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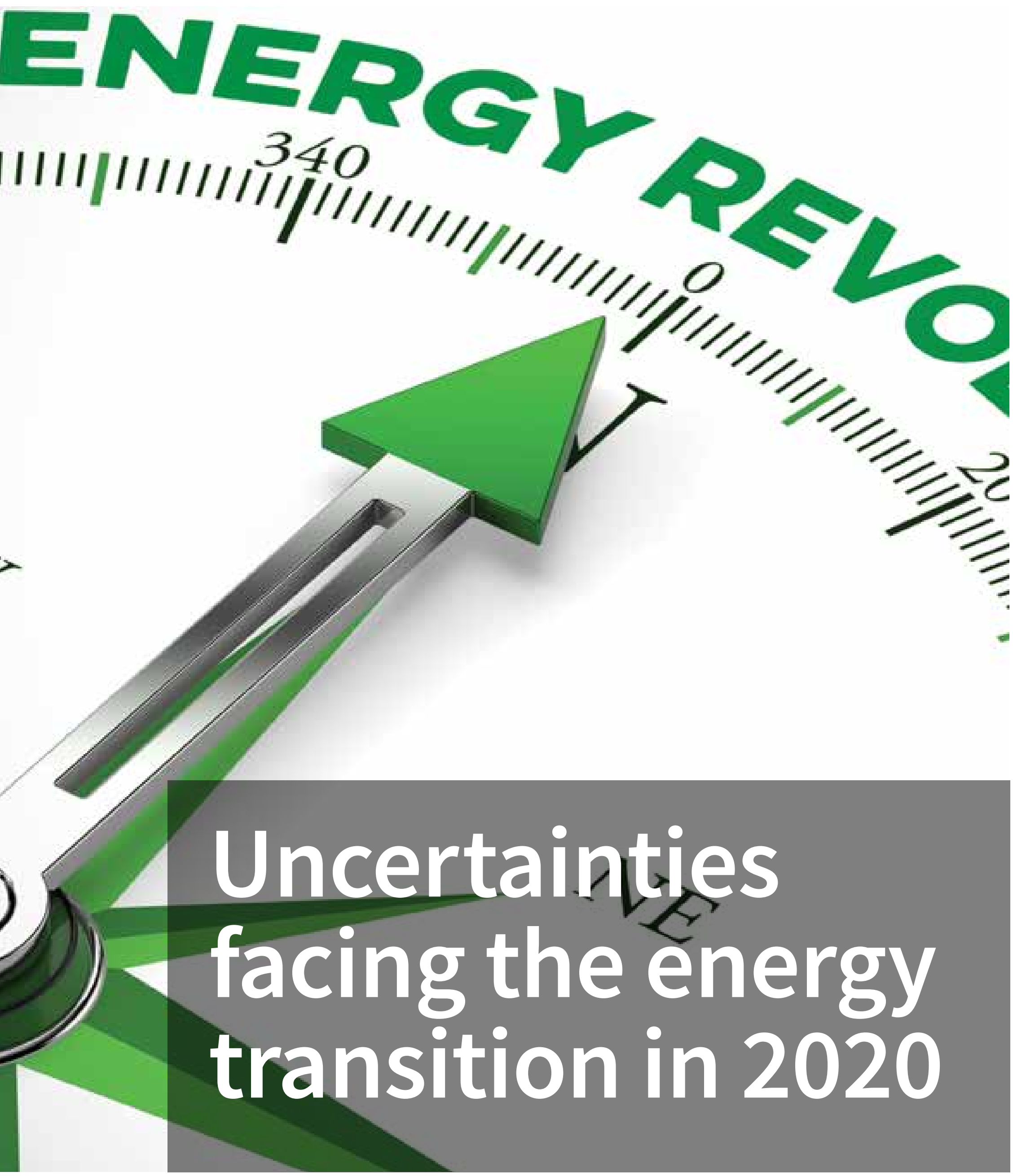

Uncertainties facing the energy transition in 2020

Uncertainties facing the energy transition

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Concerns about climate and sustainability have reached the top of the agenda for corporate leaders. For the energy business, the sustainability challenge is being addressed through the prism of the energy transition. As this edition of Insights shows, the theme of energy transition is impinging on all aspects of the value-chain and all sectors whether upstream oil investment, downstream refining and chemicals strategies, or power generation technology and fuel choices. The energy transition is also building closer links through to adjacent sectors such as plastics and the agribusiness. In each case the strategic decision is always the timing and extent of the pivot to new business models which are different for each sector, for each geography, and for each company. But if the timing and choices are difficult, the direction of travel is clear.

Oil companies face the most acute dilemma. IHS Markit's tracking of their investments illustrate a wide and diverging array of strategies. Low carbon spending is surging but still remains only about 3% of corporate capex for the largest International Oil Companies and National Oil Companies. Nevertheless they are pursuing research and development, strategic partnerships and M&A into new business sectors.

For downstream oil, new long horizon investments are faced with the prospect of declining demand for transportation fuels and pressure to decarbonize remaining liquid fuels. Refining companies can take a defensive or proactive stance. A defensive stance might include focusing on plant reliability, lowering costs, and buying emissions credits. A proactive stance involves investing in low-carbon strategies including biofuels, bio-integration, lower carbon intensity crude oils and perhaps hydrogen.

Recycling has emerged as a key challenge for the wider chemicals business. The choices are complex. Collected waste plastics can be mechanically recycled back to plastics, chemically recycled to monomers, or molecularly recycled to feedstocks. Each recycling route will exert its impact on the supply and demand of virgin plastics, virgin monomers, and virgin feedstocks.

Electricity is often considered one of the relatively easier sectors to decarbonise. Here we look at the choices being made in the developed economies of Europe and the developing markets of Southeast Asia. In Europe there has been a return to strong growth in the roll-out of solar power—both utility-scale and distributed. Solar can increasingly stand independent of subsidies because of its growing cost-competitiveness. In Southeast Asia, countries also have high and realistic aspirations for renewable power growth, but the region also has a legacy of relatively young thermal power plants—coal and natural gas-- which will remain a critical part of the mix for many years.

Beyond electricity, biofuels can play a major role in the energy transition because of their ability to blend into the existing energy complex. Key drivers behind biofuel development traditionally were energy security and farm income support. However the third driver of decarbonisation is now coming to the fore. Traditional biofuels are looking to lower their carbon intensities while the real prize is a wide array of so-called advanced or second generation feedstocks.

Carbon credit markets could play a key role in the energy transition by setting suitable price signals for emissions. These carbon markets had a mixed year in 2019 as they expanded across North America but also continued to face political opposition and legal challenges.

At times the drivers for shareholder return and the drivers for environmental stewardship are in tension and at times they are in alignment. IHS Markit's ability to monitor and analyse industry across sectors will be critical as companies face ever more complex and integrated markets.

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M&A and venture investments offer oil and gas companies differentiation opportunities within the low-carbon space

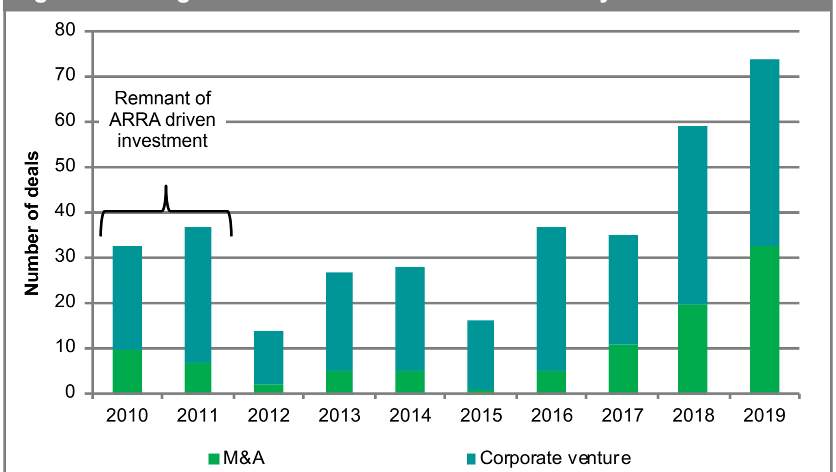
The transition toward a lower-carbon energy world has created new challenges for upstream oil and gas companies. In addition to existing pressures, including commodity price volatility and geopolitical risks, these companies also face growing pressure from shareholders, governments, and the general public to reposition their business models to compete in a new energy landscape. For now, the majority of the upstream industry remains focused on the core oil and gas business. A growing array of companies—spanning international oil companies (IOCs), national oil companies (NOCs), and the service sector—has begun to incorporate the low-carbon segment into their strategies while taking steps to build integrated business models across the energy value chain, diversify existing corporate portfolios, and reduce portfolio concentration risk.

Spending in this area remains small on a relative basis. IHS Markit forecasts the low-carbon segment to account for only 3% of overall corporate capex, in aggregate, for the largest IOCs and NOCs in 2020. Nevertheless, absolute low-carbon spending has surged and is expected to approach $14 billion for the overall industry this year, per IHS Markit estimates. We expect this trend to continue: for example, aggregate low-carbon spending among the Global Integrateds peer group is forecast to surpass $10 billion by 2025, up from $6 billion in 2018.

Some IOCs and NOCs are taking multiple approaches to incorporating low-carbon businesses into their portfolios. These range from internal research and development of low-carbon technologies (e.g., Eni's development of polymer-based solar panels at its Novara R&D facility) to strategic partnerships (e.g., a 50:50 joint venture between Bunge and BP to create a bioenergy company in Brazil) to external investments in standalone low-carbon companies (e.g., Suncor Energy's investment in Enerkem). Each approach has strengths and drawbacks. For example, internal development of low-carbon energy solutions requires a trade-off between extended time to build the technical and commercial capabilities in the organization and the benefits of strategic differentiation achieved by developing a proprietary solution.

