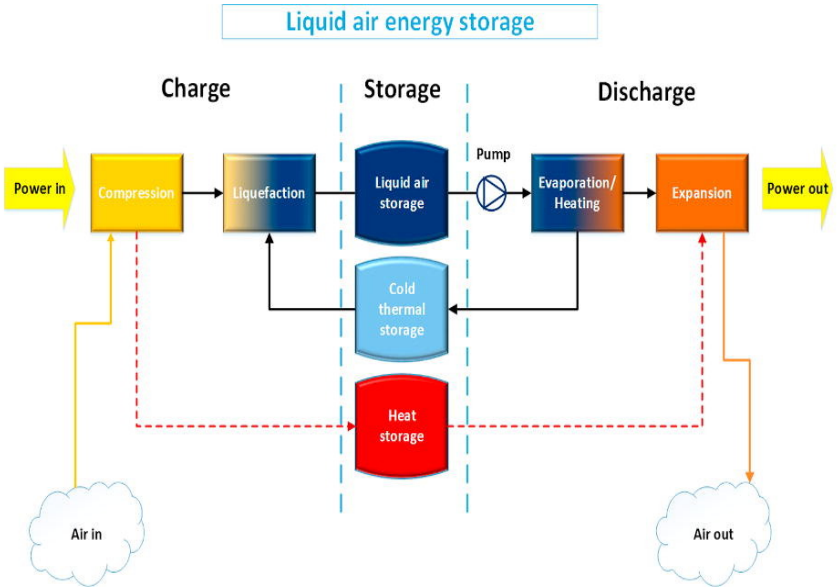
- chemical energy reservoir system
- use electricity to create hydrogen, store as liquid or compressed gas, supply hydrogen gas to fuel cell to generate electricity
- technologies: efficient hydrolysis, storage and transport systems, mechanics, fuel cell technologies, controls systems



Reservoir Systems

Liquid Air Energy Storage (LAES)

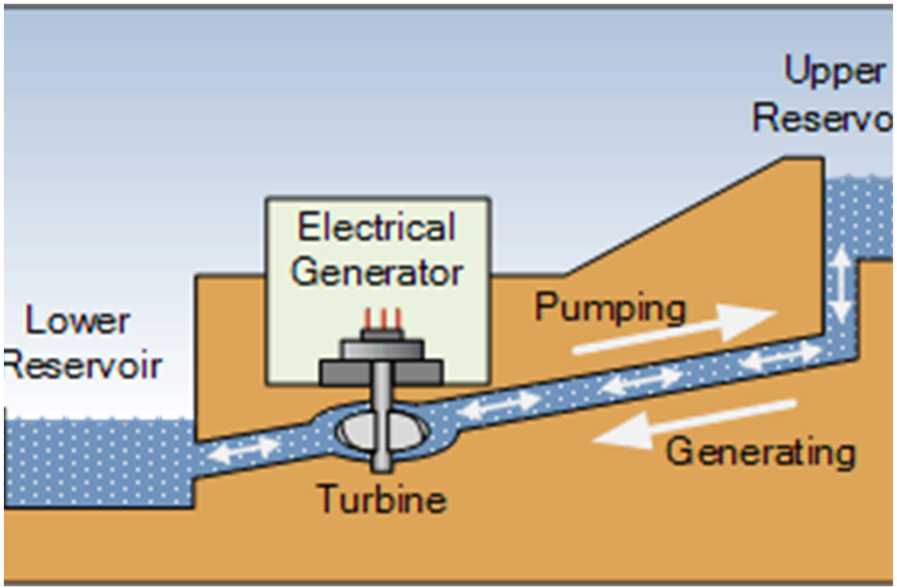
- use electricity to cool air until it liquefies, stores the liquid air in a tank, brings the liquid air back to a gaseous state (by exposure to ambient air or with waste heat from an industrial process) and uses that gas to turn a turbine and generate electricity
- technologies: thermal storage, mechanics, and controls systems



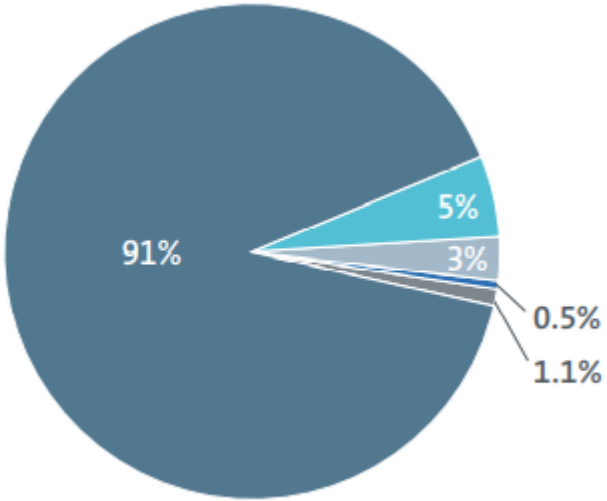
Reservoir Systems

Pumped Hydroelectric Storage (PHS)

