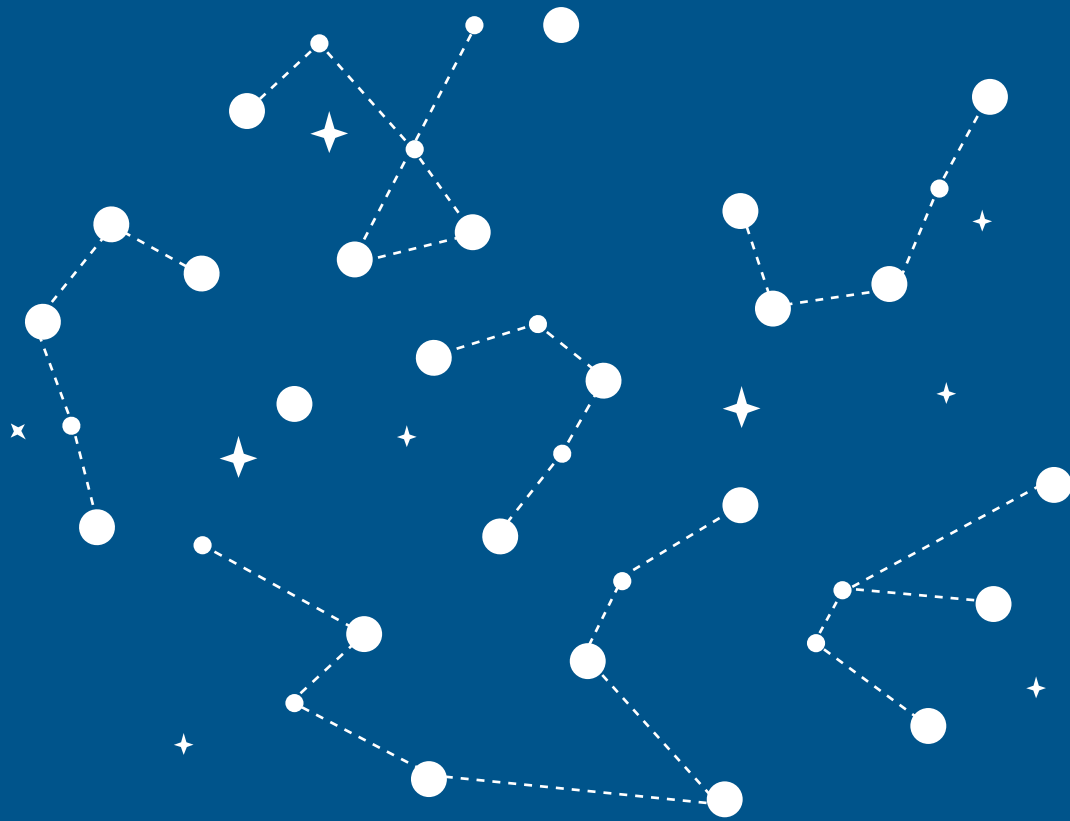


Designing for Disruptions



A NEW ERA FOR ENERGY

In Collaboration with Accenture Strategy

ABOUT THE WORLD ENERGY COUNCIL

The World Energy Council is the principal impartial network of energy leaders and practitioners promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all.

Formed in 1923, the Council is the UN-accredited global energy body, representing the entire energy spectrum, with over 3,000 member organisations in over 90 countries, drawn from governments, private and state corporations, academia, NGOs and energy stakeholders. We inform global, regional and national energy strategies by hosting high-level events including the World Energy Congress and publishing authoritative studies, and work through our extensive member network to facilitate the world's energy policy dialogue.

Further details at www.worldenergy.org and @WECouncil

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ABOUT THE REPORT

The energy sector is undergoing widespread disruption. Technology is advancing rapidly while new business models are emerging. Government policies and public attitudes and behaviour are continuously evolving. The pathway to a sustainable future for energy companies is highly complex and uncertain, with numerous interconnected, non-linear trends creating both threats and opportunities.

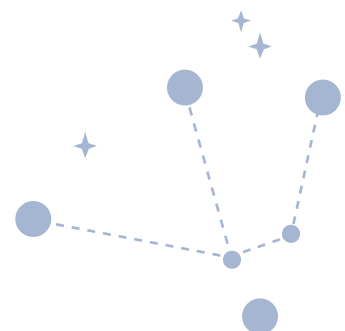
So how can energy leaders prepare for a world where disruption is simply business as usual? This is the question the World Energy Council and Accenture Strategy aim to answer in this report. Covering mindsets, trend-sensing, ecosystems, and more, the report sets out a structured methodology for understanding, managing, and leading disruption.

In particular, it introduces the “Constellation of Disruptions” (CoDs), an innovative framework for explaining the combinatorial effect of changes in technology, society, business and policy. By helping leaders better understand complex current and future changes, CoDs is a radical new way to think about – and lead – the energy sector.

Produced in collaboration with:
Accenture Strategy as Project Partner, Scenarios

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**“THE FUTURE CANNOT
BE PREDICTED, BUT
FUTURES CAN BE
INVENTED”**

– DENNIS GABOR †

A decorative graphic at the top of the page consists of several horizontal, wavy lines in shades of blue. Some lines are solid, while others are dashed. Scattered throughout these lines are several small, four-pointed star shapes and larger, solid blue circles of varying sizes, creating a constellation-like pattern.

INTRODUCTION

Managing a successful global energy transition – one that secures the benefits of reliable, affordable and sustainable energy for all – is challenging. Indeed, if not handled well it has the potential to pose an existential threat, not just to industry participants, but to society itself.

Today's energy systems are being disrupted by rapid advances in the cost and capability of technology, as well as new business models, policy changes and shifts in societal behaviour. Some sectors are converging, others are emerging and value is shifting within as well as in and out of industries. Incumbent players are looking to reinvent themselves while non-traditional players are entering the fray.

A stark example of this disruption can be seen in the coal industry. Demand over the last ten years has remained broadly flat, yet significant value has left the industry as a result of major policy and societal change. The power sector is also undergoing disruption as value is shifting to new forms of generation and to consumer-centred energy services (such as the trend for “smart everything”), where traditional sector capabilities may have limited application and new platforms built by technology start-ups can rapidly enter the industry.

