Disruptions in Energy

Singapore
24th June 2019

Peter Godfrey FEI
Managing Director Asia Pacific
Energy Institute

“The future starts today”

https://www.youtube.com/watch?v=ab4Wa516N0c&feature=youtu.be

“The future starts today”

“THE RATE OF CHANGE IS ACCELERATING AND THE RANGE OF UNCERTAINTY IS GROWING”

We must adapt to:

- ❑ *Increasing human empowerment*
- ❑ *Power transition and diffusion*

We must exploit and, where necessary, mitigate, the negative effects of:

- ❑ *Centrality of Information*
- ❑ *Accelerating technological development*

We must take urgent action relating to:

- ❑ *Changing populations and evolving habitats*
- ❑ *Increasing environmental stress*

energy institute

What is disruptive technology /innovation?

Benz Velo 1894
The world's first series-produced automobile

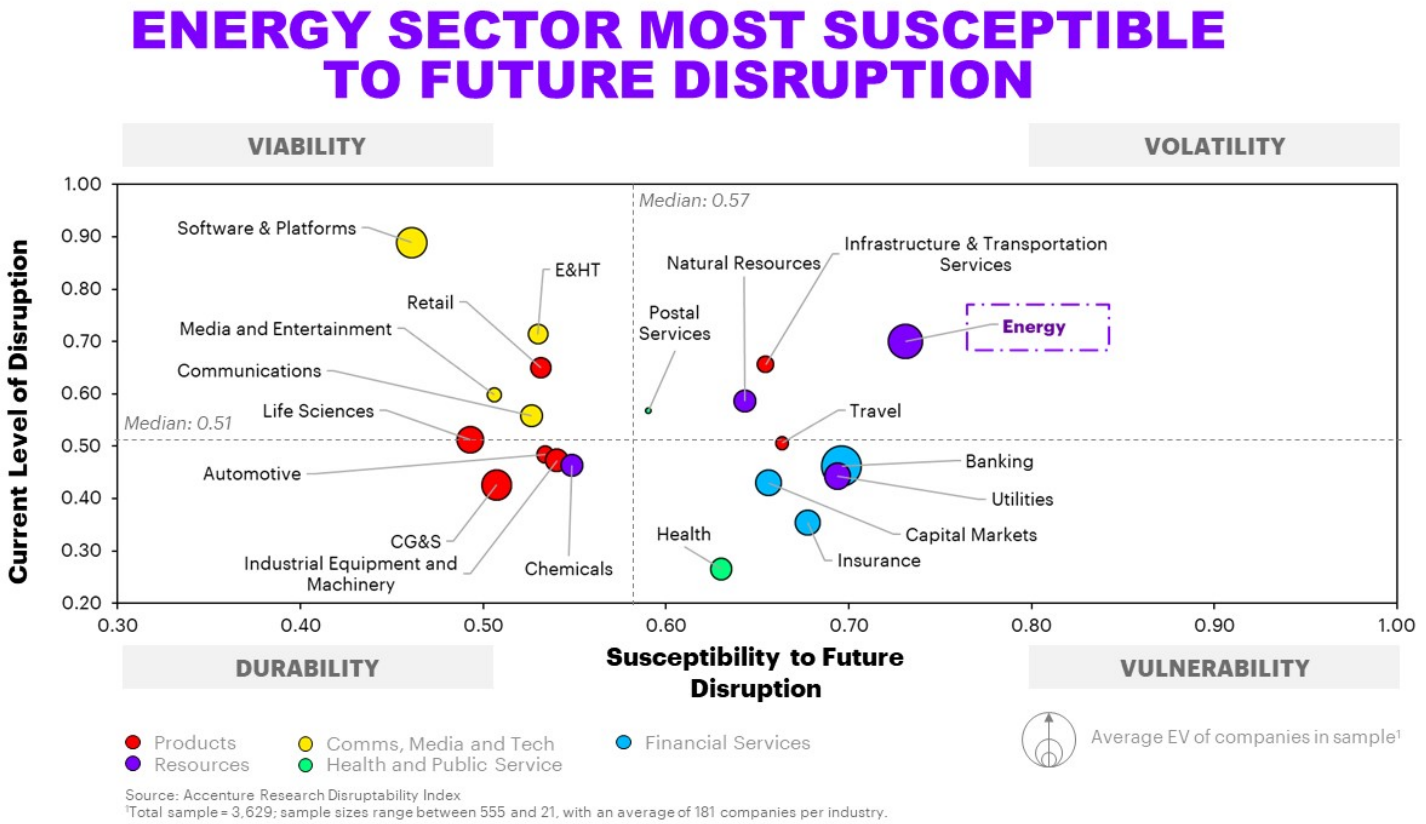
The first Model T Ford produced (1908)
Henry Ford did not invent the automobile nor or start the first production line.
What he did do was put the two together.

Why disruption occurs

- **A need to grow the core business (VIABILITY)**
  - Direct investments to build new capabilities
  - Create innovative offerings to existing customers
  - Utilise core strength to expand into adjacent markets
- **A need to transform the core business (DURABILITY)**
  - Maintain cost leadership
  - Use efficiency-enabling technologies to increase profitability
  - Free up capital toward experimentation, making core offerings cheaper and better
- **A need to re-define and re-scale portfolio (VULNERABILITY)**
  - Reduce dependence on current portfolio of assets, and monetize those that are underutilized
  - Respond to decreased demand for core products by spotting and scaling up innovations
  - Use technology and data to build enhanced services and offerings that alleviate pain points
- **A need to change strategic direction / pivot (VOLATILITY)**
  - A need to shift to new businesses and opportunities
  - A need for fundamental corporate and financial restructuring