- standard hydroelectric generation with storage of water using lower cost energy and electricity generation on demand
- technologies: controls systems



Installed Capacity, Energy Storage (2019)



= pumped hydropower

= batteries

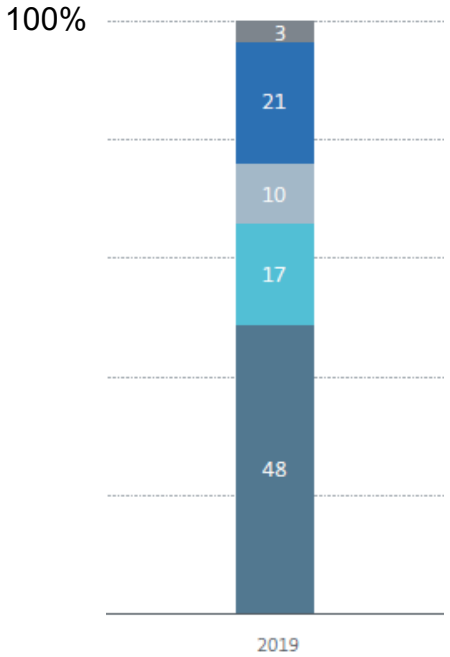
= thermal power

= compressed air

= other

Source: International Energy Agency

Applications of Energy Storage Technologies (2019)



= Metered (res/comm/ind)