The energy industry must pivot in response to this disruption. However, this is a complex undertaking that needs to consider numerous non-linear implications. For example, reductions in energy consumption and emissions per capita through efficiency improvements or cleaner fuels may be offset by higher miles travelled per capita due to the lower cost and accessibility of autonomous and/or shared mobility services. Traditional forecast models are not equipped to incorporate these kinds of combinatory developments in technology, policy, business and society.¹

So how can energy leaders better prepare and equip their businesses for disruption as usual?

The answer to this question has four parts. First, moving to a mindset of “disruption as usual”. Second, staying on top of emerging and future technology, policy and societal trends. Third, expanding know-how of and access to business ecosystems. And finally, understanding and designing for potential “Constellations of Disruptions” (CoDs).

The report now considers each of these components in turn. It also goes on to explain how, to help energy leaders better explore these themes, the World Energy Council, in collaboration with Accenture Strategy Energy and The Dock (Accenture's Global Centre for Innovation), have developed an approach to apply the CoDs concept in a workshop environment, which will be showcased at the 24th World Energy Congress.

**“WHEN YOU’RE
FINISHED CHANGING,
YOU’RE FINISHED”**

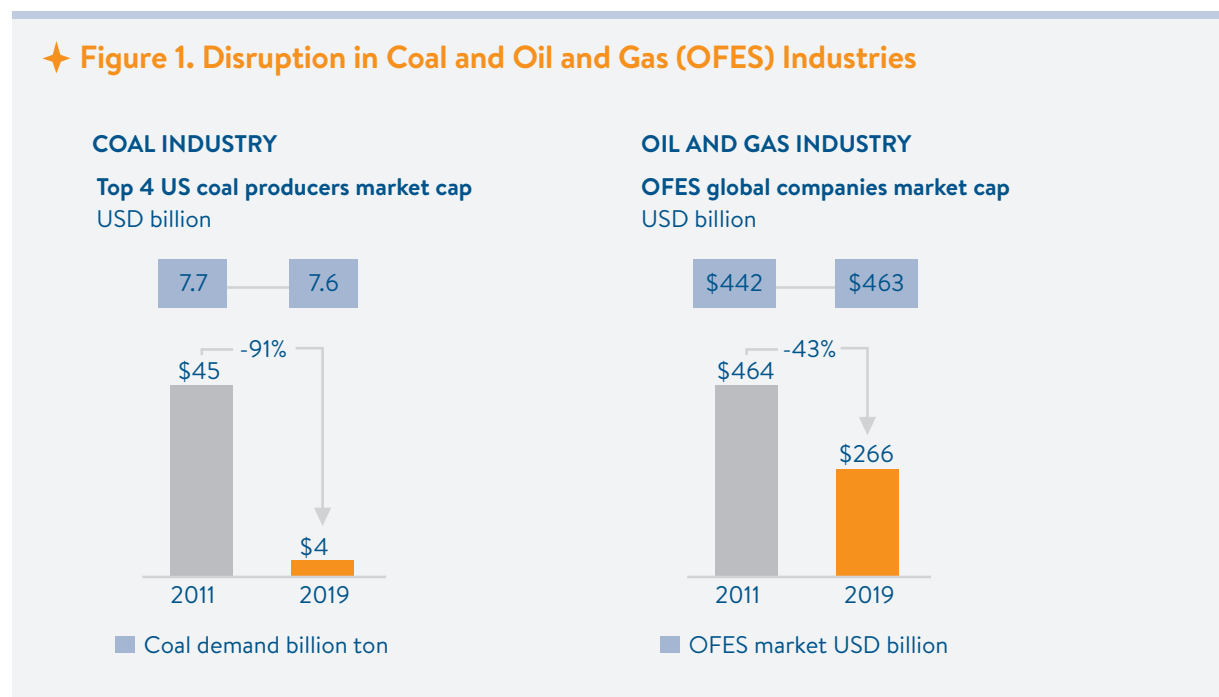
– BENJAMIN FRANKLIN ✦

PART 1 | MOVING TO A MINDSET OF “DISRUPTION AS USUAL”

Disruption is not a new business concept. Yet history is littered with examples of companies and industries which did not respond fast enough to rapid change and no longer exist. An overused yet powerful example is the demise of bricks and mortar video rental (Blockbuster) and the rise of online content streaming (Netflix).

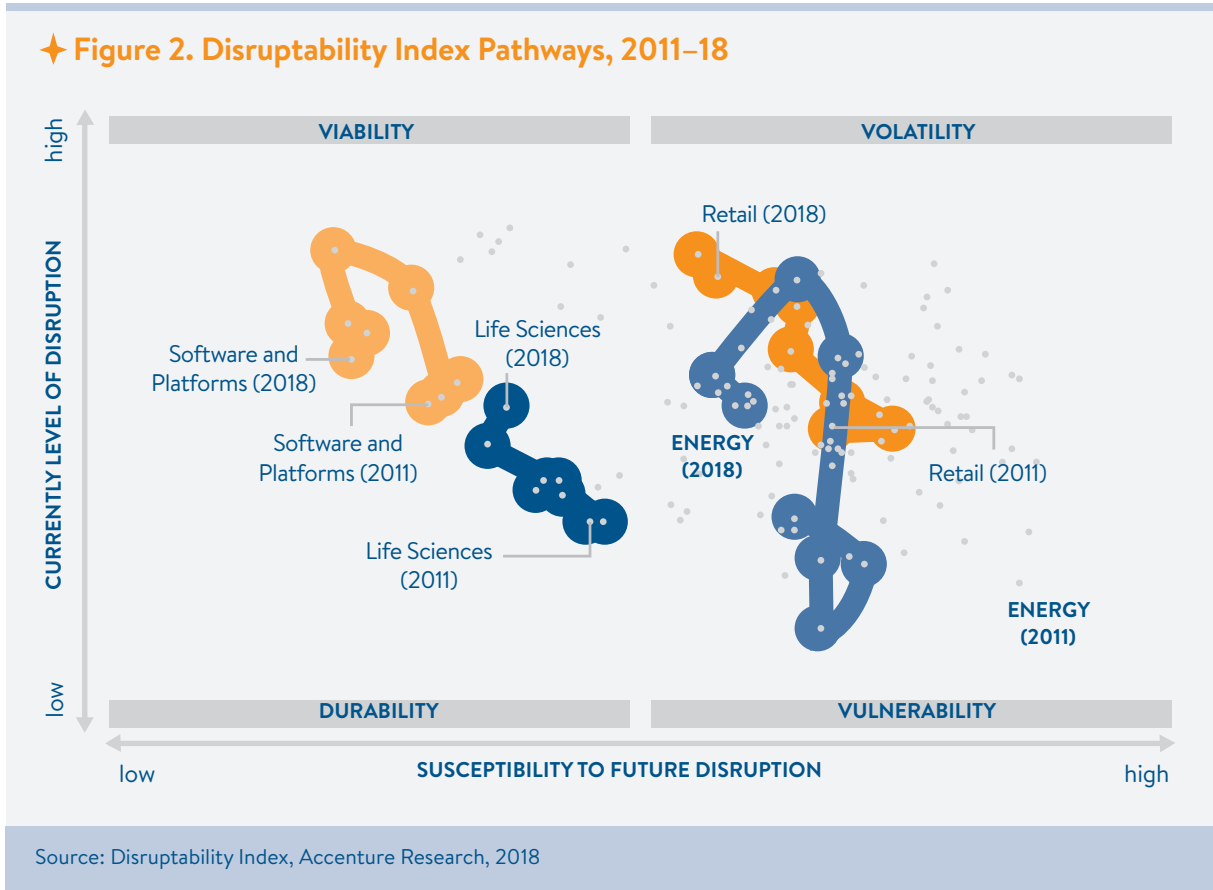
Closer to home for the energy sector, both coal and (more recently) upstream oil and gas have been undergoing profound disruption. Incumbent players are struggling to find a long-term and viable pathway due to technology-led, and often policy-supported, innovation. For example, in the oilfield services segment, while the market size has grown, an oversupply of resources has reduced the premium of new technology, lowering the entry barriers for independents who have commoditized technology and compressed margins (Figure 1).

