

Climate and Carbon Insight

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G20 price signals insufficient to reach Paris Agreement goals

Key implications

The world's largest economies have made market-based mechanisms a central feature of their climate change mitigation strategies. Carbon pricing, subsidy management, and fiscal incentives are being used by the Group of 20 (G20) countries to varying degrees, but the current implementation of these mechanisms is unlikely to result in sufficient emission reductions to realize the Paris Agreement objectives.

- **Carbon pricing mechanisms, including carbon taxes and emission trading systems, are falling well short of levels needed to achieve low-emission cases.** It has been suggested that the global economywide carbon price needed to achieve emission reduction targets consistent with the Paris Agreement is between US\$40 and US\$80 per metric ton of carbon dioxide (CO₂) by 2020. By contrast, the average carbon price across the G20 today is US\$16 per metric ton of CO₂.
- **Fossil fuel subsidies act as negative emission price signals.** Public sector subsidy support to lower fossil fuel cost profiles can counteract market-based mitigation mechanisms. G20 governments have been slow to make the changes to existing fossil fuel subsidy regimes promised over the past decade, but alone, removing fossil fuel subsidies would be insufficient to reach current greenhouse gas emission targets.
- **Subsidies for low-carbon technologies can complement other market-based mechanisms for mitigation.** Changes to tax rates, deductions, or exemptions reduce the cost of low-carbon alternative technologies. These incentives can help support the price signal from existing policies, but without additional mitigation policies in place, fiscal incentives cannot close the gap between the other market-based mechanisms, like carbon prices and target levels.

Group of 20 searching for the right mix of signals

As countries search for the right mix of tools to meet greenhouse gas (GHG) emission targets, the world's largest economies are increasingly incorporating market-based mechanisms into their climate change mitigation policies. A survey of the Group of 20 (G20) members by IHS Markit reveals that 19 of the 20 governments deploy economic instruments that increase the costs of emission-intensive activities and/or incentivize low-carbon development. Russia is the sole exception.¹ The signal for emission reductions is achieved through the establishment of a carbon pricing mechanism, reduction or removal of fossil fuel subsidies, and/or development of incentives for low-carbon technology (see Table 1).

1. G20 members include Argentina, Australia, Brazil, Canada, China, the European Union, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, and the United States.

Contacts

Anna Mosby, Senior Analyst
Steven Knell, Director

· anna.mosby@ihsmarkit.com, +1 202 481 7817
· steven.knell@ihsmarkit.com, + 44 203 159 3360

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These instruments are increasingly common because they are held to provide the most economically efficient way to incentivize GHG emission reductions. They do so by providing a price signal for carbon and allowing the market to react with flexibility through the least-cost emission reduction means available.

Carbon price signals: Insufficient to achieve emission reduction targets

Carbon pricing mechanisms, including carbon taxes and emission trading systems, were first developed in the 1990s and are now in place or scheduled for implementation in 51 regional, national, and subnational governments around the world.² Eleven of the G20 governments have implemented a carbon pricing mechanism as of 2018.

Five currently have a carbon tax, while eight governments have emission trading systems in place.³ Two governments have announced plans to implement a new or supplementary carbon pricing mechanism in the immediate future.⁴ Additionally, the Canadian government has issued guidance requiring all provinces to implement a carbon pricing mechanism with a minimum price of C\$10 per metric ton of carbon dioxide (CO₂) by 2018.⁵

The approach of G20 governments toward carbon pricing has varied to date, and it is notable that the implementation of a carbon pricing mechanism is not correlated with economic activity such as GDP or gross national income per capita. On the contrary, the popularity of such market-based mechanisms among G20 countries seems to be more related to fossil fuel production. Countries in which the most emission-intensive fossil fuels, specifically coal and oil, make up a higher percentage of domestic energy production do not typically have carbon pricing mechanisms in place (see Figure 1). Brazil, India, Indonesia, Russia, Saudi Arabia, and the United States do not have emission trading systems or carbon taxes and have not announced an intention to implement these mechanisms.

- The three largest oil-producing countries (Saudi Arabia, Russia, and the United States) and four of the seven largest coal-producing countries (the United States, India, Indonesia, and Russia) have not implemented

Table 1

Market mechanisms for climate change mitigation			
Country	Carbon pricing mechanism	Lowered fossil fuel subsidies	Rail access
Argentina	✓		✓
Australia	✓		✓
Brazil			✓
Canada	(✓)	✓	✓
China	✓		✓
European Union	✓		✓
France	✓	✓	✓
Germany	✓	✓	✓
India		✓	✓
Indonesia		✓	✓
Italy	✓	✓	✓
Japan	✓		✓
Mexico	✓	✓	✓
Russia			
Saudi Arabia			✓
South Africa	(✓)		✓
South Korea	✓	✓	✓
Turkey	(✓)		✓
United Kingdom	✓	✓	✓
United States			✓

Note: Parentheses indicate that a country has announced plans to implement a carbon pricing mechanism.