= Transmission and distribution

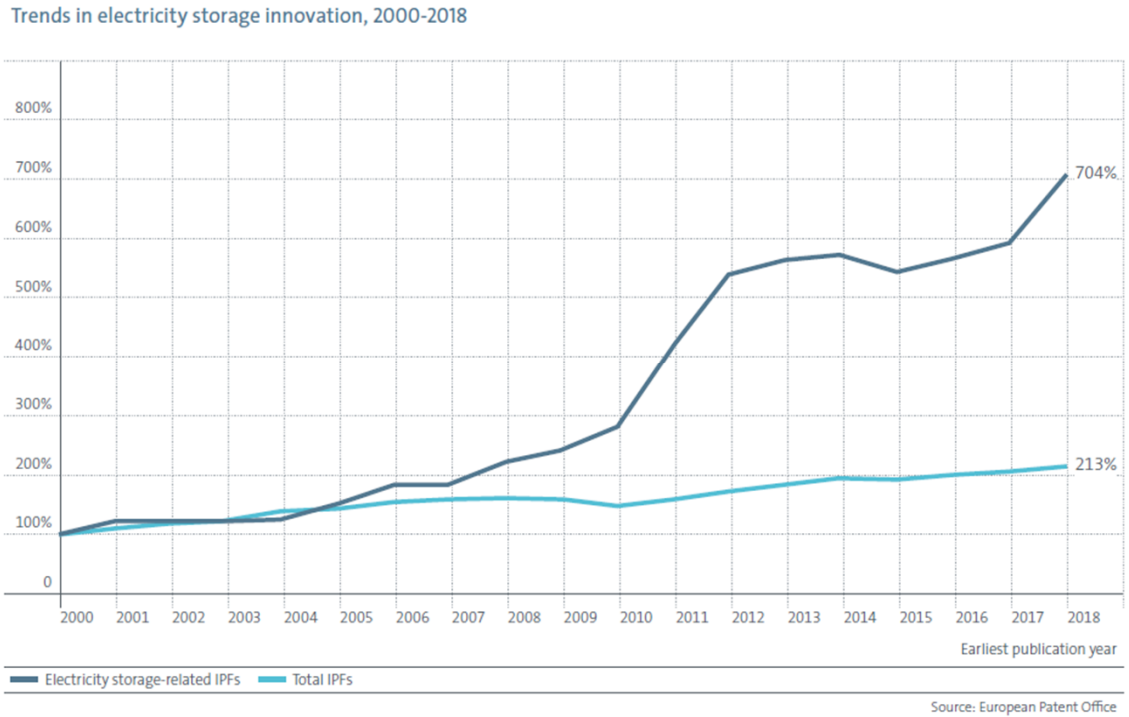
= System services

= Arbitrage and peak support

= other

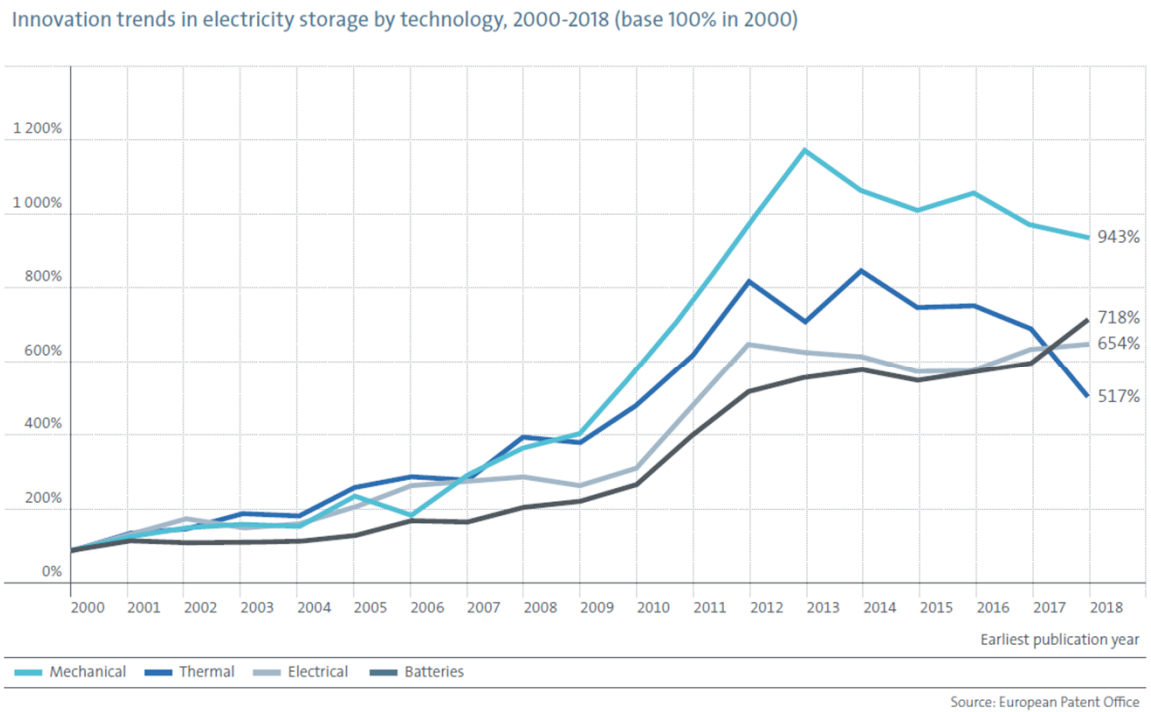
Source: International Energy Agency

Energy Storage Innovations



- **Electricity storage inventions have grown 14% a year over the past decade**

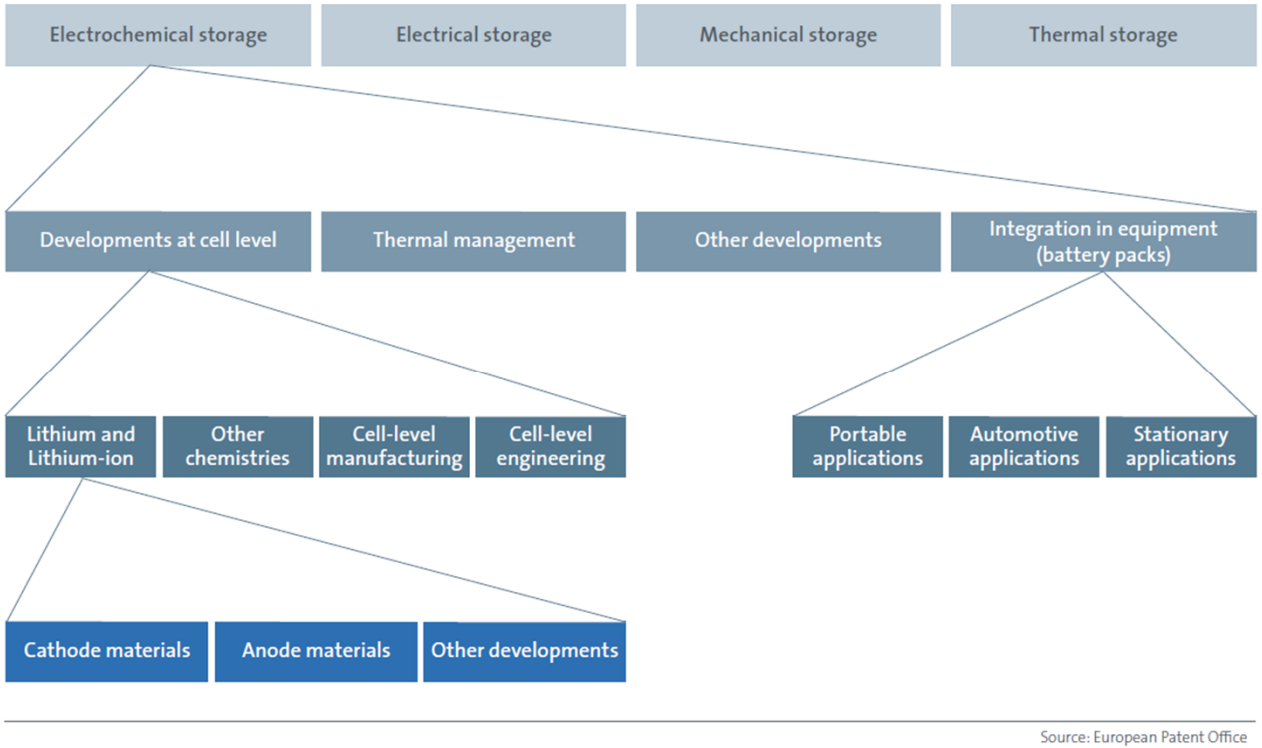
Energy Storage Innovations



- **Mechanical and thermal post-peak**
- **Electrical steady**
- **Batteries still growing**