Source: Accenture

Accenture's Disrupatability Index

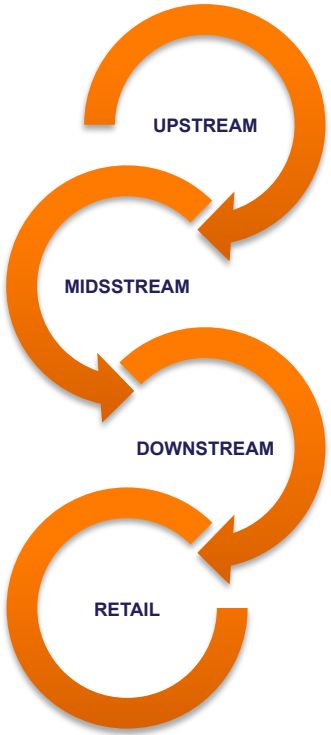


Source: Accenture

Shifting trends in supply and demand are re-shaping the energy industry

SUPPLY

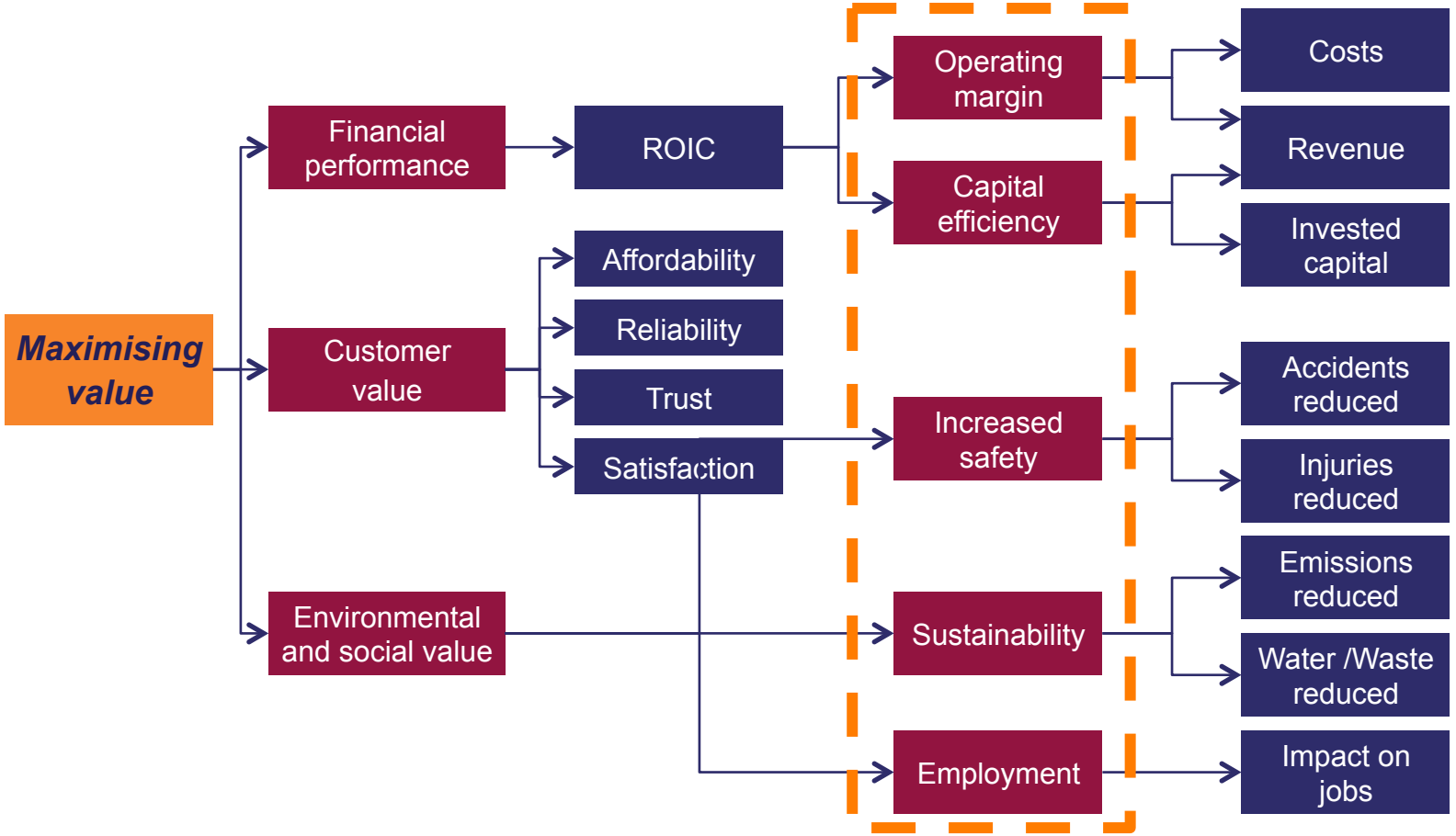
- Role of conventional and unconventional hydrocarbons
- Greater penetration of alternative energy resources
- Changing geopolitical equations
- New technologies and materials improving efficiencies
- New technologies and materials replacing hydrocarbons



DEMAND

- Climate regulations and the push for emission reductions and greater resource efficiency.
- Shift in global demand patterns
- Rise of EV's and autonomous driving
- Development of energy storage
- Technology-enabled new utility models / smart-grids etc.