Given the urgency for oil and gas companies to demonstrate their commitment to incorporating low-carbon initiatives into their portfolios, investments are an attractive option. Companies can quickly access business segments beyond traditional oil and gas operations, such as new parts of the energy value chain or geographies outside of oil- and gas-producing areas. Two classes of investment of particular interest are M&A and corporate venture investing. The M&A market allows companies to establish a new or growing presence within the low-carbon segment, via acquisitions, direct investments, and joint ventures. Corporate venturing is another option, in which E&P organizations incubate new technology at arm's length from the parent company. Through in-house venture capital groups, companies take small equity stakes, typically $1 to $5 million, in startup technology companies. Unlike traditional venture capital, which seeks to maximize its financial returns through investment exits, corporate venture capital groups also have strategic goals – such as developing technologies to enhance operations, commercializing internally developed intellectual property, or gaining

Figure 1: Oil& gas M&A and direct clean tech activity



Notes: M&A includes acquisitions, direct investments, and joint ventures. Corporate venture investments include activity from 26 oil and gas corporate venture capital firms. ARRA = 2009 American Recovery and Reinvestment Act.

market insights into emerging technology trends – in addition to financial ones. In many cases, the benefits of the strategic objectives outweigh the value of the financial goal.

Low-carbon M&A and venture capital activity by oil and gas companies reached record levels in 2019, pointing to the rising interest in this segment. In the M&A market, oil and gas companies were involved in 33 low-carbon transactions during the year (up from 20 in 2018); meanwhile, this group of companies participated in 45 low-carbon venture capital deals during the year (compared with 39 in 2018), per IHS Markit data (see Figure 1). The number of large-scale transactions has also increased, with eight M&A deals of at least $250 million occurring since 2017 (including Total's $510 million solar joint venture with Adani Group and Galp Energia's €450 million acquisition of a solar portfolio in Spain, both in 2020).

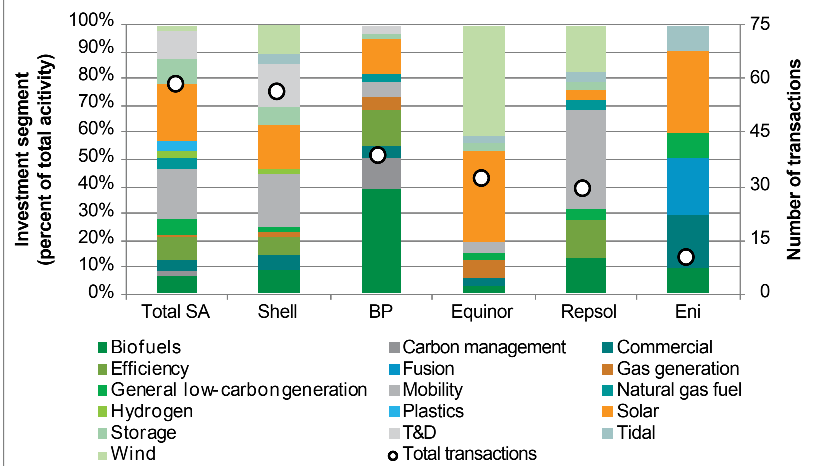
Despite this trend, individual responses by oil and gas companies vary significantly. While full-fledged transitions away from fossil fuels toward low-carbon energy have thus far been rare, several companies within this sector have earmarked a growing share of capex for low-carbon energy opportunities. Spending in this sector has been driven by the Europe-based Global Integrateds, for whom IHS Markit projects an 8% allocation of corporate capex in 2020 to the low-carbon segment.

Oil and gas companies have also pursued varying low-carbon investment strategies. For example, while some companies have opted to develop complementary low-carbon business lines from existing capabilities (e.g., Equinor with its Hywind floating offshore wind technology), others have pursued a more diversified approach, with an array of smaller-scale investments but across a broader range of sectors *(see Figure 2)*.

Each investment approach presents its own set of risks. Companies opting to maintain a focus on existing core oil and gas operations aim to benefit from the fact that the oil and gas sector is generally considered a mature business, with understood risks and returns. However, a traditional pure-play, upstream-oriented portfolio may not deliver on stakeholder expectations for returns alongside reduced carbon intensity, as would be consistent with a low-carbon world.

Companies that specialize in a small number of low-carbon segments may be able to achieve synergies with existing upstream operations and benefit from long-held expertise. The challenge for this strategy, however, is to make the right bets on low-carbon technologies. The rapidly transforming low-carbon sector creates new innovations which could quickly render other technologies obsolete, potentially resulting in some unproductive investments.

Figure 2: M&A and corporate venture investment activity in the low-carbon segment, 2005-2019



Notes: Includes acquisitions, direct investments, joint ventures and corporate venture invesments. Transactions reported: 85 M&A, 138 corporate venture capital investments.Commercial includes activities associated with low carbon electricity procurement such as trading and retail utility operations. T&D= transmission and distribution.
Source: IHS Markit.
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Companies pursuing a diversified strategy with smaller-scale investments benefit from broad-based exposure amid an uncertain outlook for winners and losers in the low-carbon segment. However, this approach may increase the cost and difficulty of achieving material scale in desired areas at a later time. Furthermore, this approach also generally involves venturing into unfamiliar, often early-stage technologies with uncertain prospects for profitability.

Nevertheless, the emergence of these diversified approaches offers companies a chance to differentiate themselves amid an increasingly challenging upstream landscape. It also provides investors with the opportunity to target companies whose views are in line with their own longer-term outlooks on the energy landscape.

Energy transition and the downstream industry

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Awareness and commitments to address climate change are advancing rapidly, and downstream companies need strategies to address the shifting landscape. The demand for transportation fuels will wane over the longer-term, or rapidly decline—depending on two variables: policy and technology innovation. Downstream investment and operating strategies must account for the fundamental shift in regulations and demand trends, but also the competitive pressure from emerging market supply where overinvestment in refining capacity may continue. Still, there are opportunities for companies able to pivot to a lower-carbon fuels world through biofuels integration, petrochemical expansions, and other avenues.

Refined product demand

Our research on energy transition in the oil sector is based on an end-use sector-wise view. This is driven by policymakers', regulators' and original equipment manufacturers' (OEMs) differing strategies for decarbonizing. The pace of deployment—and therefore the influence on demand—varies widely among end-use sectors, country markets, and the scenario considered. IHS Markit energy scenarios assumptions provide an established framework to consider the oil markets and downstream outlook.

Rivalry scenario

- Oil demand continues to grow through the early 2030s, but increasing rivalry with other energy sources, efficiency gains, emission standards, and urban policy slow oil demand growth in key markets – resulting in a peak in global oil demand in the latter half of the 2030s.
- Advances in battery cost reduction and energy density help propel electric vehicle (EV) sales in the light-duty sector—particularly expanding mobility services (e.g., ride hailing, car sharing) companies—and diesel truck fuel efficiency standards reduce on-road diesel demand. However, the scale, complexity, and inertia of the established road transportation system moderates the pace of change.
- Through the 2030s, increasing fuel economy and emission standards are a larger force in limiting oil-demand growth in transportation than the penetration of alternative vehicles.

Autonomy scenario

- The stunning pace of adoption by consumers of driverless electric cars (DECs)—with many owned and operated by new mobility services companies—leads to much weaker oil demand.
- DECs operated by mobility services companies offer lower costs for mobility to consumers who do not wish or cannot afford to buy a car. This also fuels strong policy action by many governments to restrict use and sale of oil-powered vehicles and increase fuel economy standards.
- Policies that support no internal combustion engines (ICEs)—referred to as NICEs—in favor of electric powertrains will affect both light-duty and commercial-duty vehicles that operate in metro areas. NICE policies are also referred to as zero-emission vehicle (ZEV) mandates.
- Autonomous long-haul trucking and electrification of city-based trucks limit diesel demand growth. Policy focus on aviation and shipping—combined with societal pressures—also influences demand in these growing transportation sectors.

A core belief in both scenarios is a shift from free carbon emissions to one where carbon (or carbon intensity of fuels) and operations bear a cost, either explicitly or indirectly through regulatory constraints.

The combined impact of these changes in the Rivalry outlook results in refined product demand growing by 10 million barrels per day (MMb/d) from about 88 MMb/d currently to 98 MMb/d in 2040. In contrast, demand in Autonomy falls by a similar amount to 77 MMb/d by 2040.

Investment trends

The refining environment has remained reasonably well balanced since recovering from the 2009-2014 oversupply period following the global recession of 2008/09. Global utilization rates have hovered around 81% to 82% on an annual basis since 2015.

The industry has benefited from stronger demand increases that have outpaced net capacity additions. Over a six-year historical period (through end-2019), demand has increased by approximately 7 MMb/d. Over this same period, investment in new refining crude capacity was 8.5 MMb/d on a gross basis but was partially offset by approximately 4.5 MMb/d of closures—resulting in about 4 MMb/d of net crude unit capacity adds.

Asian (specifically Chinese) refiners have dominated investment in refining over this historical period (chosen to mirror the forecast six-year known project window). The Chinese refiners added approximately 2.5 MMb/d of crude capacity, accounting for two-thirds of global net crude capacity brought online and over half of reforming vacuum gas oil (VGO) and vacuum bottoms upgrading.

Looking forward, global crude distillation capacity is set to pass 100 MMb/d, not counting an additional 4 MMb/d of condensate splitter capacity. Based on our current project list, and a conservative estimate of capacity rationalization, it appears that refining utilization should remain reasonably firm over the coming six-year period—even when accounting for weaker demand of about 0.5 MMb/d this year due to the estimated COVIDS-19 impact.