✦ **Figure 1. Disruption in Coal and Oil and Gas (OFES) Industries**



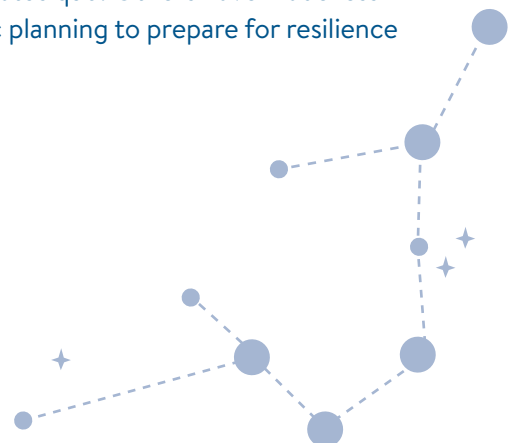
Indeed, the energy industry as a whole is braced for unprecedented disruption. Accenture research shows the industry today has the same level of susceptibility to future disruption as life sciences (which is being impacted by the patent cliff and new entrants) and is only just behind the retail sector (where digital and e-commerce continue to bite) in terms of its susceptibility to future disruption (Figure 2).² This susceptibility is a result of supply and demand side innovation: the fundamentally different economics of both new and existing sources of energy combined with changing consumer preferences, digital enablement of the energy system and a greater focus on decarbonisation. In other words, the energy industry is now shifting from compressive disruption (a series of gradual changes) to “big bang” disruption (game-changing shifts in demand and/or supply).

✦ **Figure 2. Disruptability Index Pathways, 2011–18**



Embracing disruption will require innovation at the centre of the new energy system. And the innovators will reap disproportionate rewards. Accenture’s analysis of 995 of the largest companies in 14 sectors, including a survey of 840 executives, showed that one of the key characteristics setting high-growth companies apart was their ability to harness disruption-minded innovation.³ That is, focusing on creating “what could be” rather than improving “what is”. These high-growth participants have put their innovation dollars “where their mouths are” and have significantly increased their investment in disruptive innovation with an eye on creating entirely new markets. That can mean diversification away from traditional energy assets, changing from asset-heavy to consumer-centric models, or driving virtual or real integration (and disintermediation) of the end-to-end value chain in order to capture shifting value pools.

Regardless, leading players need to adopt a mindset and culture of “disruption as usual”. For example, some companies have made visible interventions such as making board and C-suite executive appointments from outside the energy industry in order to challenge the status quo. Others have made less visible interventions such as including disruption as part of strategic planning to prepare for resilience and capitalise on opportunities.