Battery (Electrochemcial) Technologies

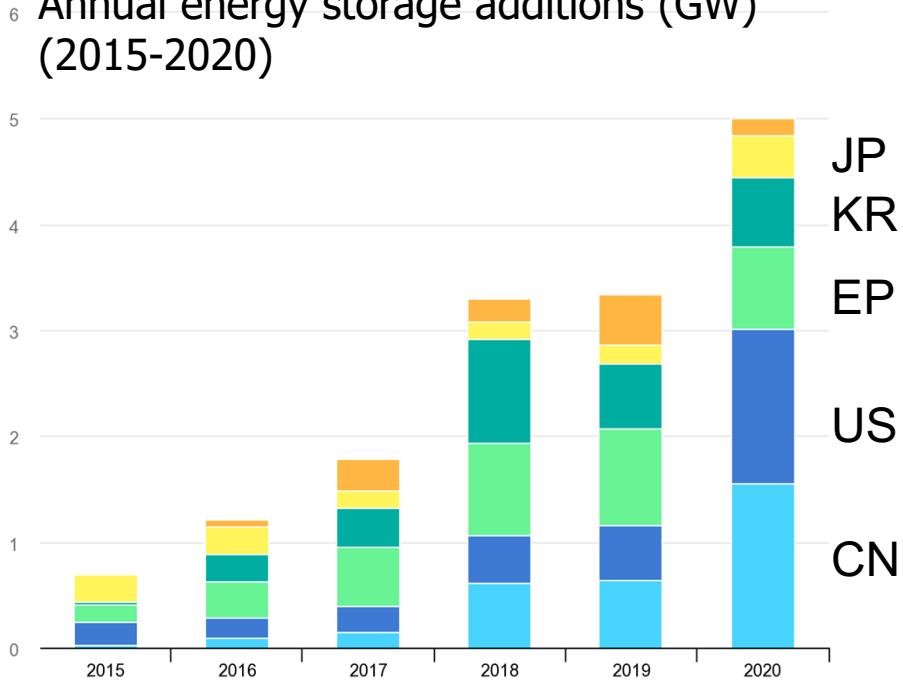
- Chemistry Systems
  - Lead | Li-based | Ni-based | Na-S | Redox Flow Batteries
- Battery Components
  - separators
- Integration
  - Control systems



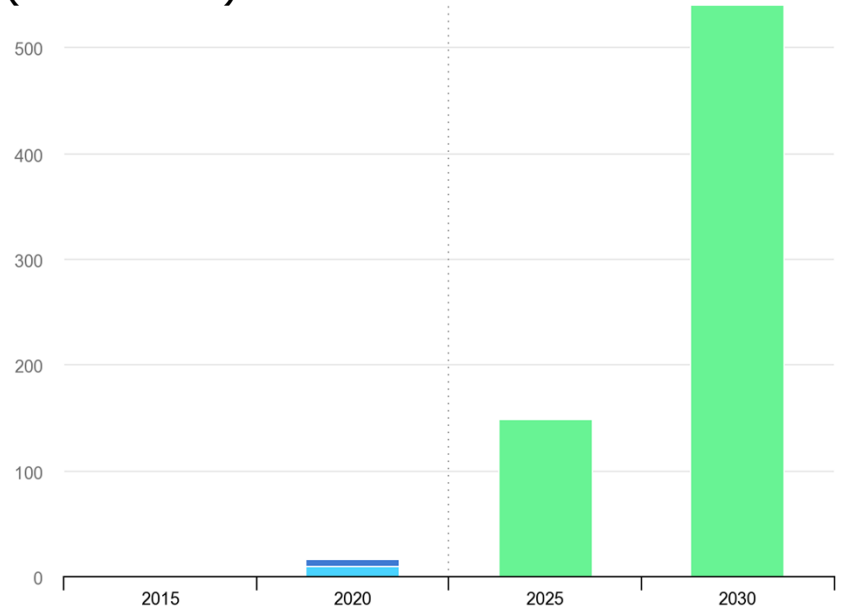
Source: European Patent Office

Trends in Battery Storage

Annual energy storage additions (GW) (2015-2020)



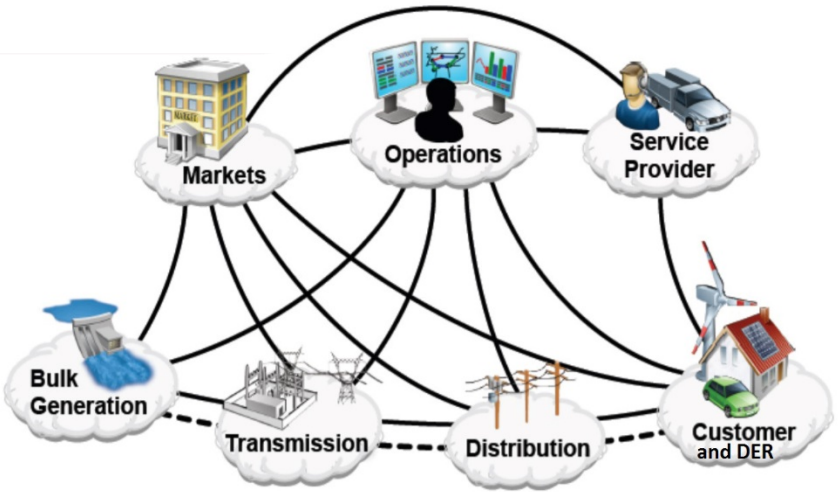
Total installed battery storage capacity (GW) (2015-2030)