Decisions, decisions

Refining companies are facing a complex set of choices. On one hand, new long-horizon investments are faced with the prospect of declining fuels demand and pressure to decarbonize remaining liquid fuels. In this view, can investments in traditional fuels capacity be justified?

On the other hand, substantial demand for liquid fuels—and therefore a refining industry—is probable for the foreseeable future. However, the structure of the refinery, its feedstock sources, and its success factors could be quite different as successful companies pivot to a low-carbon supply business.

Refining companies can take a defensive or proactive stance when it comes to addressing these pressures. A defensive stance might include focusing on plant reliability, lowering costs, buying emissions credits (as opposed to generating credits), and shifting product placement into lower regulated (export) markets. This strategy returns cash to shareholders in the near-term but might threaten viability longer-term.

Companies that opt for a proactive stance will invest in low-carbon strategies including biofuels, bio-integration, lower carbon intensity crude oils, and perhaps hydrogen. Carbon reduction will be a central goal toward profitable long-term returns. Much of the return on these investments depends on the value of carbon emissions credits, which are not without risk. For example, will regulatory programs capture Scope 2 emissions such that investments or contracts for renewable offsite power help lower the fuel life-cycle emissions?

Petrochemicals and petrochemical feedstocks

Our analysis indicates that increasing demand, slowing NGL supply growth, and peaking fuels demand will lead to a greater need for naphtha and other feedstocks from refining.

IHS Markit energy experts discuss global energy transition and its impact on crude oil supply and refining markets.

Watch Video: ihsmarkit.com/energy-transition-oil-impact1

There will simply not be enough "by-product" naphtha and NGLs produced over the coming decades to meet petrochemical growth. The multitude of streams and options – including offgases, LPG, and other low value streams – are still not enough without shifting the fundamental yield of fuels towards petrochemicals directly or petrochemicals feedstocks. Measured on a yield of naphtha-to-crude run, global naphtha yields will need to increase from about 12% today to 19% by 2040.

Refining and petrochemicals plant integration is a well-established strategy by some downstream companies. More will be needed and the most interesting questions center around which technologies and segments of the refining market will make the investments.

- In China today, there are large, highly-integrated refining and petrochemical plants that are online or starting up. These large plants produce around 40% petrochemicals but use no novel technology. Instead, they employ a series of naphtha-producing hydrocrackers to produce large volumes of hydrocrackate that is fed to reformers for paraxylene production (and some light naphtha-to-steam cracking.) Given the capital required and "downgrade" of diesel to naphtha, does this configuration make sense anywhere outside of China?
- New crude-to-chemicals technology and configuration schemes are being researched with one such plant online in Singapore. These plants promise even higher petrochemicals yields of 50% to 75% in a world-scale refining size (400+ kb/d). These plants are most likely to be built as greenfield sites in the Middle East, India, or Eastern Asia and they require a substantial commitment.

Finally, new technologies are coming to the market that promise to increase the yield of petrochemicals from existing fuels refineries. Many of these are based on fluid catalytic cracking technology, a long-time workhorse of the modern refinery. There are a multitude of intermediate or semi-finished streams used to produce fuels today that could, with the right reconfiguration, be converted to petrochemicals – typically light olefins or BTX aromatics. A potential advantage of these more modest process unit investments is they may be suitable for large existing Western refiners as well as Asian and Middle Eastern refineries.

Assessing the power generation fuel mix of Southeast Asia for the next decade

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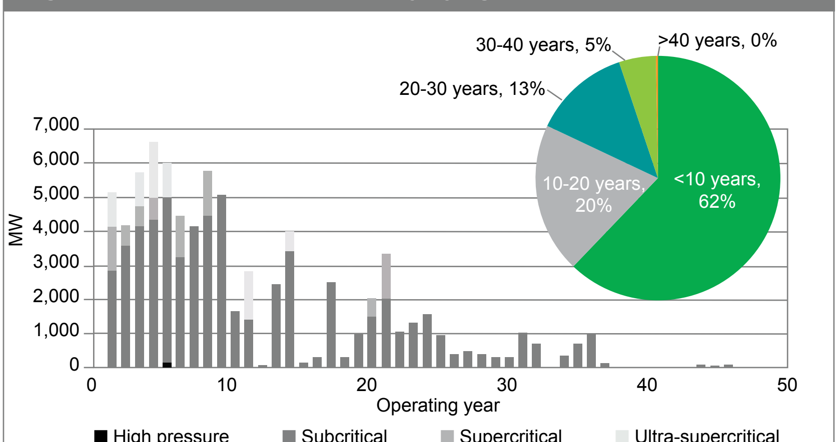
Over the past decade, Southeast Asia has enjoyed strong economic and power-demand growth. By the end of 2019, around 90% of the power generated in the region came from conventional sources (coal, gas and hydro), while renewables contributed to less than 10%. Southeast Asia's growth story will continue along this trajectory over the next decade. To fuel power-demand growth, independent power producers have focused on gas-fired power and renewables.

Strong demand growth will continue

In the last 10 years, half of the Association of Southeast Asia Nations (ASEAN) countries achieved more than 5% annual GDP growth, which was fueled by strong power-demand growth. Myanmar and Vietnam led power-demand growth in the region with a more than 9.5% annual peak demand increase. While demand grew rapidly, supply has been unable to keep pace, leading to reports of a low power-generation capacity reserve margin. As a result, load shedding must be arranged and blackouts are a frequent occurrence in Myanmar.

In the next decade ASEAN's power demand will continue growing, owing to continued economic, electrification, and population growth together with industrialization and urbanization. Growth will be largest in Vietnam, with its total annual power consumption doubling by 2030 to reach 460 terawatt hours (TWh). In most ASEAN countries, the power-demand pattern will remain at a 70-20-10 ratio, which means that around 70% of the demand needs to be served by baseload generation, 20% by mid-merit and 10% by peaking generation.

Figure 1: Coal-fired power capacity by age



Source: IHS Markit, APRA.

Thermal generation will continue to play an important role

Thermal power generation remains part of most countries' power development plan as it provides stable, reliable, and affordable (depending on the country) baseload generation. Currently, the operating coal-fired power plant fleet in the region is still relatively young, as shown in Figure 1. Because 95% of plants are younger than 30 years, few coal plants in Southeast Asia are likely to be retired in the next decade. Similarly, more than 70% of the gas-fired power capacities are younger than 20 years. By 2030, most existing coal and gas units will still be operating.

Currently around 21 gigawatts (GW) of coal and 17 GW of gas power projects are being built. Although many coal projects have faced delays recently, the possibility that any of them will be canceled is low, as construction has already begun. These capacity additions will come online over the next five to six years, helping thermal generation maintain its share in the fuel mix.

Some uncertainties lie with these planned projects. From the governments' plans and developers' project announcements, there are 50 GW of coal- and 62 GW of gas-power projects under consideration. In total, this will require around US $140 billion of new investments. As financial support for coal gradually erodes, some proposed projects may be dropped from the plans. Gas-fired power projects, on the other hand, have been able to acquire financing. Their main hurdles for project development have been securing gas supply from either domestic gas projects or liquefied natural gas (LNG). Taking into account the various constraints, IHS Markit forecasts about 90 GW net capacity addition from coal and gas by 2030.

Aggressive renewable targets and policies unlock a new wave of development

ASEAN set an aspirational target to incorporate 23% of renewables into their energy mix by 2025. Individual member countries also set renewable energy targets (RETs), which were mostly less aggressive than the aspirational one but still highly ambitious. Over the past few years, most of the ASEAN countries refreshed their individual RETs, either increasing the target or bringing forward the target year. Figure 2 summarizes the major ASEAN countries' RETs, as well as the current installed capacity level.

The figure also shows the current renewable energy policy map. Most countries are moving away from feed-in-tariffs (FiTs) to tenders or other options. Vietnam transformed from a country with no utility-scale solar projects to one with around 5 GW of solar capacity over the past 18 months, owing to a \$93.5/megawatt hour (MWh) FiT. The Vietnamese government plans to transition from FiTs to solar auctions in 2020, alongside a reduced FiT level for approved projects. Philippines intends to implement the renewable portfolio standard (RPS), following the establishment of its renewable energy market system. As part of its RPS rule, the country indicated that the renewable generation share should be increased by 1% annually. Overall, ASEAN countries have been actively adjusting their policies to better support their RETs.

While policy support helps incentivize renewable development, the declining cost of renewables will also be a big contributor to growth. The average levelized cost of energy (LCOE) for solar photovoltaic (PV) in ASEAN countries is expected to drop by 50% by 2030, eliminating the cost argument that has hindered renewable development. There will be a wave of new developments in the next few years before renewable penetration reaches a higher level – resulting in increased stability, grid connection, and curtailment challenges. From IHS Markit's analysis, not all countries will achieve their RETs. Of the six countries illustrated in *Figure 2*, half will fail to meet their targets while the others will likely beat their targets, thanks to outdated targets, strong growth in on-grid renewables, and faster adoption of behind-the-meter solar in the commercial and industrial sector.

Coming soon: A balanced fuel mix

In contrast to the more developed regions around the globe, the fuel mix development in Southeast Asia is not a "replacement" scenario. Due to strong demand growth, there is room for all generation technologies. IHS Markit expects strong growth across all generation types, both conventional and renewables, while costly diesel and oil generation will be gradually displaced.

By 2030, the region will add 178 GW of new power generation capacity – with about 50% from thermal projects, 32% from renewables (solar PV and wind), and the remainder from hydro and other forms of renewables. Coal- and gas-fired power plants will contribute about 73% to the total fuel mix, slightly lower than the current share of 76%. Additional hydropower developments will be constrained by resource potential and the mismatch in the locations of demand and supply. The share of hydro generation will remain at about 14%. The power generated from solar PV and wind will more than quadruple from 25 TWh to 117 TWh in the next decade. In general, the trend for the region will be a balanced generation mix, with increasing adoption of cleaner and more sustainable generation.