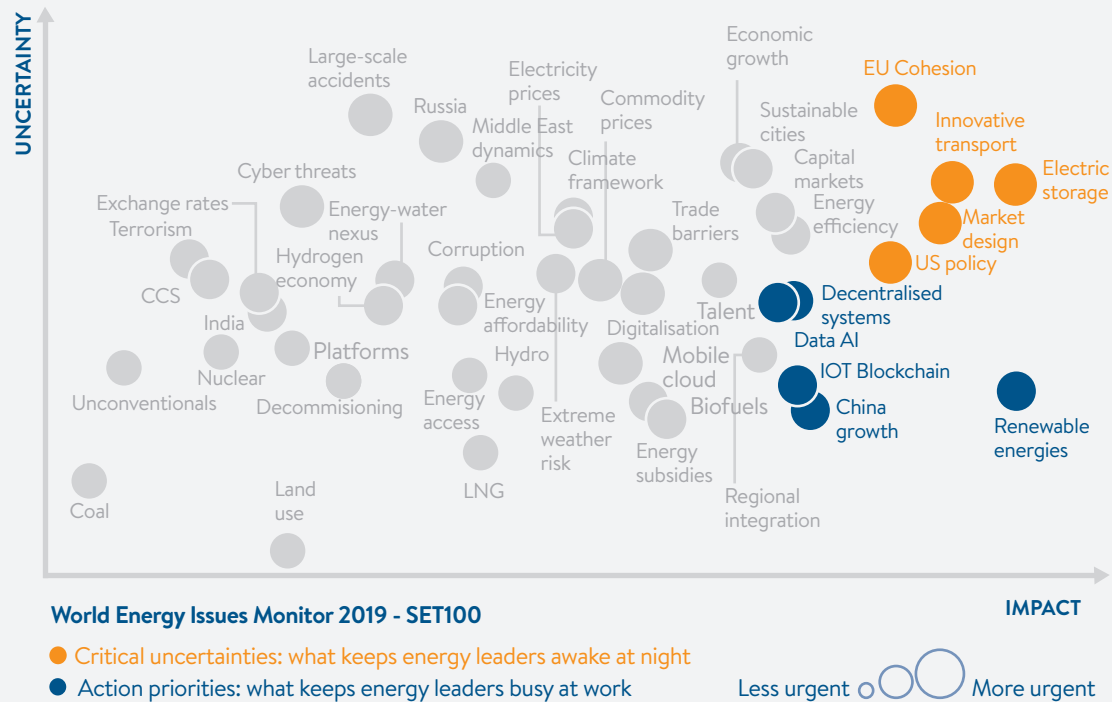


PART 2 | STAYING ON TOP OF EMERGING AND FUTURE TECHNOLOGICAL AND SOCIETAL TRENDS

This is an era of rapid technological innovation, changing market conditions, increasing regulatory intervention and, at times, agonizing geopolitical volatility. As such, to better understand where to play in the energy system – and how to win – energy leaders must be able to spot and react to significant new trends. This will not necessarily mean always being the first mover – fast followers can be effective as well. It does, however, imply that every industry participant must be able to detect the pulse of advances happening in a wide range of technologies, such as artificial intelligence or advanced materials, which have potentially material consequences for the sector. The same is true of shifts in society: how consumers prefer to live, work, and spend. These are the building blocks for identifying and pre-empting game-changing shifts in energy markets (Box 1).

BOX 1: ENERGY TRENDS CONCERNING THE TOP 100 START-UP INNOVATORS ✦

The World Energy Council’s Issues Monitor study identified the trends that were most concerning to the 100 most promising global energy start-ups (SET100).⁴ This revealed a combination of technology-driven, policy-driven, consumer-driven and market structure trends ranking highest in terms of uncertainty and impact.



Take the shale revolution in North America, for example. Many of the energy majors missed the combinatorial impact of emerging trends in hydraulic fracturing, horizontal drilling and water management. As a result, the majors fell behind and are having to pay (and in most cases overpay) billions to catch up. The winners were the smaller, nimbler and niche independents who spotted the technological advantage of combining these technologies early and were able to work with an ecosystem of different partners to drive the shale revolution that has reshaped the industry.

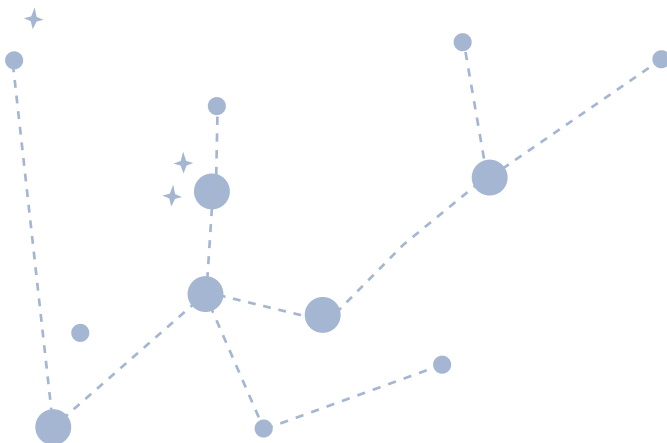
Looking ahead, storage is another trend that will effectively reconfigure many parts of the energy system, including mobility, power and consumption. The market is expected to grow at between 25 and 35 per cent CAGR over the next ten years as the “electrification of everything” continues. Currently, many different technologies are competing to become the storage solution of choice, from pumped hydropower storage to hydrogen-based energy systems to traditional batteries.

Batteries are undergoing rapid development as new technologies come to the fore. Lithium-ion (Li-ion) batteries, for years the go-to solution for battery storage, are being challenged by several new technologies. These look set to overcome the limitations of cost, raw material sourcing and overheating that have traditionally challenged Li-ion technology.

MIT, for example, is investing in the research of room-temperature sodium sulphur batteries (RT-NaS). These are promising alternatives to Li-ion batteries given the similar chemical properties of sodium and lithium ions. There are still technical challenges to overcome, such as lower theoretical capacity, but given the investment and research activity in this space, it is likely a matter of when rather than if this battery technology becomes a viable alternative at scale.

This type of investment and patent activity is expected to increase across emerging battery technologies, and furthermore across the various different types of storage solutions beyond batteries. The pull from consumers and society for clean energy will only continue to grow.

Knowing where to place bets on new technology is becoming harder and harder. Not all emerging technologies will be winners, and the industry will likely adopt a combination of solutions. Spotting which these will be requires further analysis into the specific underlying technologies and technological development driving each solution forward. One way to do this is to access knowledge from other industry participants and, sometimes, from outside the industry. Identifying emerging trends will inform how new ecosystems will emerge and access to these new ecosystems will increasingly become a source of competitive advantage.



PART 3 | EXPANDING KNOW-HOW OF AND ACCESS TO DIVERSE BUSINESS ECOSYSTEMS

The word “ecosystem” can have many meanings. In this report, it is defined as a network of cross-industry players who work together to define, build and execute a desired outcome underpinned by innovation in some form (whether in technology, consumer-centricity or business model). The power of the ecosystem lies in the fact that no single participant needs to own or operate all components of the solution, and that the value the ecosystem generates is larger than the combined value each of the participants could contribute individually.

Accenture Strategy surveyed 1,252 business leaders from diverse industries across the world to better understand the degree to which companies are capturing ecosystem opportunities.⁵ The findings showed companies are pursuing new business models to navigate, or even lead, disruption. When asked what they would typically do to disrupt their industry, 60 per cent of executives said, “build ecosystems”. Indeed, nearly half have already built or are currently building an ecosystem to respond to disruption.

The challenge for the energy industry is the complexity of new ecosystems. An estimated \$300 billion of venture investments have flowed into the sector through new entrants and non-traditional players in the past few years (Figure 3). The ecosystem is rapidly expanding, with over 1,000 new energy start-ups emerging. Participants range from traditional integrated companies looking to diversify and remain relevant to new energy transition actors, including mega-techs, VC-funded energy start-ups, globally connected cities and renewable energy communities. These players have started to combine their functional, technological and industry strengths to deliver new value propositions to customers that extend beyond the basic provision of heat, light and mobility. New energy value chains and business ecosystems are becoming consumer-centric rather than commodity-centric or supply-side driven.