Internal Drivers creating the need for change



Global megatrends

Growth:

- Population / Demographics
- Urbanisation
- Energy and transport

Challenges:

- Climate change
- Air pollution
- Resource Efficiency

Technology disruption:

- Business no longer as usual!

energy institute

The future of energy

- **Supply Side**
  - Focus on productivity, efficiency and sustainability
  - Increasingly diversified portfolio mix
  - Remote asset management and predictive maintenance
  - Operational efficiency / streamlined supply chains
  - ***Resource efficiency!***
- **Demand Side**
  - Changing patterns of consumption
  - Consumerism versus Prosumerism
  - Integrated energy services
  - ***Resource efficiency!***

Resource Efficiency

energy institute

ENERGY VALUE CHAIN

Systems Design & Construction	Energy Production	Energy Distribution	Energy End-Usage	Energy Services	End-Life
Design and build with recyclability of materials and equipment in mind	Maximise renewable energy within energy systems Energy recovery from waste	Encourage the development of products and services that enable “smart grids”	Demand response 2-way district heating and cooling systems Exhaust air heat pumps	Encourage the development of integrated energy and utility services Focus on lifecycle sustainable provision and efficiency	Encourage recycling of materials from plant, equipment and materials Minimise and optimise disposal of un-exploitable waste

Energy by-products

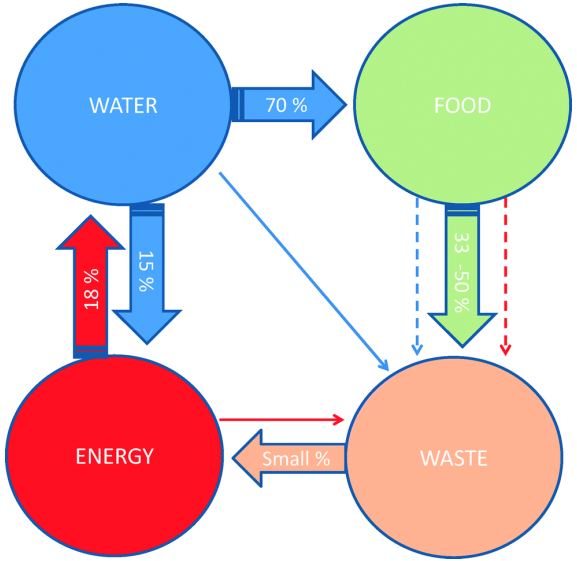
Maximise energy use of side-streams
Utilisation of excess energy, heat and waste
Utilisation of hitherto waste products

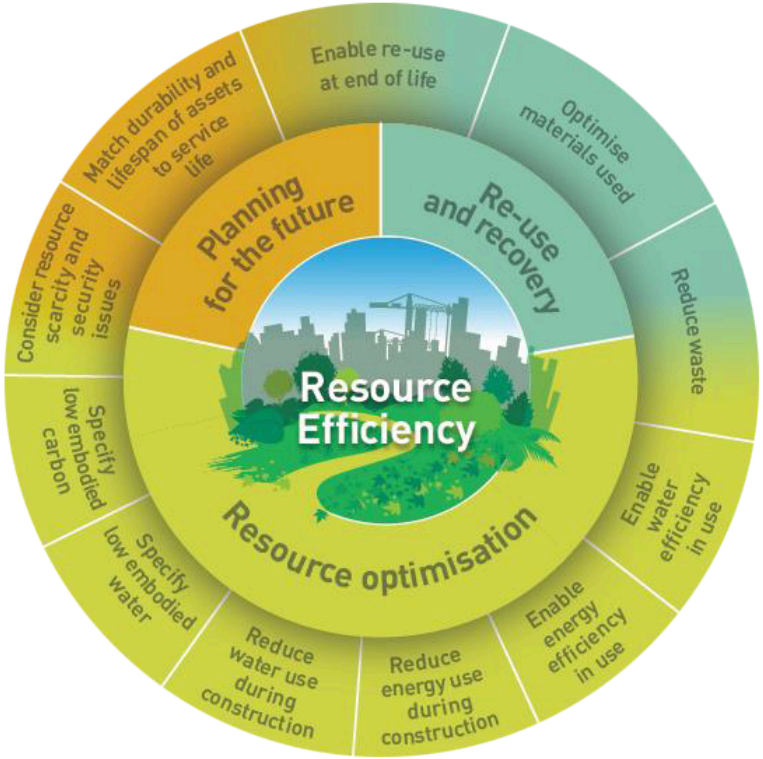
Core disruptions in the Energy Sector

A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

The energy /water/waste nexus





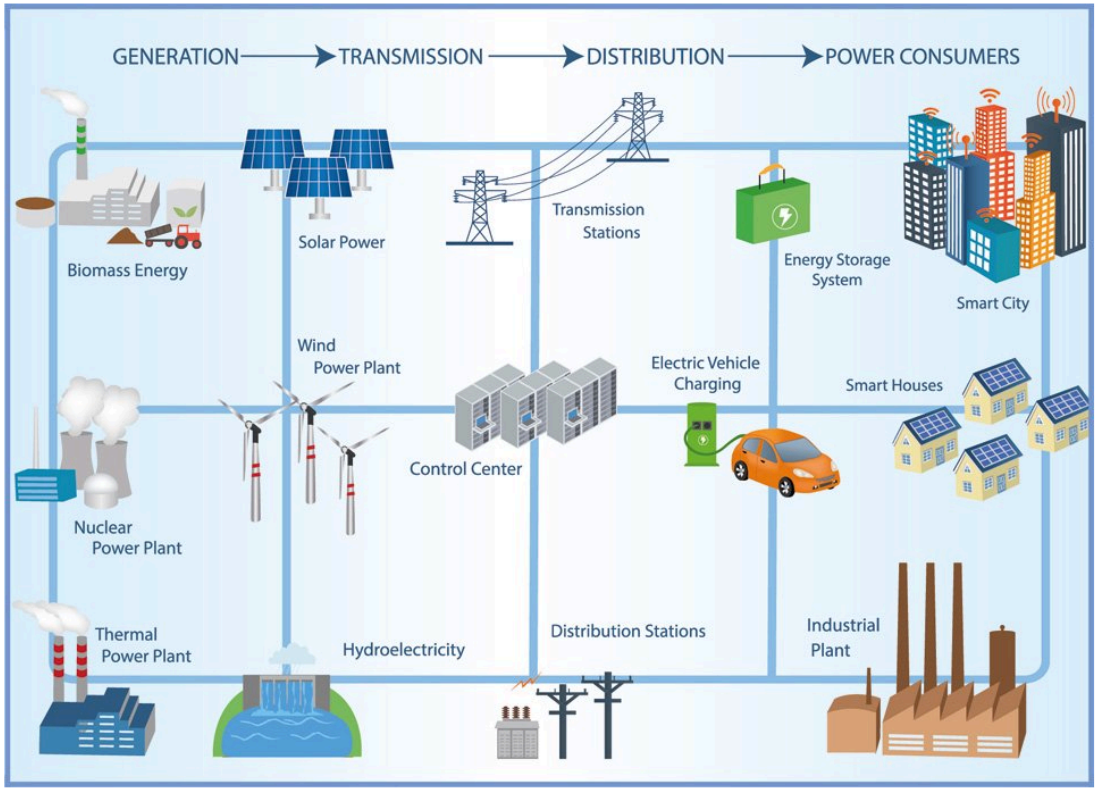
- 0.8 Billion people in chronic food hunger
- 1.4 Billion people suffer from “energy poverty”
- 0.7 Billion people lack sufficient potable water and growing rapidly