Figure 2: Southeast Asia renewable targets and policies

Source: IHS Markit 1763329

Case Study: Measuring and managing portf
vulnerability in the face of Energy Transition

Situation

The Energy Transition is happening faster than we expected

Driver	Examples	Discussion
Underestimation of political and regulatory will	NEPOOL, California, Germany	• Regulators and policy makers have shown themselves willing to bear the burden of high initial costs to help improve long-term economics for renewables and other technologies
Underestimation of technology development, technology transfer and technology ceiling	Fracking, Solar, EVs/Battery	• In these cases, and others, technology developed faster and drove down costs far further than industry observers believed possible • While many still believe that technical limitation prevents renewables penetration to surpass 15%, today some markets are already over 50% and there is broad realization that the integration challenges are diminishing with time
Underestimation of consumer desires	The Green Movement	• In many geographies consumers have been willing to bear modestly higher costs if associated with environmental benefits. Relatively low energy costs in general have provided headroom to absorb the initial costs of introducing new technologies
The herd effect/ “Group Think”	Various forecasts from a range of industry sources	• Most thinking is evolutionary, not revolutionary; in the box not out of the box. Are we being sufficiently brave?

The Challenge with Energy Transition

Properly valuing assets

- The future of electric vehicles? Battery storage in combination with wind and solar power generation? Carbon capture and storage? The difficulty in dealing with forecast uncertainty contributes to keeping most discussions at a high level
- Understanding what is changing that will affect our assets? Which ones, specifically? How and how much? How vulnerable are our existing assets?

Often our high level thinking does not lead to the granularity required

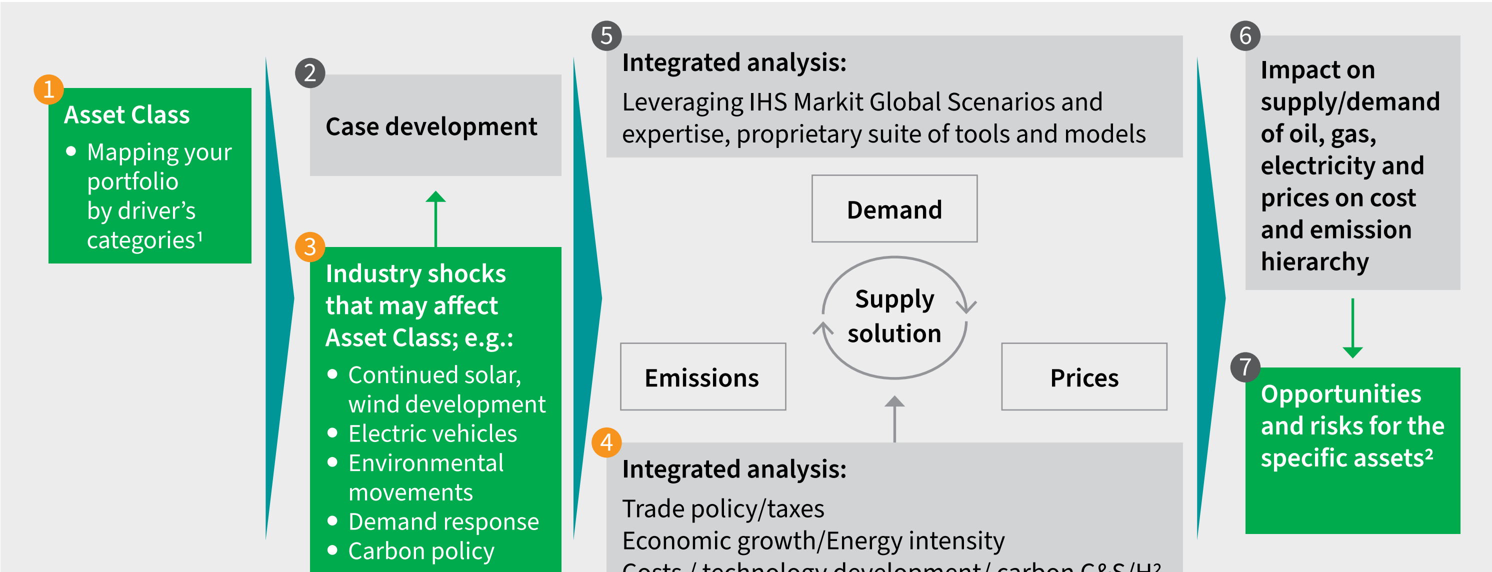
- Not all assets are equal and not all assets within a specific asset class will be impacted in the same way
- Throughout the value chain, understanding not only the cost but the emission intensity hierarchy and determine where the specific asset falls is becoming increasingly important

Assessing the potential vulnerability of your asset portfolio

- Are we fully accounting for the range of potential outcomes in reviewing risks to our portfolio? Move the thought process from high-level scenario planning to targeted, asset-specific stress testing
- Which assets are potentially vulnerable to changes in externalities? Why?
- Develop sign posts for each asset class to help us better understand the range and timing of their potential vulnerability

IHS Markit Approach

Asset-specific vulnerability stress testing

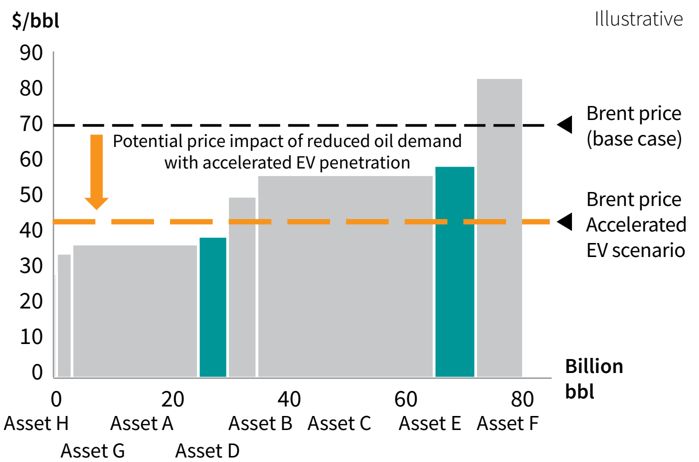


Note:
1) Examples of asset classes might include NA natural gas, Permian gas, Brazilian pre-salt, West Coast refining, Gulf Coast ethylene, global LNG, etc.
2) Can be performed on one asset class at a time or across a number of assets
Green are areas of focus for the Tailored, Asset-Specific Cases methodology

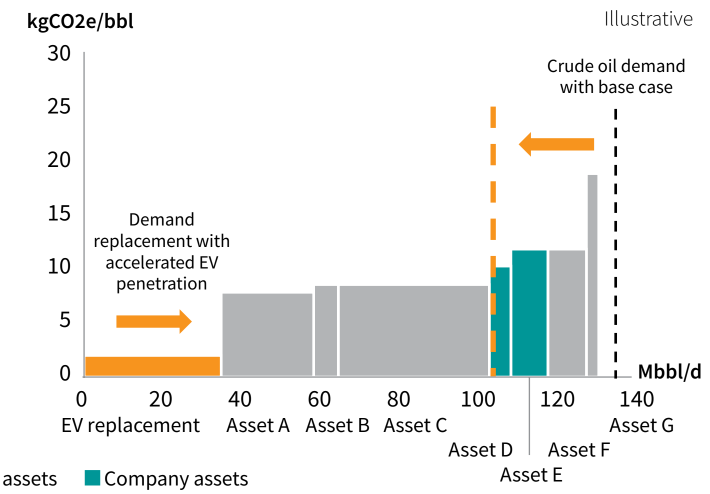
Impact

The impact of the case can be visualized on a cost and emissions basis, comparing specific assets to the rest of the asset class

Breakeven cost curve – Price impact on asset class



GHG emissions curve – Demand impact on asset class



EV replacement   Other assets   Company assets

Note:
1) Examples of asset classes might include NA natural gas, Permian gas, Brazilian pre-salt, West Coast refining, Gulf Coast ethylene, global LNG, etc.
2) Can be performed on one asset class at a time or across a number of assets

European solar installations enter a new era of sustained growth

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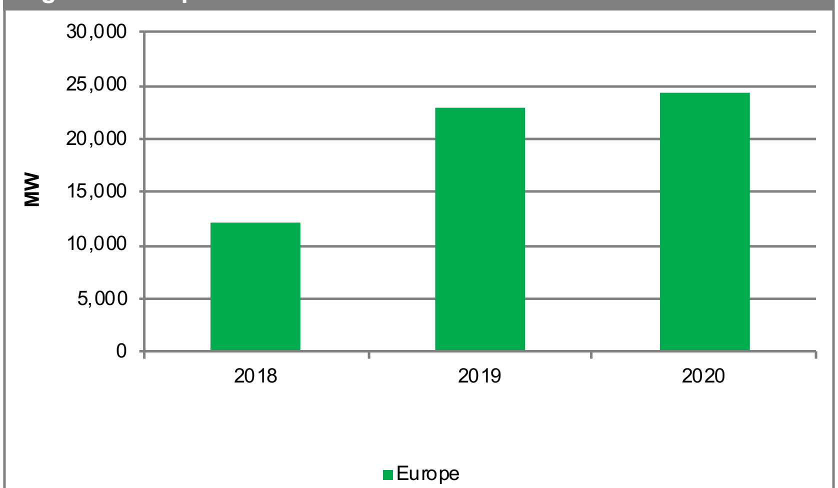
After several years of weak solar-demand growth in Europe – especially when compared to the historical highs of 2011 – installations surged by 88% to reach a new installation record of 23 gigawatts direct current (GWdc) in 2019 (*see Figure 1*). A variety of favorable macro conditions coalesced to reignite the European solar market.