✦ Figure 3. The Rapidly Expanding Energy Ecosystem –Transport and Power Examples

		TECHNOLOGY DISRUPTIONS	EMERGING PLAYERS	NEW BUSINESS MODELS
ENERGY BUSINESS OF THE FUTURE	TRANSPORT	Rise of autonomous vehicles	Apple, Google, Ford, Mercedes-Benz	✦ Fleet as a service
		Connected vehicles and sharing economy	Uber, Lyft, Zipcar	✦ Logistic systems e.g. always connected
		Technology - Multiple powertrains (e.g. fuel cells)	Tesla, BYD	✦ Retail automation
	POWER GENERATION			✦ Self-driving fleet
				✦ Fuel on demand
				✦ NextGen convenience
			✦ Connected home	
			✦ Demand response (smartgrid)	
			✦ Beyond-the-meter solutions	
			✦ Buying into storage - dispatchable power	
			✦ Distributed generation (roof solar, microgrid)	
			✦ Data-related services	

Source: Accenture Strategy Energy

Enabled by new digital capabilities, the emphasis is shifting from volume-based to value-added growth. The aim is to meet growing demand for highly customised, flexible, affordable and on-demand energy and energy-plus service offerings rather than simply enabling cheaper and cleaner energy supply and storage options. This is also one of the central elements of the energy future narratives in the World Energy Council's 2019 World Energy Scenarios.⁶

Managing ecosystem complexity is not just a challenge for the energy industry. Many organisations in many sectors are grappling with the same issues. But Accenture Strategy's research into ecosystems has identified three common attributes that organisations who extract the most value from ecosystem participation are getting right.

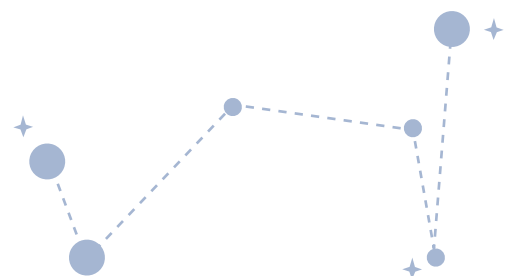
The first is data collaboration. Leading organisations see **data collaboration** as a winning capability rather than a threat. Companies are increasingly using analytics to drive data insights, but the richness and depth of those insights increases exponentially when internal data is coupled with data from outside the enterprise. This, however, requires a mindset shift for an industry where knowledge is power, and data is a driver of competitive advantage.

The second attribute is **talent pooling**. This is particularly relevant to the energy sector, where talent is scarce and aging. Leading organisations are willing and able to lift and share talent with other organisations for a certain amount of time and then bring that talent back. This approach speeds up access to experience and differentiated capabilities and opens the door to a deeper and wider talent pool. This way of working is nascent in the industry today and provides a significant opportunity to extract value from the ecosystem. Industry examples to date have typically been between two organisations (such as niche analytics providers and upstream geologists) rather than among multiple partners as part of an ecosystem.

The final attribute is **platform co-development**. Platforms are the lifeblood that enable ecosystems to collaborate and thrive. Importantly, they cannot be created alone. Successful platforms start with a smart foundation to build partner interest and investment, accelerating adoption and expansion. The energy industry has made significant inroads into common platforms. But a mindset shift is still required to open internal systems to a rich and collaborative partner platform where data, insight and value can be created for all participants.

Consider how a leading European utilities player has embraced the power of ecosystems and launched a Smart Energies initiative to create a start-up environment where all participants can thrive. The common goal is to drive innovation in the transition to clean and green energy initiatives. The organisation funds the ecosystem and drives a culture of data collaboration and talent pooling enabled by a common platform.

Ultimately, the pace and breadth of innovation today means no single entity can access, develop, utilise, or invest in the range of available opportunities or shape a targeted outcome on its own. By bringing together multiple players – in effect forming an ecosystem of participants with common objectives – existing value chains can be disrupted and new sources of value scaled rapidly. This is a new kind of horizontal and collaborative innovation that has the potential to reshape competitiveness by reducing costs by more than 40 per cent.⁷ Leaders pursuing disruptive growth through an ecosystem initiative must make the right plays, find the right partners and think outside of traditional boundaries.



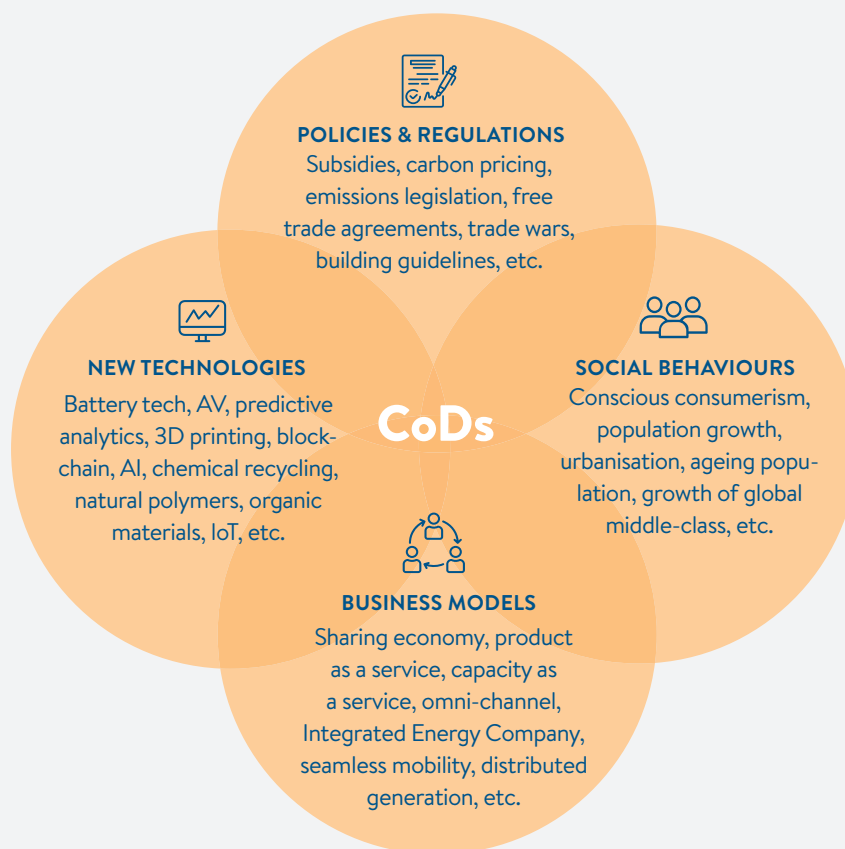
PART 4 | DESIGNING A CONSTELLATION OF DISRUPTIONS

A Constellation of Disruptions (“CoDs”) refers to a grouping – a constellation – of trends that provides new ways of understanding the combinatorial effect of changes in technology, society, business and policy (Figure 4). Understanding the CoDs approach will enable ecosystem leaders to identify how best to capture new and shifting value pools by pushing the boundaries of the traditional energy sector.