Core disruptions in the Energy Sector

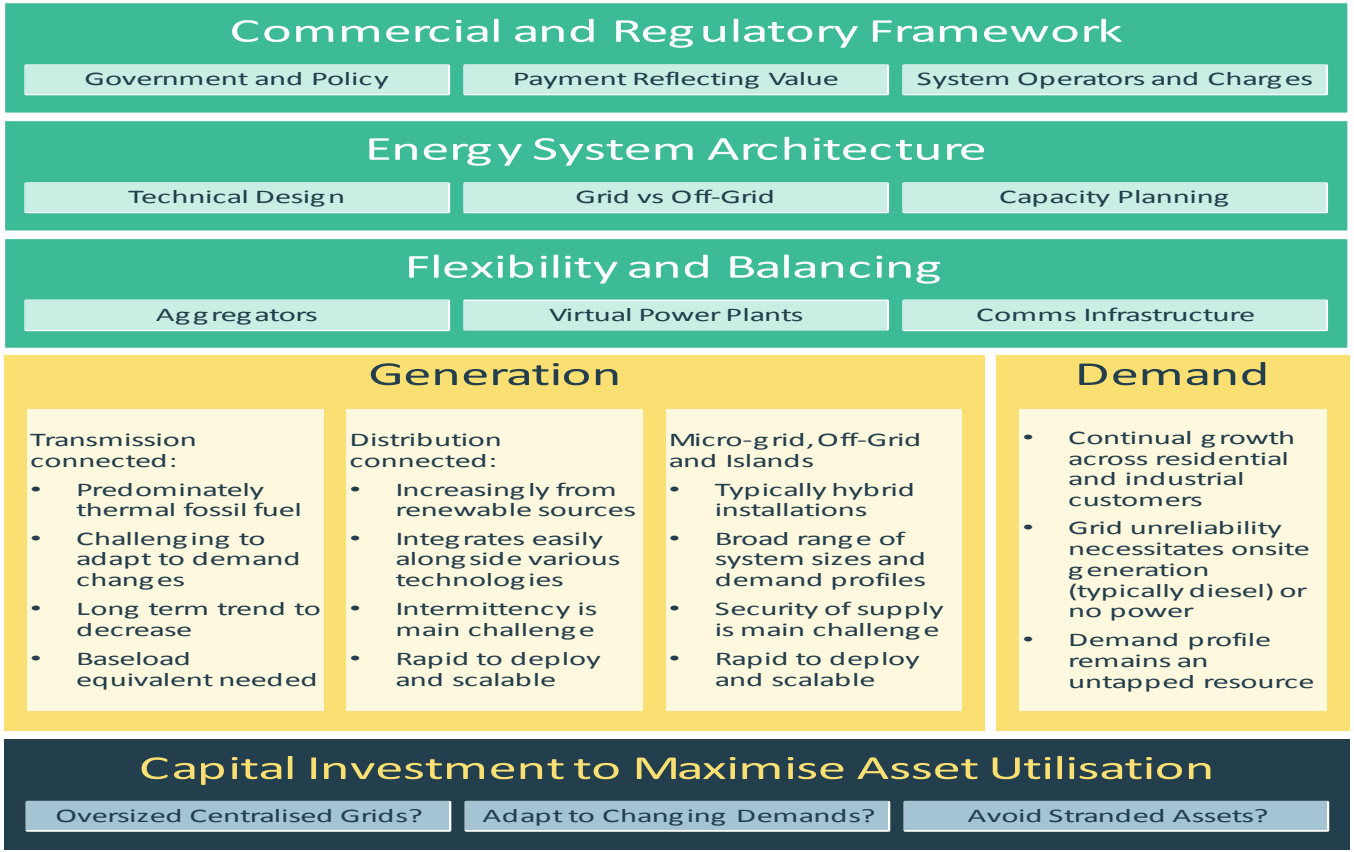
A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