These conditions include:

- Low module prices, assisting the cost-competitiveness of solar
- A return to the growth of utility-scale project, driven by tenders and power purchase agreements (PPAs)
- Steady growth of distributed photovoltaic (DPV) across the region, driven by carefully managed policies
- A broadening of the number of large solar markets in the region, particularly in Eastern Europe

While the European region is forecast to grow over the next five years, headwinds do exist. For example, grid connection issues, planning permission issues due to a large installed base of PV in some local areas in key markets, and shortening PPA terms as financial market drivers move towards merchant payment terms can cause delays. However, overall the European solar market is moving towards a new level of maturity and a growth trajectory catalyzed by more than just rich subsidies. Increasingly, it will be spurred by market fundamentals such as increasing interest from corporates, utilities, and off-takers considering solar as a cost-competitive energy generation source.

Figure 1:Europe PV installlations



Source: IHS Markit

China's loss is Europe's gain

The 2019 global solar market was highly interconnected and sensitive to big changes in demand, such as the decline of a large market like China. The solar supply chain has now reached such a scale that suppliers will seek new growth opportunities instantly if key markets fail to meet expected demand for components. A prime example of this trend was 2019, where the failure of China to reach the same heights as 2018 caused module and inverter suppliers to swiftly expand internationally and rapidly lower prices in order to fulfil their orderbooks.

Among the beneficiaries are European engineering, procurement, and construction (EPC) firms and developers, who actively installed solar products during the lull in Chinese domestic demand in the first nine months of 2019. European installations surged to account for an estimated 18% percent of total global installations, an increase of six percentage points over 2018. Several Chinese module manufacturers are expected to increase capacity in the next few years, believing that scale is their strategy to maintain profitability and be cost-competitive. As a result, PV system prices are expected to fall in 2020 – mainly due to PV module price decreases caused by potential excess module capacity. This trend will help drive Europe to install more cost-competitive solar.

European solar growth super-charged

After several years of modest growth, 2019 saw a large resurgence in solar demand across multiple markets in Europe, according to PV Installations Tracker: Fourth quarter 2019. Major solar markets such as Germany, Spain, Italy, France, and Netherlands that have been stalwarts of the European solar industry are expected to remain top-10 markets. However, markets such as Ukraine, Poland, Hungary, Turkey, and Portugal are expected to flourish and drive growth. Demand is forecast to be quite concentrated. For example, the top four PV markets of Germany, Spain, Ukraine, and Netherlands represent 13 GW of installations and will account for almost 60% of European demand.

Utility-scale installations surged across a number of key markets such as Spain, Portugal, Ukraine, and Netherlands in 2019. The trend is expected to continue into 2020 with markets such as France, Italy, and the United Kingdom adding to the list of utility-scale markets expected to grow as result of tenders, PPAs, and unsubsidized projects. AS a result of this rapid growth rate in utility-scale installations, ground-mount installations exceeded roof-top installations in 2019 for the first time since 2015. However, while utility-scale installations will grow strongly in some of these booming markets, issues associated with large solar deployments still exist. In some markets such as Spain, grid connection issues can delay solar installations. Other markets may decrease as they change market drivers. For example, Ukraine is pivoting from a feed-in-tariffs (FiT)-driven market to a tender-driven market.

Utility-scale installations accounted for 43% of total European installations in 2019, but distributed PV (both residential and commercial) remained a large and growing segment. Many key markets such as Netherlands, Germany, Poland, Belgium, and Italy increased their residential installations in 2019, and markets such as Germany, Netherlands, Turkey, France, and Hungary will be key markets for commercial installations.

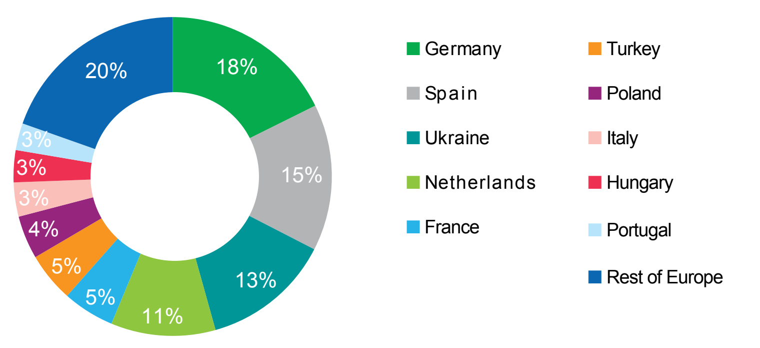
Is the European solar renaissance sustainable?

The European PV market is not immune to the vagaries of changing industry drivers and policies that can cause individual markets to boom or bust. PV installations in Europe have now reached a new level of critical mass, with over 19 markets claiming an installed base over 1 GW by the end of 2019. A decade ago, only Germany, Italy, and Spain had an installed base over 1 GW.

The industry that survived the initial market collapses is more resilient and educated – and more able to compete effectively with other energy-generation forms such as coal. Solar is now in a new era of cost-competitiveness, thanks to the scale of the industry that produces well over 100 GW globally per year. In Europe, self-consumption is a major market driver, and merchant and/or PPAs are rapidly emerging as significant market segments.

However, for the time being, tenders will be necessary by many European governments to be able to push large-scale installations in a controlled way. New tenders have been announced this year in markets including Germany, France, Italy, Portugal, Poland, Hungary, and the Ukraine. The development of the large-scale unsubsidized PV segment depends crucially on the regulatory environment and the overall power market evolution, and those forces will impact how well solar installations prosper in Europe over the next five years.

Figure 2: Top-ten European PV markets in 2019



Source: IHS Markit. © 2020 IHS Markit

Changing course: Plastics, carbon and the transition to circularity

The global transition to a Circular Economy has reached an inflection point of no return

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Climate change is leading many oil companies to continue to decarbonize their energy portfolios as projections indicate that the 2 degree C for global warming as laid out in the Paris Accord cannot be achieved. The resulting "Energy Transition" results in further exploration of gas and renewables as growth sectors in energy.

Carbon tracking for the full energy value chain is being demanded. Today, financial institutions are advancing to require oil companies to reveal and track their carbon footprints, chemical companies' requirements for carbon tracking are expected to follow in the near future.

Energy companies' efforts to shape a positive discussion around actions that reflect climate change transitions have never been stronger. Unprecedented amounts of operational emissions data, scenario-based stress testing evidence and aggressive action targets have been disclosed. Yet the industry is not aligned on what to disclose, how to measure, or whether cleaner energy diversification would add or destroy value. In the meantime, countries are increasing regulatory focus on oil, gas and power sector-specific measures that will cause even more change in the future.

Increasing climate change concerns are expected to drive a need for a greater understanding of greenhouse gases (GHG) emissions for crude oil and chemicals through their value chain. The need to understand GHG emissions for chemicals is especially important as the industry explores ways to recycle plastic waste back into monomers and feedstocks to bring circularity to the system. Optimum processes will need not only to provide adequate economic return but increasing carbon footprints will be used to measure the viability of any approach.

> Today, financial institutions are advancing to require oil companies to reveal and track their carbon footprints, chemical companies' requirements for carbon tracking are expected to follow in the near future

Unmanaged plastics waste threatens the very "license to operate" for the chemical industry. Significant development is underway in all aspects of plastics waste management including chemical process recycling technology development, further refinement of mechanical process recycling, reclamation and logistics systems development, improving circularity capability of single use plastics, etc.

The petrochemical industry remains focused on future risks and opportunities as the plastics value chain transitions from a linear to circular infrastructure.

Disruptive forces could potentially reshape the consumption of plastics and in turn disrupt chemical industries and Large Volume plastics are at the nexus of these changes. The petrochemical industry has unique challenges in the transition to circularity. The integrated processes of petchems assets are among the largest and most complicated in the world; this illustrates the advances in the linear model and challenges of changing to one of circularity.

How will the chemical industry transition from a linear to circular value chain?

Sustainability initiatives in chemicals extends from the need to address end of life management of plastics to multiple examples of the benefits of chemicals, including food usage, clean water, and clean energy.

The transition from a linear (make, use, dispose) to circular economy in which resources are used as long as possible while extracting the maximum value during use and, at the end of each service life, recovered to generate new materials and products will require significant change at an accelerated pace if success is to be achieved.

Many questions remain. What will be the pace of transformation? What and when will inflection points occur? What disruptors will result? How will the industry structure evolve? How might new entrants displace incumbents and what positions in the value chain are the most vulnerable? How will regulations and stakeholder policies evolve? What are the resulting implications to economic models? What insights and actions are needed to address climate neutral initiatives? How will consumer system behavior change? How will stakeholders evolve and how will it impact economies, geopolitics, and efforts to address climate change and pollution?

Chemical recycling technologies are a potential game changer for the plastics industry. However, to technology and scale to commercial viability needs to accelerate much faster than current momentum. Support for vast infrastructure improvements, including collection, sorting and recycling requires aggressive government and financial community support on a global scale.

In 2020 IHS Markit will prepare a special study, "Changing Course: Plastics, Carbon and the Transition to Circularity", which will provide a comprehensive understanding of the current regulatory environment, stakeholder policies and industry group/NGO initiatives and how these activities will develop under different scenarios for society's transition to circularity. The study will also provide an understanding how alternative technologies for recycling and recovery, both mechanical and chemical, will develop and fit within an overall macro infrastructure / reverse supply chain designed for circularity.

Changing Course: Plastics, carbon and the transition to circularity Study - Develop your strategy around the risk and opportunities as the plastics value chain transitions from a linear to circular infrastructure.

For more information: ChemicalSpecialReports@IHS Markit.com

Energy companies' efforts to shape a positive discussion around actions that reflect climate change transitions have never been stronger

Implications of carbon valuation, and how it might impact future capacity investment decisions will be included along with an assessment of risk from demand loss via demand deselection and replacement of primary supply with post-consumer/commercial resin and the implications for the petrochemical chain.