✦ Figure 4. Constellation of Disruptions Defined

CONSTELLATION OF DISRUPTIONS

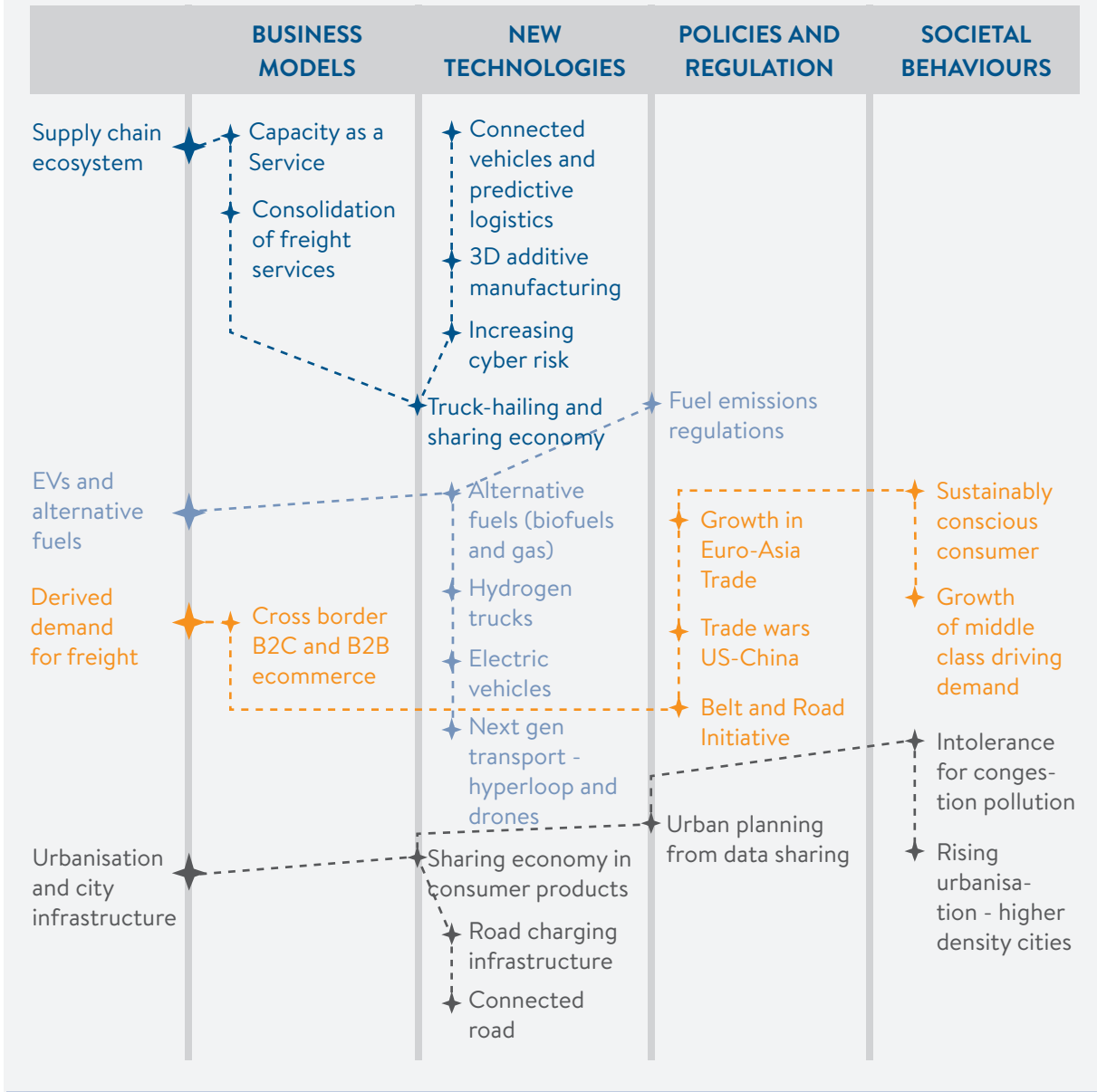
A collection of disruptions that, at their intersection, yield game-changing shifts in the way energy markets operate.



The CoDs approach was explored in a series of regional workshops as part of the World Energy Council’s global “foresight and scenarios refresh” in 2019. In these sessions, a wide range of constellations was explored, including the future of passenger mobility and freight transport, the future of plastics and the new consumer, smart industry and green buildings.

One such constellation was commercial mobility (that is, commercial fleets and road freight), where a number of individual high-impact emerging disruptions were identified (Figure 5).