The future of power

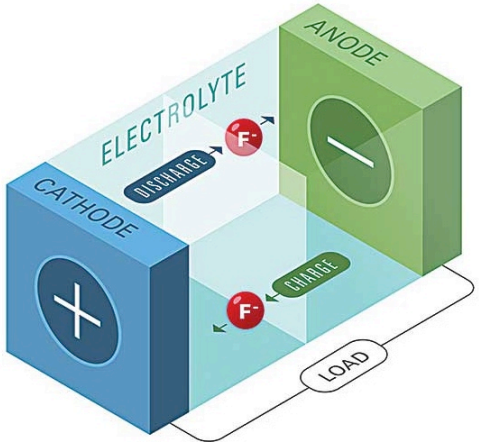


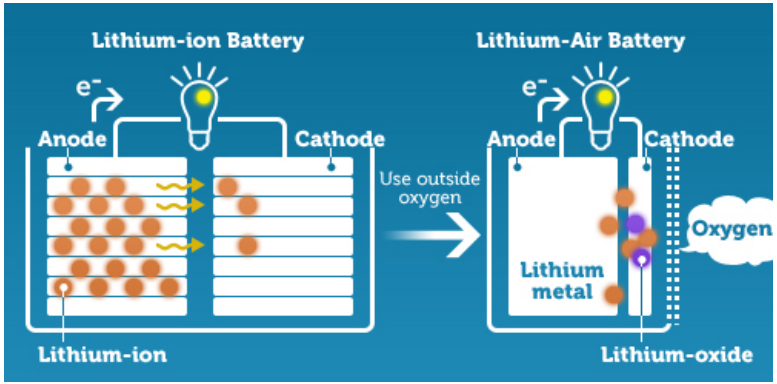
Energy optimisation & storage

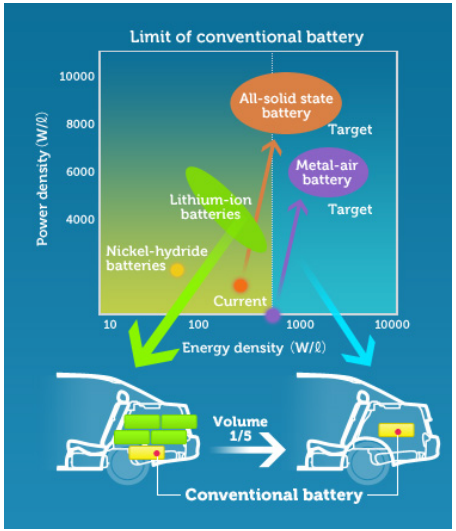


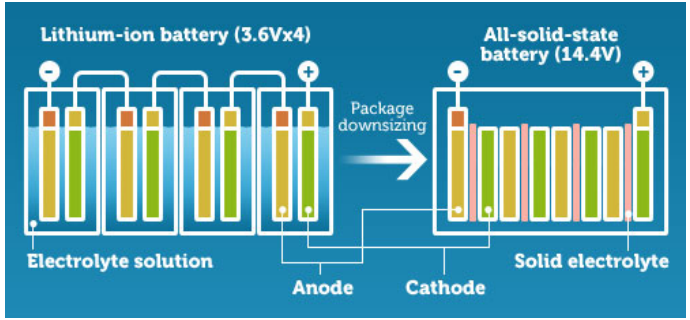
The Solid State Battery

Japan and China appear to be leading the charge









Core disruptions in the Energy Sector

A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

Modular construction

The potential to revolutionise all aspects of energy infrastructure development

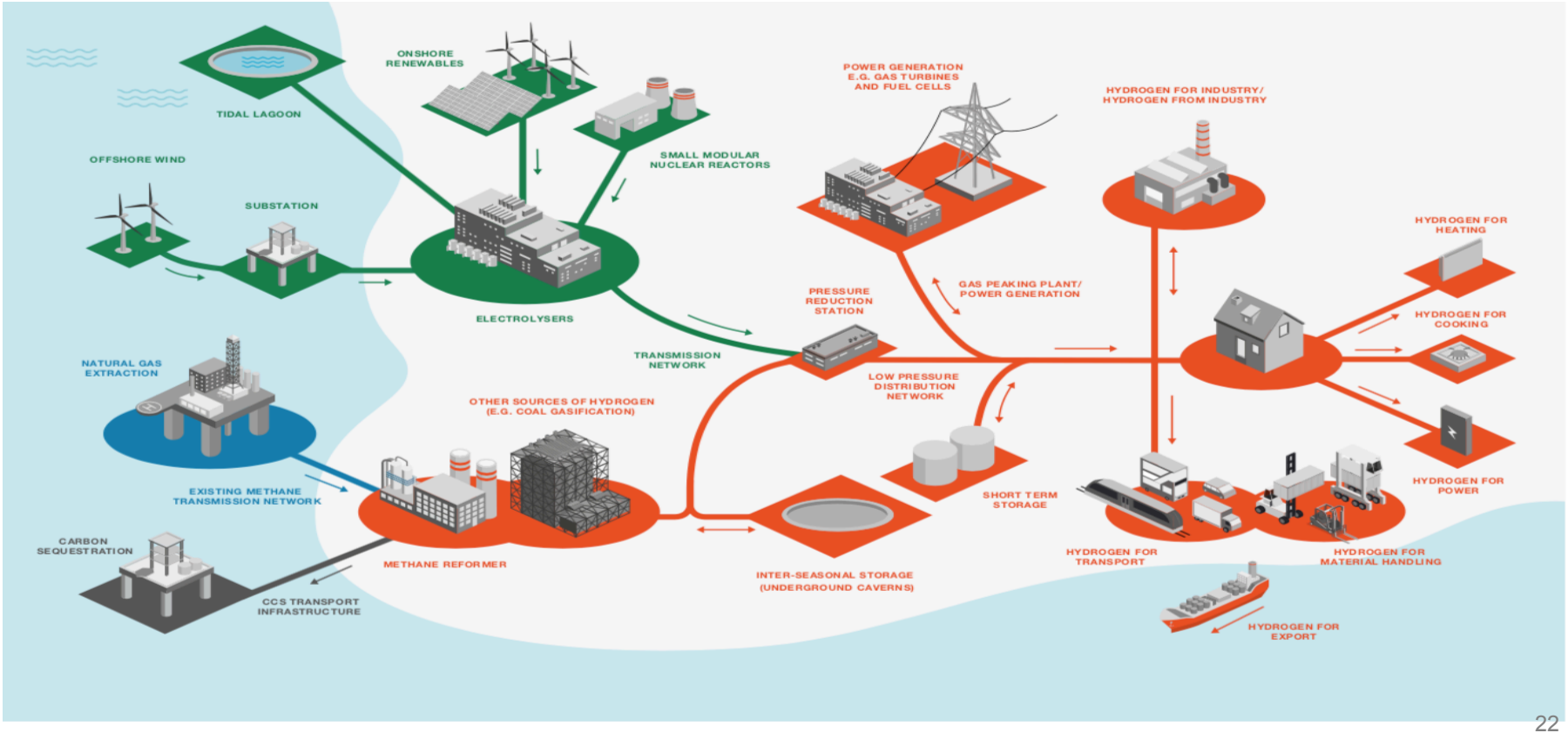
- **Manufacturing** – scale & productivity
- **Development** – increased productisation & new collaborative models
- **Material Suppliers** – re-invented supply-chains
- **Engineering & Construction** – increasingly commoditised
- **Infrastructure** – bundled projects & simplified codes and standards
- **Investment** – re-evaluation of future opportunities