Impact of plastics recycling on future energy transition

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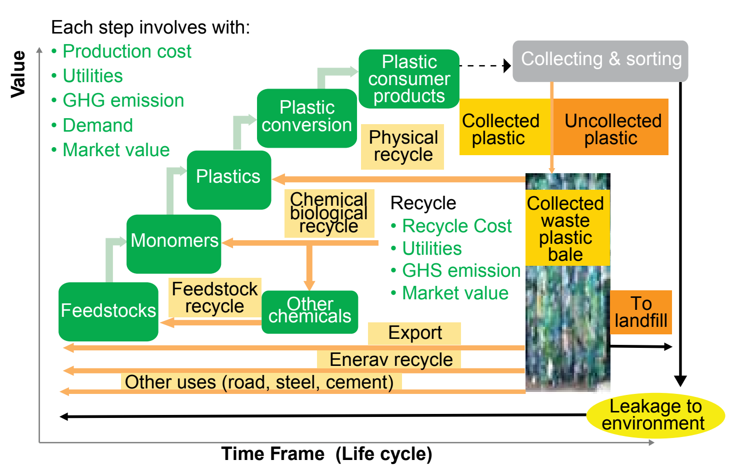
The petrochemical industry is facing mounting environmental pressure to reduce plastic waste through increased recycling. Yet plastics recycling is a complex issue that involves not just plastics producers but also brand owners, consumers, municipalities, waste management companies, and waste recyclers. Industry infrastructure, government regulations, and technology development also play important roles. To delineate the issues and to assess factors that will determine future plastics recycling rates, IHS Markit proposes a process economics framework that enables systematic and quantitative evaluation of plastics recycling *(see Figure 1)*.

In the production of virgin plastic, feedstocks typically cost US $100 to US $500 per ton. Every conversion step requires capital investment and involves operating costs that provide maximum value at a typical consumer product value of US $2,000 per ton. Yet due to lack of effective sorting and collecting infrastructure, most post-consumer plastics end up in landfill or as environmental pollutants. These wasted post-consumer plastics have zero or negative value, which represents a tremendous loss in resource utilization. Because the most urgent issue for plastics recycling is addressing environmental pollution, plastics recycling must also be considered from the standpoint of associated resource utilization and value preservation.

The collected post-consumer plastic materials may be viewed as "the new oil" in the circular economy.

There is already a market for waste plastic bales in each geographical region. As recycling activities pick up and markets expand, waste plastic bales will become an important new commodity with prices set by supply and demand. Sorting efficiency, collection costs, and quality will be reflected in the market price, similar to other commodities.

Figure 1: Plastic recycle-a process economics framework



Source: IHS Markit Process Economic Program.

Collected waste plastics can be mechanically recycled into plastics, chemically recycled to monomers, or molecularly recycled to feedstocks. Each recycling route exerts its impact mainly on the supply and demand of virgin plastics, virgin monomers, and virgin feedstocks, respectively. All recycling routes will eventually impact the supply of incumbent feedstocks: crude oil, natural gas liquids (NGL), and even natural gas or coal.

The extent to which recycled materials impact future demand for virgin plastics depends on the future recycling rate versus the total demand growth rate. Figure 2 illustrates this concept using mechanical recycling of polyethylene terephthalate (PET) as an example.

In Figure 2, the total annual demand for a plastic is D_t, which is the sum of demand for virgin plastic D_v and demand for recycled plastic D_r. Thus, $D_v = D_t - D_r$ in any given year. The impact of plastic recycling on future demand for virgin plastic can be determined as follows:

1-Demand balance in year 0 (base year):

$Dv_0 = Dt_0 - Dr_0$

Letting $R_0 = Dr_0/Dt_0$, where R_0 is recycle ratio in year 0:

$Dv_0 = Dt_0(1-R0)$

2-Demand balance in year n:

$Dv_n = Dt_n - Dr_n$

3-Assuming total annual demand grows at x% and recycle rate grows at y%:

$Dv_n = Dt_0 (1+x)^n * [1-R_0(1+y)^n]$

The future growth rate of virgin resin thus depends on three factors: the growth rate of total demand (x), the current recycle ratio (R0), and the future growth rate of plastics recycling (y).

Equations (1)–(3) can be extended to any plastic and to multiple end markets, each with a different scenario of demand growth rate, current recycling rate, and future recycling growth. IHS Markit Process Economics Program created an interactive template for quantitative estimation of the impact of future recycling rate on future demand for a virgin plastic, in any region . The template also allows estimation of annual and cumulative leakage to the environment, either as landfills or pollutants. Similar analyses can be applied at monomer and feedstock levels for chemical and molecular recycling, respectively.

Future recycling growth rate will be determined by the relative production economics and quality of recycled versus virgin material. Figure 3 presents a comparison of production cost structure for mechanically recycled PET (rPET), at 18 KTA capacity, and virgin PET from monoethylene glycol (MEG) and purified terephthalic acid (PTA), at 650 KTA capacity. Also shown is the carbon footprint of each process, to show relative sustainability.

The current scale of mechanical recycling for PET is relatively small, which means that fixed and other costs per ton of rPET are very high compared to production of vPET. However, due to the relatively low price of feedstock (waste PET bales), the total production cost of rPET is lower than that of vPET. rPET also commands a lower price than vPET, due to its generally lower quality, resulting in lower profitability for rPET. To improve the economics and profitability of rPET, its production scale must be increased substantially and its quality must improve to command a higher market price.

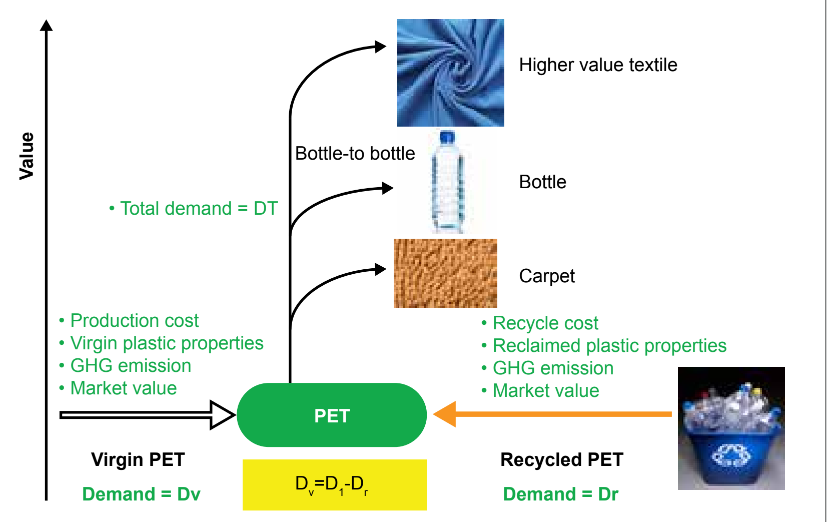
From a sustainability viewpoint, rPET has a lower total carbon footprint than vPET produced directly from MEG and PTA. When tracing MEG production to ethylene by ethane steam cracking and PTA production from PX (para-xylene) and heavy naphtha (HN) in an aromatic complex, the sustainability of rPET vs. vPET is even more striking.

Future recycling operations will require multiple solutions. Chemical and feedstock recycling offer the possibility of operating at a larger scale, and they may be right for certain situations. However, these processes require energy to break down larger molecules to smaller molecules, plus additional energy to convert small molecules back to plastics by repeating the long conversion steps as used in production of virgin polymers. The net result is much higher carbon emissions for chemical and feedstock recycling than for mechanical recycling.

From the sustainability, resource utilization, and value preservation viewpoints, the industry's priorities should be mechanical recycling, chemical recycling, and feedstock recycling. Mechanical recycling has challenges that require industry innovations. Sample opportunities include: developing better tagging or tracking of materials to significantly increase sorting and collection of higher-purity post-consumer plastics; providing blend stocks to compensate for somewhat inferior properties of recycled plastics; and developing new, large-volume markets that decrease use of recycled plastics for short life-cycle applications, such as packaging materials, with use for long life-cycle applications, such as textiles, pipes, or even housing construction materials.

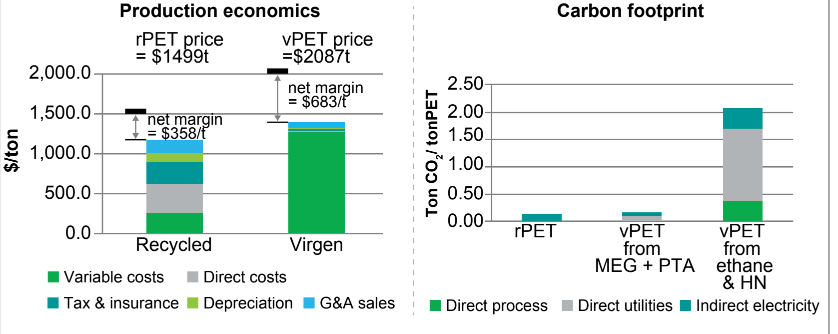
With the emergence of EPR (extended producer responsibility) policy approaches, producers are at least in part operationally and financially responsible for recycling the products they produce. The new regulation is expected to build a more effective infrastructure that will lead to a larger supply of well-sorted, high-quality, post-consumer plastics – which will significantly increase the scale and further improve the economics of mechanical recycling.

Figure 2:Recycling rate versus total demand growth rate with PET example



Source: IHS Markit. © 2020 IHS Markit

Figure 3: Production economics and carbon footprint comparison of mechanically recycled vs. virgin PET in the US [Total carbon footprint = direct process emission + direct utilities (fuel) emission + indirect emission from electricity consumption]



Post consumer PET bottle bale price set at $264/ton in Q1 2019
rPET capacity set at 18.2 KTA while vPET capacity set at 650 KTA

Source: IHS Markit. © 2020 IHS Markit

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Changing Course

Plastics, carbon and the transition to circularity

This study will assist in developing your strategy around the risks and opportunities on the pathway to plastics sustainability.