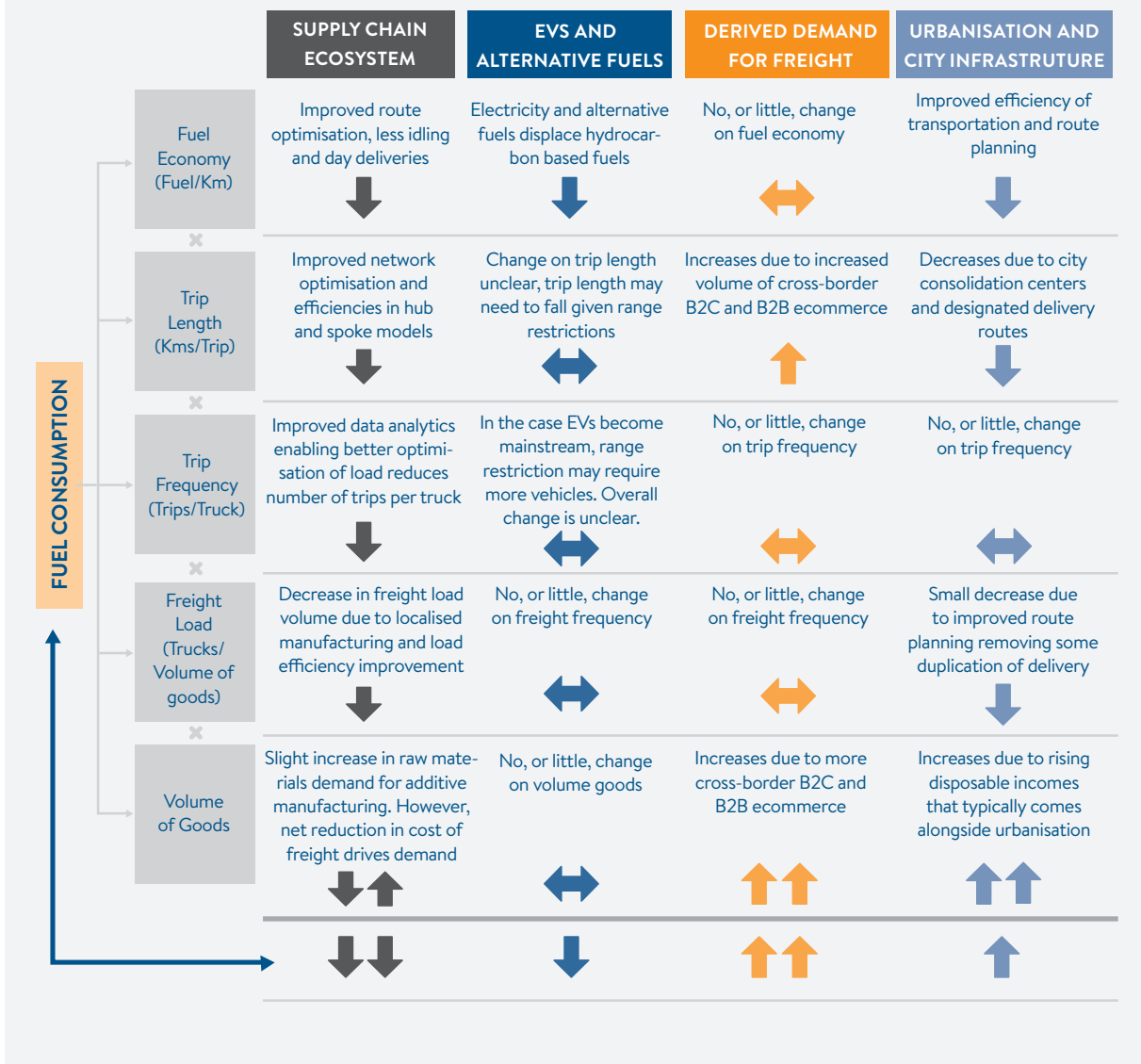
✦ **Figure 5. Constellation of Disruptions in Commercial Road Fleets**



Each trend was grouped into one of four themes: policy, social, technology or business model. By looking across these themes, and investigating the links and relationships between the trends, four constellations emerged. These were the supply chain ecosystem, electric vehicles (EVs) and alternative fuels, the derived demand for freight, and urbanisation and city infrastructure.

However, these four constellations represent just one possible grouping of disruptions. The intention is not to define a linear and single version of the future, but rather to explore a series of constellations that could emerge and result in non-linear outcomes. These constellations can then support a better understanding of the combined directional impact on areas like fuel consumption and fuel mix (and consequently the distribution between clean and fossil fuels). Figure 6 highlights, for example, how the impact on fuel consumption can be assessed.

★ Figure 6. Impacts of Constellation of Disruptions on Fuel Consumption of Commercial Road Fleet



In the **supply chain ecosystem** constellation, technology and business model trends combine to yield a reduction in fuel consumption. The increase in the volume of data from vehicles, supported by predictive analytics, enables an optimisation of supply chain networks. In parallel, new manufacturing technology reduces the volume of final goods to be transported. The net impact is a significant reduction in final energy (fuel) demand, regardless of source.

In the **EVs and alternative fuels** constellation, options differ by vehicle size. For light commercial vehicles (defined as less than 3.5 tonnes), electrification at pace is displacing petroleum fuels. For medium and heavy commercial vehicles, change is much slower, due to the typically lower vehicle turnover rate and the slower progress of alternative fuel technologies. In this segment of the market, hydrogen, gas and biofuels are the emerging alternatives to diesel as consumers continue to demand sustainable supply chains and as distribution infrastructure issues are resolved. The net impact is a significant reduction in the carbon footprint of final energy demand and a relative reduction in final energy demand due to increased fuel efficiency.

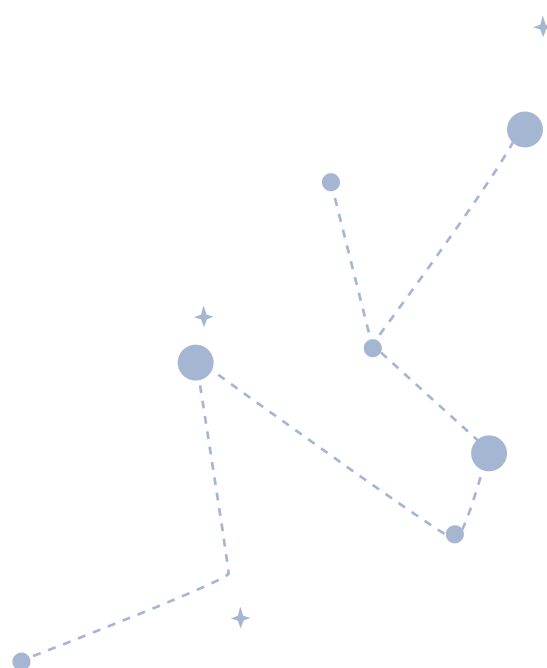
In the **derived demand for goods** constellation, the continued growth of e-commerce as a share of total global retail, combined with projected population growth and rising incomes, will significantly increase the demand for consumer goods and thus the freight of products and raw materials. An increasing urbanisation rate (the share of total population living in urban environments is expected to rise from 33 per cent in 2017 to 50 per cent in 2060)⁸ will only accelerate this trend as incomes continue to rise.