Related Technology Areas of Interest

Smart Grid

- power production and distribution system that allows for two-way flow of electricity and communication
  - efficient transmission and distribution
  - quicker restoration after outages
  - increased and efficient integration of variable energy systems
- technologies: control systems, application technologies, computer and AI



Carbon Capture Utilization and Storage: Topics and Trends in Technology and IP

Morgan Lewis

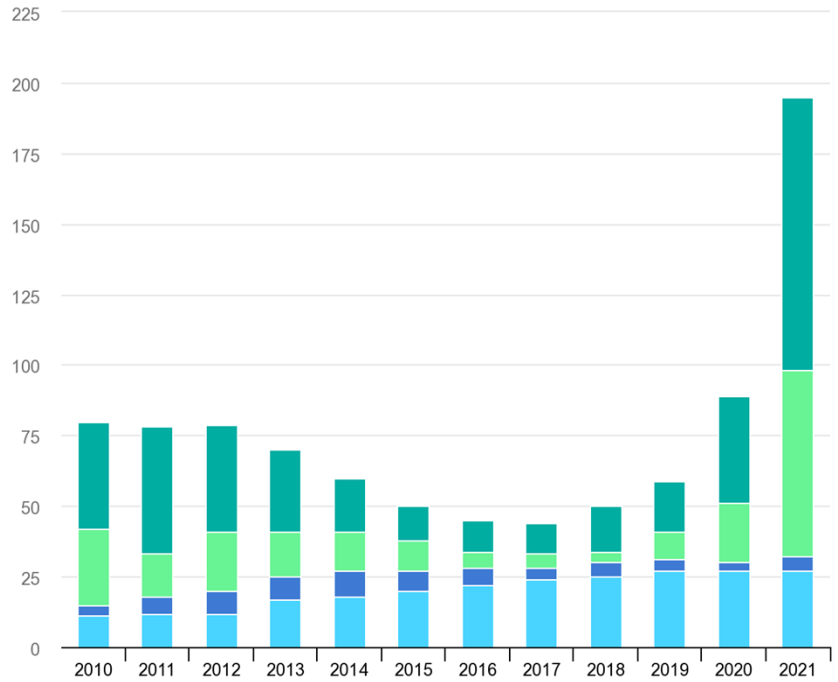
Overview of Carbon Capture Technologies

- Capture of carbon dioxide (CO2) from fuel combustion or industrial processes
- Transport of this CO2 via ship or pipeline
- Use as a resource to create valuable products or services
- Permanent storage deep underground in geological formations
- Carbon removal or "negative emissions"
  - CO2 from bio-based processes or directly from the atmosphere

Trends in Carbon Capture

- Investments in Carbon Capture by Companies and Individuals
- Net Zero goals
- Policy Incentives

Global Pipeline of Commercial CCUS Facilities Operating and in Development, 2010-2021



IEA, *Global pipeline of commercial CCUS facilities operating and in development, 2010-2021*, IEA, Paris https://www.iea.org/data-and-statistics/charts/global-pipeline-of-commercial-ccus-facilities-operating-and-in-development-2010-2021