A comprehensive review of how the plastics value chain is expected to transition from a linear to a circular economy, accounting for changing policy and regulations, implications of carbon intensity and the impact on future capital investments.

Climate change is leading many oil companies to continue to decarbonize their energy portfolios. The resulting "Energy Transition" results in further exploration of Gas and Renewables as growth sectors in energy.

Carbon tracking for the full energy value chain, including chemical companies, is expected to further emerge in the near-term horizon.

Unmanaged plastics waste threatens the very "license to operate" for the chemical industry.

The study will provide an understanding of how alternative technologies for recycling and recovery could develop, the impact on demand loss via deselection replacing virgin resin and the overall implications for the petrochemical value chain and finally, the potential scope for the management of plastics waste.

This study will address these key questions

Pace of Transformation
How will the transition evolve? What and when will inflection points occur? What disruptors will result?

Regulatory and Policy Environment
How will government regulations, stakeholder and industry/NGO initiatives evolve and impact the plastics value chain?

Carbon
What insights and actions are needed to address climate neutral initiatives?

Industry Structure
How will new entrants displace incumbents and what positions in the value chain are the most vulnerable?

The Global System
How will this transformation evolve?

Demand
What is the current and future impact of sustainability on demand for plastics and petrochemical feed slates?

Agriculture and biofuels: A transition in process

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Drivers of Biofuels Demand

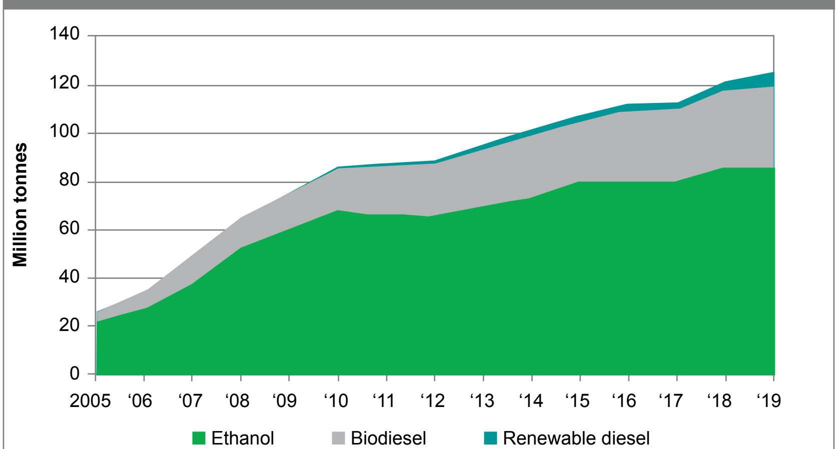
Biofuels – along with fertilizer, crop-protection chemicals, transportation, and packaging – is a major area of intersection between the agriculture and energy sectors. Over the past 15 years, biofuels demand rose (see Figure 1) and production increased globally, becoming a major part of the energy profile of developed and developing countries. Energy security, farm income support, and to a lesser extent environmental concerns were early pillars of biofuels policy. This focus led to policy development that emphasized mandated levels of biofuels into the fuel mix with capacity buildout often supported by tax and other government incentives. While ethanol benefited as an octane replacement and a focus on reduction of carbon dioxide levels, energy security and farm price support considerations have driven much of the volume increases in ethanol.

Biofuels as a "Bolt On" into Agriculture

Consistent with the themes of energy security and farm price support, most feedstocks currently used in biofuels production are traditional agricultural products, including crops such as corn, sugarcane, and palm and other vegetable oils. While the concept of advanced biofuels and "cellulosic" fuels were introduced in the US Renewable Fuel Standard (RFS) and Europe's Renewable Energy Directive (RED) in the early to mid-2000s, these fuels and the associated feedstocks have not met the volumes originally planned. This use of food crops already present in the agricultural economy helped accelerate the development of the biofuels industry, because it allowed new biofuels plants to "slip into" an existing stream of agricultural output. Essentially, all biofuels producers had to do was – in the case of US ethanol, find a surplus region of corn production and build an ethanol plant close to those supplies. For Brazil, in some ways it was even easier, as sugar-based ethanol plants were able to co-locate with sugar production. This gives these types of plants the ability to switch between sugar and ethanol production, based on whichever market offers the best price.

While the buildout of the ethanol industry around food-based agricultural output had the advantage of tapping into existing flows of feedstock, it did lead to "food versus fuel" debates. A few crisis-level episodes occurred where food price rises were seen as driven, at least in part, by feedstock demand from the biofuels sector. In fact, ethanol production accounts for almost 40% of today's corn usage in the US compared with about 12% just 15 years ago. Within agricultural economy sectors such as animal-feeding operations, grain processors, and vegetable oil, users have had to accommodate the increased feedstock usage of biofuels firms. The "food versus fuel" debate has subsided as agricultural supplies have grown and the price of agricultural commodities remained low for the past four years. Yet a resurgence of the "food versus fuel" debate is always possible as agricultural production is dependent on weather, policy changes, disease, and other factors that can limit supply and increase price. For now, biofuels are a critical component of demand for agriculture.

Figure 1: Global biofuels demand



Source: IHS Markit.

New Drivers of Demand for Agriculture From Biofuels

Currently the global biofuels industry sits at a critical crossroads. Efforts around sustainability and decarbonization have created an opportunity for the biofuels and agriculture sectors to play a critical role in lowering carbon dioxide levels from fuel consumption. As such, biofuels as a solution to developing renewable, sustainable, low-carbon sources of energy is a major theme in both commercial and policy organizations considering future biofuels development. The EU RED and California's Low Carbon Fuel Standard (LCFS) are policy initiatives that set a trend for other standards and plans (*see Figure 2*). These initiatives emphasized meeting specific carbon intensity (CI) levels in the biofuel feedstocks so consumers of these biofuels could release fewer carbon dioxide emissions into the atmosphere. As other states in the US and countries and regions in the world follow adopting LCFS initiatives, the demand for biofuels that meet these standards, and the agricultural feedstocks that support the biofuels production, will grow.

While the shift toward decarbonization represents a tremendous opportunity for the agriculture and biofuels sectors, there are challenges as well. The existing stream of conventional agricultural feedstocks are not necessarily what is needed to meet many of the low carbon fuel standards. New biofuels plant capacity will likely focus on sourcing renewable feedstocks with lower CIs relative to conventional feedstocks (e.g., corn, vegetable oils) to meet CI targets set out in the LCFS policies; these low carbon feedstocks are often referred as "advanced" or "second generation" feedstocks. Alternatively, or in addition to new advanced feedstocks, applying new technologies such as plant genetics, precision farming, digital farming and innovative processing technologies to conventional crops will lower the CI of conventional feedstocks as well.

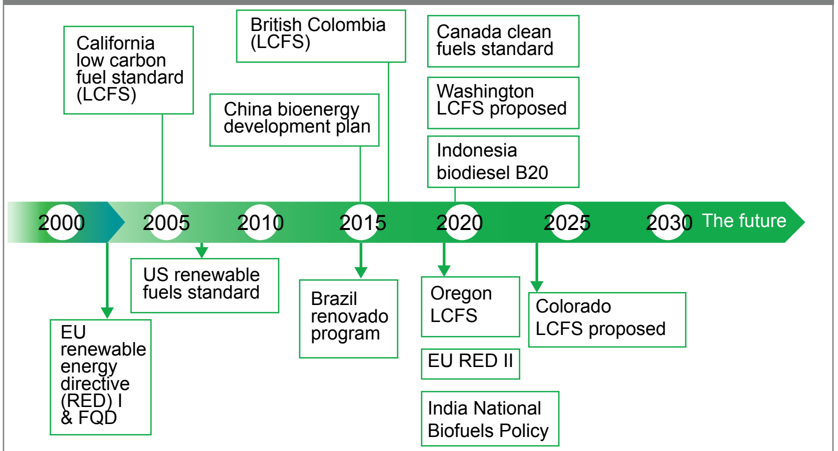
Examples of advanced feedstocks are byproducts from various industries, including used cooking oil (UCO), animal fats and grease, distillers' corn oil, field waste, straw, wood chips, or energy crops (crops specifically cultivated for biofuels) such as switchgrass, algae, or wood chips/trimmings from eucalyptus trees. Because these feedstocks come from waste streams or are cultivated in a way that actually increases factors such as soil health and environmental sustainability, they have a lower CI score and can be used as feedstocks for biofuels production while meeting LCF standards.

The Challenge and the Solutions

Globally there is a pool of byproduct feedstocks that began the shift from other uses to biofuels over the past five years. However, the supply of these feedstocks is inelastic to biofuel demand – that is, low carbon biofuel demand will not drive beef tallow production, a byproduct of the beef packing industry. Hence, at some point increased low-carbon biofuel demand will incentivize higher production of energy feedstocks or innovation to extract or collect a greater volume of waste streams from new sources (such as used cooking oil collection from residential use or from municipal wastewater).

The technology needed to utilize these next-generation feedstocks either already exists or is in development, with ongoing research and investment that will create pathways to fuel production from these streams. Less apparent is the supply chain for these feedstocks into new and existing biofuels plants.

Figure 2: Decarbonization initiatives over time



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Unlike conventional agricultural feedstocks – where the supply-demand dynamics and price formation are well understood and regularly tracked – data and information around next-generation feedstocks is just developing. Fortunately, the IHS Markit position in both the energy and agricultural sectors gives us the opportunity to work with participants in both sectors, as we jointly develop with our industry, policy, and NGO partners the data and information systems needed to support the advancement of next-generation biofuels.