In the **urbanisation and city infrastructure constellation**, the emergence of connected infrastructure, the use of the resulting data for urban planning and the demand for sustainable cities will enable an optimisation of commercial transportation and last-mile delivery. The net impact is increased commercial miles and higher final energy demand.

The value of the CoDs approach is thus clear. Moreover, the impacts it can identify are often missed in other projections and scenarios where the focus is on a single trend (for example, the transition from internal combustion to EVs) or on a single combination of trends (such as ride sharing and EVs). Such a narrow approach risks grossly underestimating the exponential impact of CoDs across technology, policy, consumer behaviour and business model vectors.

Through its work on future World Energy Scenarios, the World Energy Council aims to transcend these limitations. The dominant drivers of the three 2019 scenarios are: coordinated policymaking in **Unfinished Symphony**, market-led innovation and consumer choice in **Modern Jazz**, and localisation and energy security in **Hard Rock**. These drivers offer a vital steer on the potential scale and speed of development in each sector.

Take transport, for example. In the **Modern Jazz** scenario, the rapidly falling battery costs and high availability of hydrogen, gas and biofuel vehicles drives a displacement of oil-based fuels in the light and heavy commercial vehicles segments. In the **Unfinished Symphony** scenario, a similarly paced dynamic accelerates post 2030 with progressive regulatory support where final energy demand for transport declines below 2020 levels. Here, consumer choice and advocacy play critical roles. In the **Hard Rock** scenario, some progress in EVs and other alternative fuels is seen as current investment plays out, especially in regions where energy security drives an adoption of locally produced fuel. However, if EVs and alternative fuels were to reach affordability faster (that is, before exceptionally high barriers to trade kick in) and supporting infrastructure is put in place, this scenario could see a rapid transition in commercial mobility.



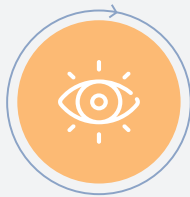
PART 5 | APPLYING A CONSTELLATION OF DISRUPTIONS

At its heart, the CoDs approach seeks to help leaders navigate an uncertain world in a structured way and realise fast-emerging value growth opportunities. Traditional global energy modelling systematically fails to analyse the combinatorial effects of innovations accurately. With CoDs, the user overcomes this short-coming and makes a measured judgement on which disruptions could yield material combinatorial effects on the sector concerned. This judgement can then be taken forward into a formal modelling exercise, once the disruptions of interest and their relationships have been explored.

The World Energy Council, Accenture Strategy and The Dock (Accenture’s Global Centre for Innovation) have co-designed a toolkit for exploring the CoDs concept through an engaging and immersive experience. Building on leading practices in strategic foresight, design thinking, and immersive technology, this toolkit can help leaders contextualise trends and help them better respond to future disruption innovation.

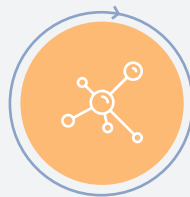
At the World Energy Congress 2019, the World Energy Council, Accenture Strategy and The Dock will be convening around 80 CEOs in a “Design for Disruption” workshop, taking them through a series of exercises to explore the CoDs concept and use it to uncover pockets of disruptive innovation (Figure 7). The workshop will introduce elements of facilitation, game play, experience and learning to increase engagement with the concept and open new areas for discussion not previously anticipated by attendees or the research.

✦ Figure 7. Constellation of Disruptions Design Process



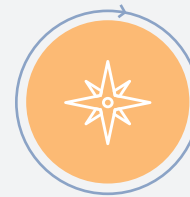
VISION

Groups get to know each other through a facilitated exercise and go on to discussing and formulating their future vision for the energy sector.



DISRUPTION

Participants are presented with a set of future disruptors and are prompted to explore how a combination of various factors will impact their vision.



EXPLORATION

After having gained a good understanding of the effects of specific disruptors, participants get exposed to three macro-level scenarios of how the energy system will evolve by 2040.

Source: The Dock, Accenture Strategy, World Energy Council

In small facilitated groups, leaders will develop a vision for the future of their energy sector. In exploring the CoDs to articulate that vision, participants will develop a richer understanding of the CoDs approach and content. With a disruption mindset, participants will evaluate how the CoDs impact their current state and future vision, investigating disruption trends. They will explore new visions of the future leveraging the disruption content and, using their own personal industry experience, contextualise the impacts of that future for other attendees.

This process acts as an introduction to the World Energy Scenarios 2019, through which attendees can stress-test their disruption designs and explore the pathways by which those designs are accelerated or challenged. It is through an immersion in the scenario content and an application of the CoDs tool that leaders can begin to identify where disruption-driven opportunities may arise –and what implications they have for the energy sector.

ANNEX

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✦ REFERENCES

1. Maurizio Gargiulo and Brian Ó Gallachóir, 2013, Long-term energy models: Principles, characteristics, focus, and limitations, Wiley Blackwell, vol. 2(2), pages 158-177, <https://onlinelibrary.wiley.com/doi/abs/10.1002/wene.62>
2. Accenture (2018), Disruption Need not Be an Enigma, <https://www.accenture.com/gb-en/insight-leading-new-disruptability-index>
3. Accenture (2018), How to unlock the value of your innovation investments, <https://www.accenture.com/us-en/insights/consulting/innovation-investment-value>
4. World Energy Council (2019), World Energy Issues Monitor 2019, <https://www.worldenergy.org/publications/entry/world-energy-issues-monitor-2019-managing-the-grand-energy-transition>
5. Accenture (2018), Cornerstone of Future Growth: Ecosystems, <https://www.accenture.com/gb-en/insights/strategy/cornerstone-future-growth-ecosystems>
6. World Energy Council (2019), World Energy Scenarios 2016: Managing the Grand Energy Transition, <https://www.worldenergy.org/publications/entry/world-energy-scenarios-2016-the-grand-transition>
7. Accenture (2017) Breaking Bad Habits: A new Ecosystem Strategy in Oil & Gas, <https://www.accenture.com/gb-en/insight-breaking-the-bad-habits>
8. Goldman Sachs (2019) Equity Research – The Future of Mobility, <https://www.goldmansachs.com/insights/pages/future-of-mobility.html>

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