Core disruptions in the Energy Sector

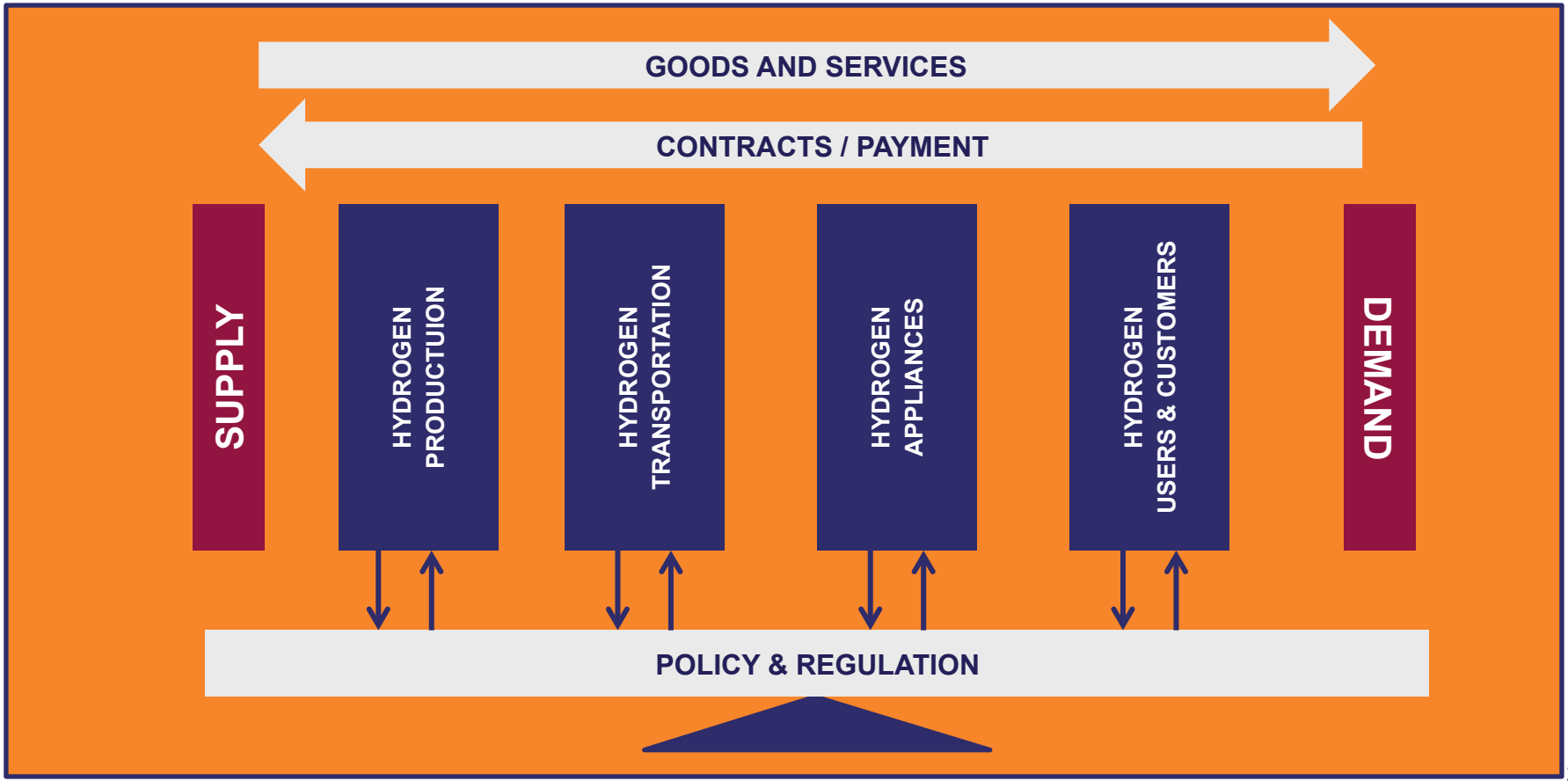
A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

The Hydrogen economy



Developing the Hydrogen value-chain

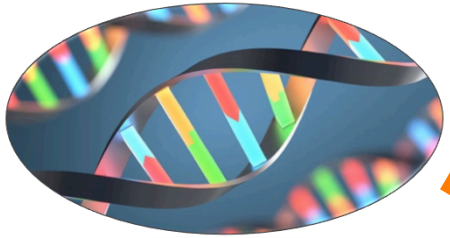


Core disruptions in the Energy Sector

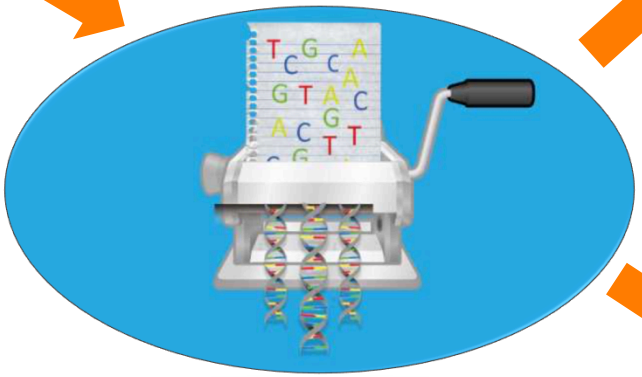
A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