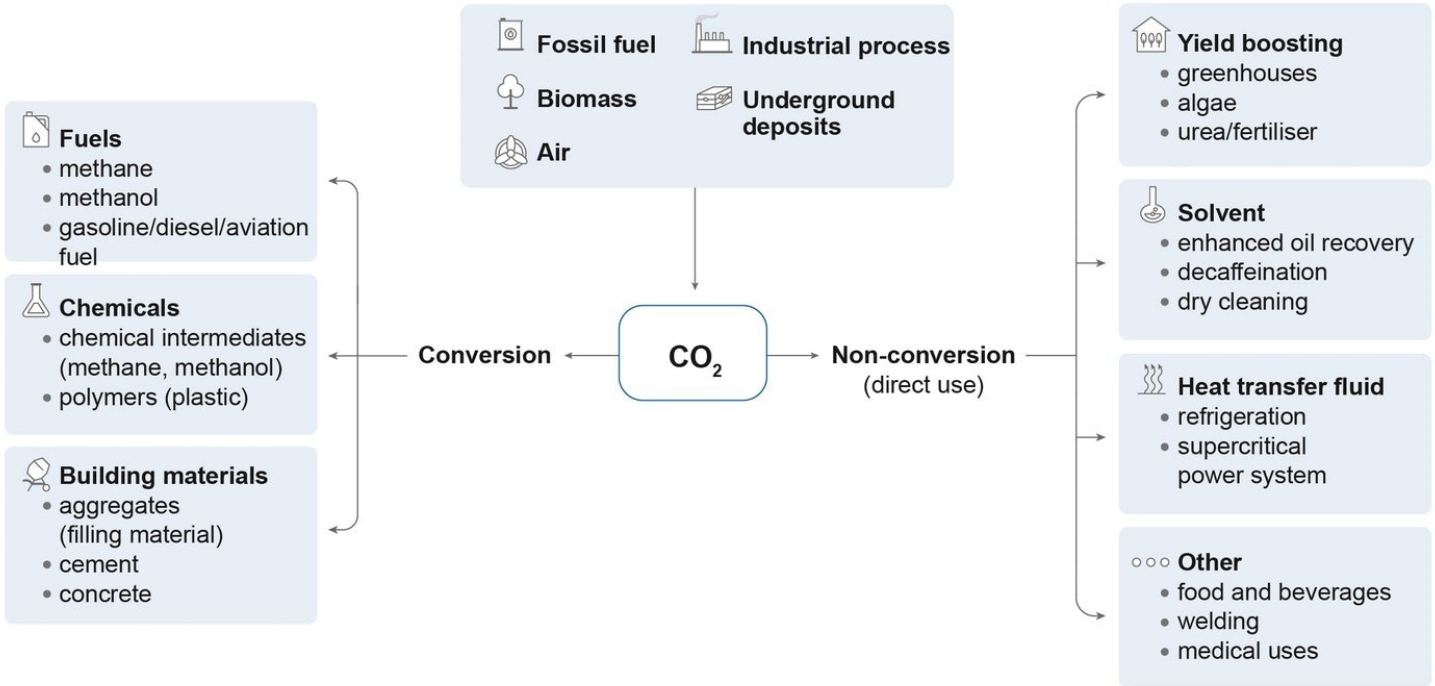
Carbon Capture Technologies

- Chemical absorption
- Physical separation
- Oxy-fuel separation
- Membrane separation
- Calcium looping
- Chemical looping
- Direct separation
- Supercritical CO2 power cycles