Undercurrent of uncertainty to persist in carbon credit market: OPIS analysis

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Potential and existing carbon market participants in 2020 will navigate increasingly stringent and evolving emissions-reduction programs as key jurisdictions extend environmental initiatives into the new decade and beyond, OPIS analysis shows.

Ever-threatened by potential political resistance or change, both well-established and new carbon programs face an undercurrent of uncertainty that will persist during 2020. Trying to navigate that uncertainty will continue to be one of the largest challenges for current and potential participants in carbon-pricing programs.

Aviation carbon-reduction program makes progress, but hurdles remain

In March, the United Nation's International Civil Aviation Organization (ICAO) announced the selection of six carbon offset programs for compliance with its Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) program, which targets carbon-neutral growth in global aviation using offsets and sustainable fuels. The six offset programs chosen by ICAO are:

- American Carbon Registry
- China GHG Voluntary Emission Reduction Program
- Clean Development Mechanism
- Climate Action Reserve
- The Gold Standard
- Verified Carbon Standard Program

ICAO also limited the window for eligible emissions reductions activities to projects commencing between January 1, 2016, and December 31, 2020.

Yet, the CORSIA program has some issues to address before it is ready for launch.

The pilot stage of the program would begin on January 1, 2021. Baseline emissions are currently slated to be set using the average of 2019 and 2020 levels, although the debilitating impact of coronavirus disease 2019 (COVID-19) on airline operations this year has raised concerns about setting the baseline in what is shaping up to be a time of uncharacteristically low air traffic, and subsequently, aviation emissions.

The heavy financial hit airlines are experiencing from the COVID-19 pandemic also puts into question what kinds of funds they will have available to purchase offsets to comply with the program.

California carbon credit market remains front and center amid rocky politics

In North America, California remains a cornerstone in the carbon-mitigation effort, though a recently filed Trump administration lawsuit challenging the constitutionality of the state's cap-and-trade program injected doubt into the California Carbon Allowance (CCA) secondary market.

In October 2019, the United States Department of Justice filed a civil complaint claiming that California had unlawfully entered into a cap-and-trade agreement with partner Quebec. The California and Quebec cap-and-trade programs linked at the start of 2014 to participate in four joint carbon allowance auctions per year. In late 2018, the California Air Resources Board (CARB) approved amendments to modify and extend the program to 2030.

While California's cap-and-trade program is not at risk of being dismantled by the suit, delinkage with Quebec's program could impact allowance trade liquidity and, ultimately, prices.

California scored an early win in March, with a federal judge ruling that the linkage between the jurisdictions does not violate the United States Constitution.

However, the judge only ruled on two of the claims in the DOJ's complaint. If the DOJ decides to pursue the remaining claims and/or appeal the initial decision, the process could easily continue through the end of the year. In that case, the results of the next U.S. presidential election could affect the status of the lawsuit, sources tell OPIS. If a new president assumes office in January 2021, the U.S. Department of Justice could be directed to drop the case.

The outcome of the lawsuit could also have far-reaching global influence on nations considering similar environmental policy by setting an unfavorable precedent for future linkages between foreign jurisdictions, say industry experts.

Oregon cap-and-trade program stalls, Governor intervenes

In Oregon, the state legislature failed to pass a cap-and-trade program similar to California's twice in the past year after Republicans left the state capital to avoid a vote on the proposed legislation both times, denying the necessary quorum and effectively killing the bill.

There has also been heavy opposition to

cap-and-trade in Oregon from groups of truckers, loggers, and farmers, many of whom say that the issue should be brought to voters.

In March, Governor Kate Brown enacted an executive order to aggressively target climate change with a number of directives. However, it stopped short of creating a carbon market, which Brown told reporters she did not have the authority to do. The order does, however, direct a state agency to enforce caps on industrial and transportation fuel initiatives, possibly laying the groundwork for a future program should the legislature take the matter up again.

If cap and trade legislation does eventually manage to pass in the state, Oregon would likely link to California's and Quebec's existing programs under the Western Climate Initiative (WCI). Even so, uncertainty would likely continue to loom, with program implementation and longevity dependent on who is in office.

Regional greenhouse gas initiative participant list grows

On the East Coast, state lawmakers made plans to receive at least one new participant to the Regional Greenhouse Gas Initiative (RGGI) during 2020. The nine-state cap-and-trade consortium welcomed New Jersey on Jan. 1, 2020.

For the program, Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont each have individual but similar CO2 budget trading programs for the power sector.

"The Garden State's participation can only further strengthen the robust, stable market that has delivered remarkable success for over a decade, with even greater results anticipated in the years to come," said RGGI board of directors Chairman Ben Grumbles in a December 2019 news release.

Pennsylvania lawmakers announced earlier in 2019 an interest in joining the emissions-reduction trading program. In October 2019, Pennsylvania Gov. Tom Wolf (D) issued an executive order for the state's Department of Environmental Protection to join RGGI and draft a market-based emissions reduction for power facilities by July 2020. However, the state's Republican-controlled General Assembly is poised to offer stiff resistance. In addition, a number of labor and industry groups have formed a coalition, Power PA Jobs Alliance, to fight "carbon dioxide emission taxes on fossil fuel generation, manufacturing operations, and motor fuels."

Meanwhile, Virginia has legislative action in the works that is pushing it closer to entering the program as well. Efforts to join RGGI stalled in the state last year but were re-energized after Democrats secured majorities in the Virginia house and senate in November.

While RGGI expands to reduce additional power emissions, a group of 12 Northeastern and Mid-Atlantic states and the District of Columbia is working to reduce greenhouse gas emissions from transportation fuels under the Transportation Climate Initiative (TCI). The program's current proposal mirrors California's cap-and-trade system. States will decide in 2020 if they want to opt in, with compliance obligations starting as soon as 2022.

Carbon clash continues between Canada federal and provinces

Canada's federal Output-Based Pricing System (OBPS), commonly known as the backstop program, was put into place at the start of 2019. The regulation gave provinces a choice: Develop a carbon pricing program that meets federal benchmark requirements or accept the federal pollution pricing systems.

As of January 1, 2020, the federal fuel charge was in effect in Ontario, New Brunswick, Manitoba, Saskatchewan, and Alberta.

These rules set off a cascade effect of court appeals by some provinces in 2019, while others continued strategies or implemented the backstop. As the situation continues to unfold at the provincial level, federal lawmakers are forging ahead with climate action.

The federal carbon pricing plan appeared to be on solid footing heading into 2020 following an election in October 2019, in which the Liberal Party won the most seats in Canada's House of Commons but lost majority status. The loss of that status puts the party's grip on power, and ultimately, the fate of the federal carbon pricing program, in a more tenuous position, however.

Conservative Party criticisms of the program have focused on increasing fuel costs to consumers, including working families, and the effects on local businesses and industry. Ontario Premier Doug Ford scrapped the province's cap-and-trade program immediately upon taking office in 2018.

The federal carbon tax was upheld by Canadian courts in decisions considering challenges by Saskatchewan and Ontario, but Alberta's court of appeals found the program unconstitutional in a separate provincial lawsuit in 2020. The federal government is expected to appeal that decision.

Hearings for appeals by Saskatchewan and Ontario regarding the decisions in their challenges are tentatively scheduled for June 2020.

OPIS Carbon Market Report

OPIS By IHS Markit

Daily Pricing, News, and Analysis on Emissions and Clean Air Initiatives

August 16, 2019

IN THIS ISSUE

CALIF. LEADS LAWSUIT AGAINST EPA EMISSIONS RULE

California is one of 22 states and the District of Columbia to file a lawsuit against the U.S. Environmental Protection Agency on Monday over the Affordable Clean Energy Rule, which is meant to replace the Clean Power Plan.

Finalized in June, the Affordable Clean Energy Rule would replace the Clean Power Plan, which was signed by President Barack Obama in 2015 with a goal to reduce carbon emissions from power plants by 32% under 2005 levels by 2030.

"We know what our energy future must look like, and we won't get there by following President Trump's misguided proposal. Because we're prepared to confront the climate crisis head-on, we're prepared to confront President Trump head on in court," California Attorney General Xavier Becerra said in a news release.

According to the lawsuit, the Affordable Clean Energy Rule would violate the Clean Air Act by not significantly decreasing carbon emissions from power plants.

The Affordable Clean Energy Rule would seek to lower emissions from the power sector between 0.7% to 1.5% by 2030, drastically reducing the goal of the Clean Power Plan.

Colorado, Connecticut, Delaware, Hawaii, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, North

California Carbon Allowance Assessments ($/mt)

Product	Vintage	Timing	Low	High	Mean	Change	Wt. Avg.
Previous Yr.	V18	Pmt Aug 19	17.35	17.37	17.360	0.030	----
Previous Yr.	V18	Fwd Dec 19	17.58	17.60	17.590	0.040	----
Current Yr.	V19	Pmt Aug 19	17.35	17.37	17.360	0.030	17.360
Current Yr.	V19	Pmt +1 Sep 19	17.39	17.41	17.400	0.015	----
Current Yr.	V19	Pmt +2 Oct 19	17.44	17.46	17.450	0.030	----
Current Yr.	V19	Fwd Dec 19	17.58	17.60	17.590	0.030	17.590
Next Yr.	V20	Pmt Aug 19	17.35	17.37	17.360	0.030	----
Next Yr.	V20	Fwd Dec 19	17.57	17.59	17.580	0.020	----
Forward Yr.	V21	Pmt Aug 19	17.34	17.36	17.350	0.030	----
Forward Yr.	V21	Fwd Dec 19	17.56	17.58	17.570	0.020	----
Advanced Yr.	V22	Pmt Aug 19	17.29	17.31	17.300	0.030	----
Advanced Yr.	V22	Fwd Dec 19	17.51	17.53	17.520	0.020	----