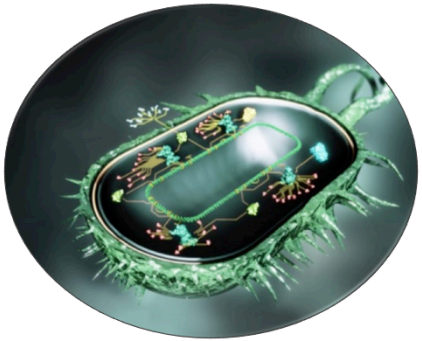
Synthetic Biology



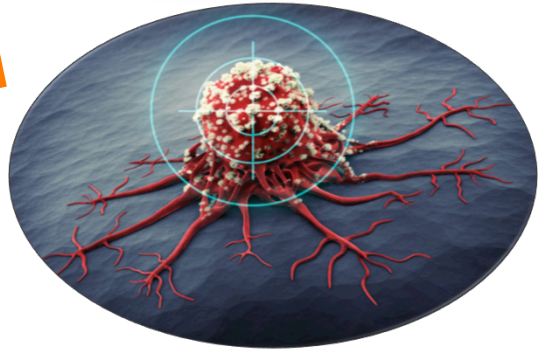
GENETIC ANALYSIS



GENETIC ENGINEERING

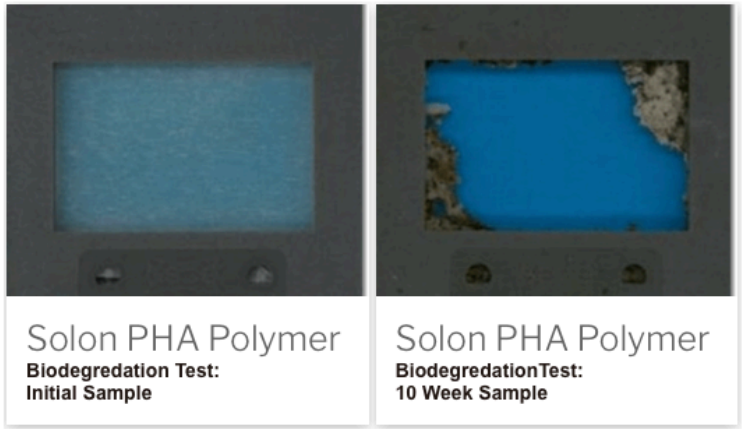


HIGH VALUE BIO-PRODUCTS



RWDC - SOLON

RWDC Industries has developed technology to harvest outputs of a microbial fermentation process using plant-based oils that produces a naturally occurring biodegradable polymer called PHA (or polyhydroxylalkanoate).



Solon is 100% Biodegradable

Solon breaks down into harmless substances—carbon dioxide and water—in marine, fresh water and soil conditions.

Solon has all the functional benefits of a petroleum-based solution, without the devastating environmental or ecological impacts.

Core disruptions in the Energy Sector

A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

Autonomous vehicles

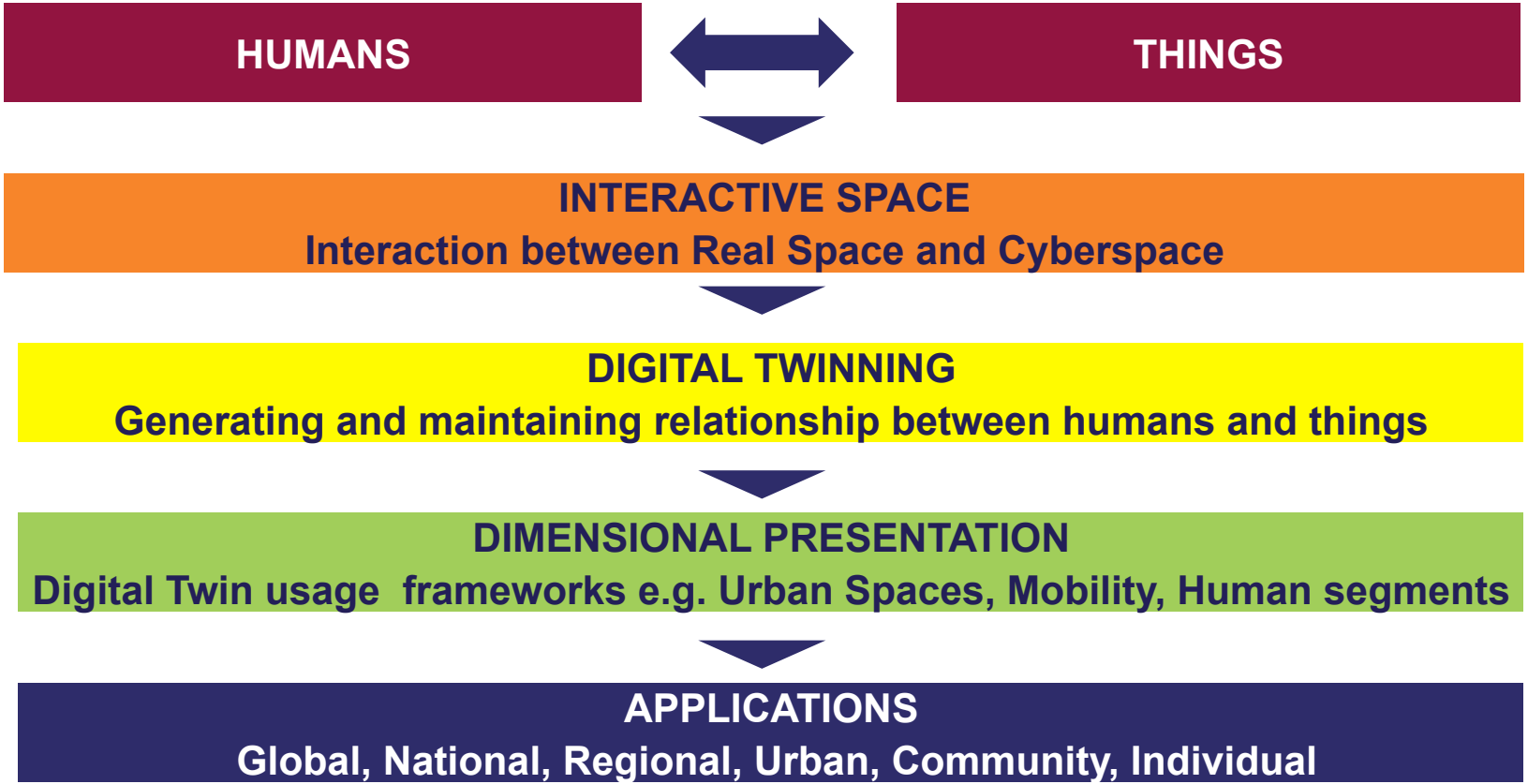
Time to start planning for a new mobility world