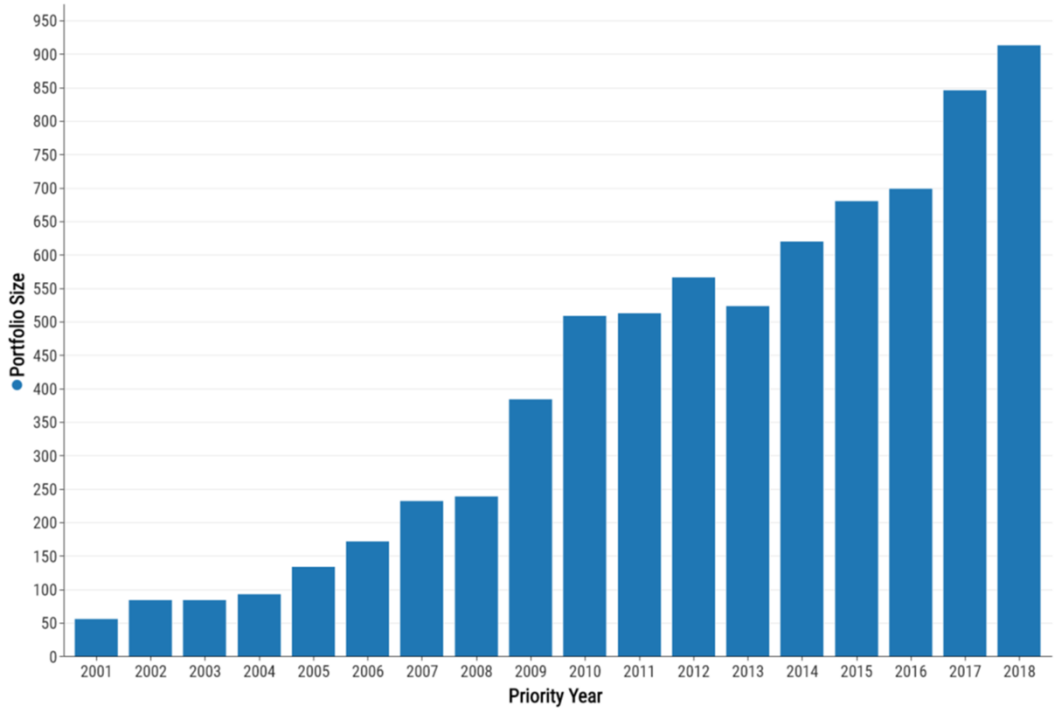
Carbon Transport and Storage

- Pipeline
- Shipping
- Saline formations
- Depleted oil and gas reservoirs

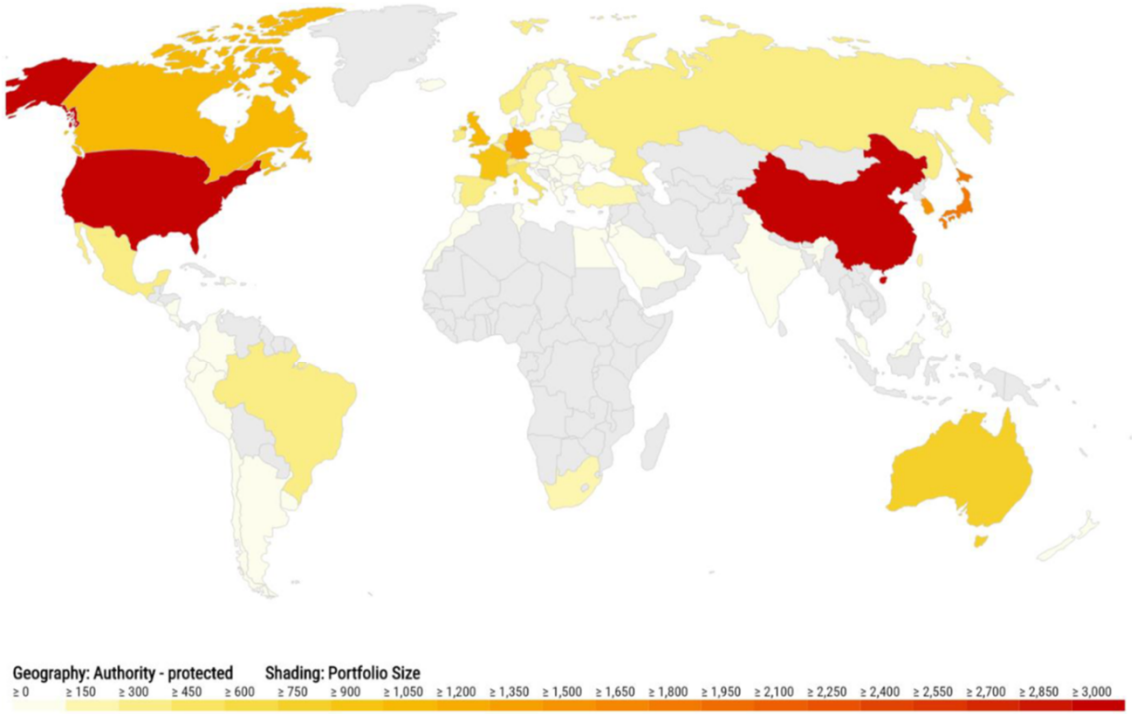
Carbon Use


Fossil fuel
Industrial process
Biomass
Underground deposits
Air
Fuels
• methane
• methanol
• gasoline/diesel/aviation fuel
Chemicals
• chemical intermediates (methane, methanol)
• polymers (plastic)
Building materials
• aggregates (filling material)
• cement
• concrete
Conversion
CO_2
Non-conversion (direct use)
Yield boosting
• greenhouses
• algae
• urea/fertiliser
Solvent
• enhanced oil recovery
• decaffeination
• dry cleaning
Heat transfer fluid
• refrigeration
• supercritical power system
Other
• food and beverages
• welding
• medical uses

Carbon Capture Patent Activity



Where Carbon Capture is Being Protected



Trends in Carbon Capture IP

Biography

C. Erik Hawes
Houston, TX
+1.713.890.5165
erik.hawes@morganlewis.com

C. Erik Hawes serves intellectual property clients in litigation and pre-litigation counseling, patent prosecution, management of patent and trademark portfolios, trade secrets and confidentiality issues, due diligence concerning IP issues in transactions, and day-to-day counseling concerning IP issues of every size and shape. While he has a strong background in other industries, Erik works primarily with clients in the energy industry and is the co-head of the oil and gas subsector within the firm's energy industry team. He also serves as head of the firm's intellectual property practice in the Houston office, which is recognized by *Chambers USA*, as is Erik individually.

Biography

Jeffrey G. Killian, Ph.D.
Washington, D.C.
+1.202.739.5592
jeffrey.killian@morganlewis.com

Jeffrey G. Killian, Ph.D., helps businesses and inventors secure and enforce patent protection for their inventions. Jeffrey prepares patent applications, represents clients before the US Patent and Trademark Office (USPTO), provides intellectual property (IP) opinions and licensing advice, and supports due diligence projects. He has experience before the Patent and Trial Appeal Board (PTAB) in ex parte appeals and inter partes review (IPR) proceedings, and litigates IP cases in district court, at the International Trade Commission (ITC), and before the US Court of Appeals for the Federal Circuit.

Biography

Sujohn Das
Houston, TX
+1.713.890.5792
sujohn.das@morganlewis.com

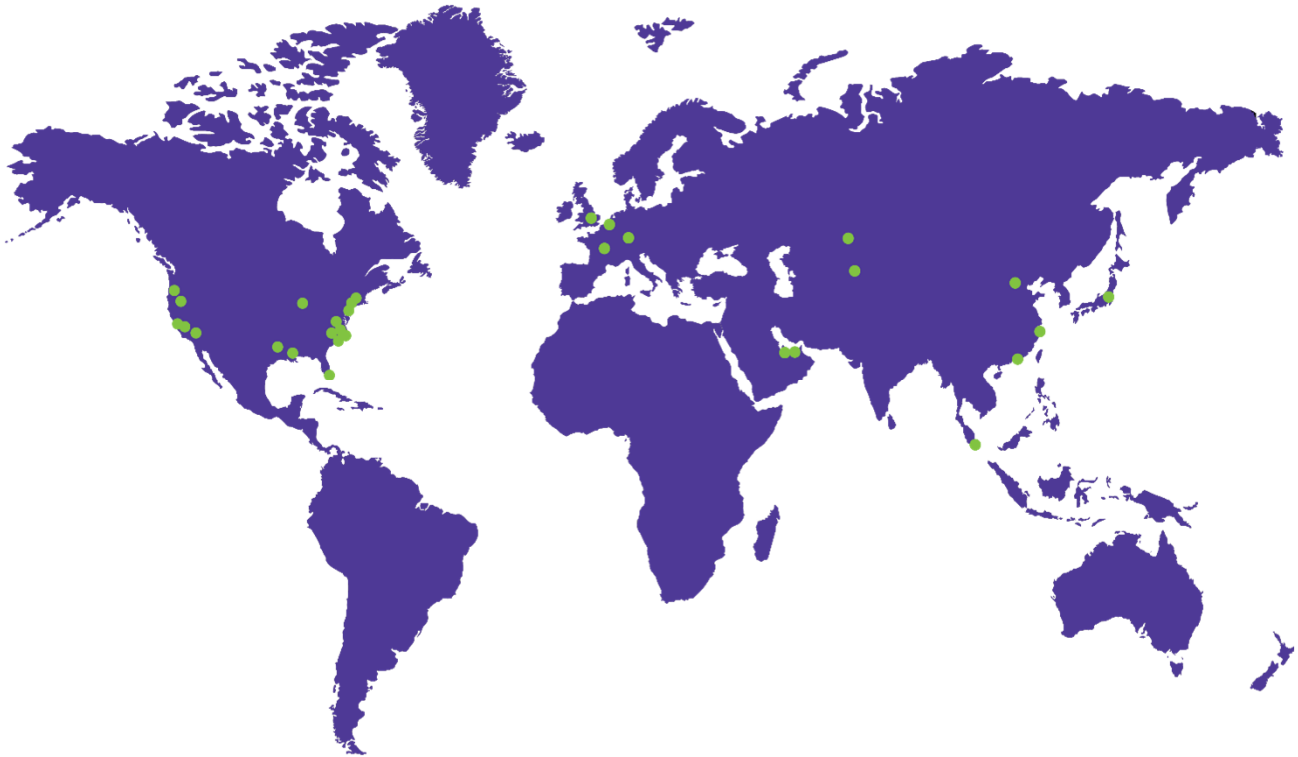
Sujohn Das counsels clients in a wide array of intellectual property matters, including the acquisition of intellectual property, management and growth of patent portfolios, and strategies for protection of intellectual property, including intellectual property litigation. He has a particular focus on oilfield services and medical device companies.

Our Global Reach

Africa
Asia Pacific
Europe
Latin America
Middle East
North America

Our Locations

Abu Dhabi
Almaty
Beijing*
Boston
Brussels
Century City
Chicago
Dallas
Dubai
Frankfurt
Hartford
Hong Kong*
Houston
London
Los Angeles
Miami
New York
Nur-Sultan
Orange County
Paris
Philadelphia
Pittsburgh
Princeton
San Francisco
Shanghai*
Silicon Valley
Singapore*
Tokyo
Washington, DC
Wilmington



Morgan Lewis

Our Beijing and Shanghai offices operate as representative offices of Morgan, Lewis & Bockius LLP. In Hong Kong, Morgan, Lewis & Bockius is a separate Hong Kong general partnership registered with The Law Society of Hong Kong. Morgan Lewis Stamford LLC is a Singapore law corporation affiliated with Morgan, Lewis & Bockius LLP.

THANK YOU

© 2022 Morgan, Lewis & Bockius LLP
© 2022 Morgan Lewis Stamford LLC
© 2022 Morgan, Lewis & Bockius UK LLP

Morgan, Lewis & Bockius UK LLP is a limited liability partnership registered in England and Wales under number OC378797 and is a law firm authorised and regulated by the Solicitors Regulation Authority. The SRA authorisation number is 615176.

Our Beijing and Shanghai offices operate as representative offices of Morgan, Lewis & Bockius LLP. In Hong Kong, Morgan, Lewis & Bockius is a separate Hong Kong general partnership registered with The Law Society of Hong Kong. Morgan Lewis Stamford LLC is a Singapore law corporation affiliated with Morgan, Lewis & Bockius LLP.

This material is provided for your convenience and does not constitute legal advice or create an attorney-client relationship. Prior results do not guarantee similar outcomes. Attorney Advertising.