Core disruptions in the Energy Sector

A personal selection:- "Hope or Hype?"

1. **The Energy / Water / Food / Waste Nexus**
2. **Electrification – Energy Storage has the potential to be the single biggest disruptor in the energy sector**
3. **Modular Construction**
   - Mastering New technology, hybridised design, manufacturing, logistics
4. **The Hydrogen Economy**
5. **Synthetic Biology**
   - Bioplastics, Biofuels & Chemical recycling solutions
6. **Autonomous transportation**
   - Ultimate objective - delivery becomes cheaper than public transport
7. **Impact of AI / Machine Learning - Data integration / aggregation**
   - Re-layering the way everything works

A re-layering of the way everything works



Data Integration / Aggregation

- **Digital asset life-cycle management (the digital oilfield)**
  - Agility
  - Productivity
  - Pace of strategic decision-making
- **Circular collaborative ecosytems' development**
  - Cost reduction
  - Supply-chain re-engineering
  - Fast-tracking innovation
  - Operational transparency improvement
- **Innovative customer / stakeholder engagement models**
  - New services
  - Greater flexibility of offerings
  - New revenue- generating activities
- **Energising new energies**
  - Evolving energy value-chain architecture,
  - New energy sources and carriers
  - Innovative models to optimise and market energy

Unicorns and the rise of the Zebra

"There isn't much point trying to win the casino on the Titanic"

GLOBAL UNICORN CLUB: 326 PRIVATE COMPANIES VALUED AT $1B+

(as of 03/05/2019)

CYBERSECURITY

Cloudflare, CrowdStrike, Darktrace, Illumio, Lookout, Tanium

MEDIA

BuzzFeed, ByteDance, 网易云音乐, STX, SoundHound Inc., Vice, Vox Media, 一点资讯

TRAVEL TECH

Klook, Lime, traveloka, TripActions

AUTO TECH

Aurora, Momenta, Pony, Quanergy, 小鹏汽车, Youxia

DATA ANALYTICS

Actifio, Celonis, Cellibra, Confluent, Dataminr, MarkLogic, Palantir, Uptake

SOCIAL

Discord, hike, kik, 快手, Medlinker, Nextdoor, Pinterest, Tango

HARDWARE

Bitmain, Cambricon, Carbon, Coocaa, DJI, formlabs, Global Switch, Graphcore, Infinidat, Meizu, Royole

ON DEMAND

cabify, Careem, Convoy, 达达, 滴滴, DoorDash, GO-JEK, Grab, instacart, Lyft, Ola, Postmates, Swiggy, taxify, Uber, VistaJet

HEALTHCARE

Adaptive, Benevolent AI, Butterfly Network, Clover, DevotedHealth, GRAIL, GoodRx, HealthCatalyst, HeartFlow, indigo, ottobock., Nanopore, proteus, ROIVANT, samumed, Tempus, Zocdoc

FINTECH

Affirm, avaloq, AVANT, avidxchange, chime, Circle, credit karma, go'euro, Gusto, Kabbage, Klarna, monzo, N26, PLAID, policybazaar, Revolut, robinhood, stripe, TRADESHIFT, TransferWise, Toss, ZENEFITS

E-COMMERCE

About You, 爱回收, airbnb, allbirds, coupang, Fanatics, hims, Jollychic, JUMIA, OfferUp, OYO, PAT McGRATH LABS, SHOPCLUES, snapdeal, SoFi, THG, Thumbtack, tokopedia, udaan, VANCL 凡客诚品, WARBY PARKER, wish, 小红书

OTHER

APUS, CELLO, COMPASS, ESR, easyhome, IMPROBABLE, JUUL, KATERRA, KENDRA SCOTT, L&P Cosmetic, LifeMiles, MINISO, 满帮集团, mindmaze, NIANTIC, Opendoor, ORCAM, PROCORE, ROCKET LAB, ROOT, RUBICON, SPACEX, Supreme, toast, UBTECH, unity, WeWork, yello mobile, iTutorGroup

INTERNET SOFTWARE SERVICES

58同城, afiniti, Airtable, AppDirect, APPLOVIN, asana, AUTOMATTIC, BREX, BYJU'S, confluent, DEEZER, docker, FLASHEX, FLEXPORT, freshworks, HashiCorp, infor, INTERCOM, InVision, ironSource, 拉卡拉, legalzoom, 链家, LinkDoc, LinkSure, looker, MEDALLIA, netskope, oscar, pagerduty, Quora, RobloxRoblox, rubrik, 商汤, ServiceTitan, slack, SMS ASSIST, SQUARESPACE, STARRY, SYMPHONY, talkdesk, UiPath, VIPKID, walkme, 依图 | YITU, zeta, 知乎, ZipRecruiter, zomato, zoom

Unicorns and the rise of the Zebra

"There isn't much point trying to win the casino on the Titanic"

Thank you

Questions?

www.energyinst.org

Follow us: @EnergyInstitute

Join us: Energy Institute