Source: IHS Markit

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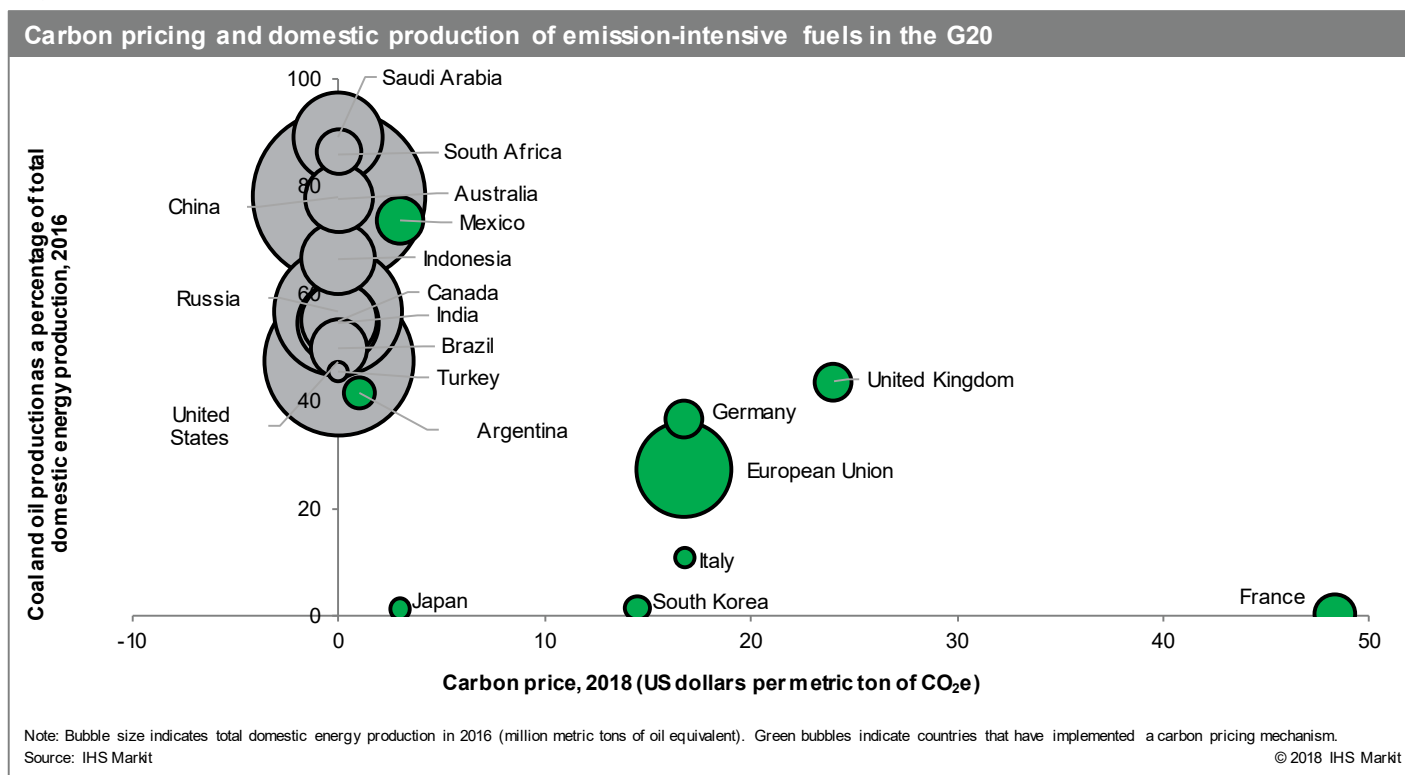
2. World Bank and Ecofys. 2018. "State and Trends of Carbon Pricing 2018 (May)", by World Bank, Washington, DC. Doi: 10.1596/978-1-4648-1292-7, retrieved 21 August 2018.

3. Argentina, France, Japan, and Mexico have a carbon tax, and the United Kingdom has a carbon price floor. Australia and South Korea have national emission trading systems in place, and China announced the launch of an emission trading system in late 2017. France, Germany, Italy, and the United Kingdom are currently subject to the EU Emissions Trading System (EU ETS), but future UK participation in the EU ETS is uncertain in light of Brexit. South Africa plans to introduce a carbon tax.

4. South Africa and Mexico.

5. Provinces may implement their own systems, but those that do not have a suitable system in place will be subject to a federal carbon pricing system. The proposed backstop includes a carbon levy on fossil fuels and an output-based pricing system on industrial facilities emitting 50,000 metric tons of CO₂ equivalent (e) per year or more.

Figure 1



a carbon pricing mechanism. Protection for trade-vulnerable industries and the importance of export competitiveness for primary fossil fuel supplies are the main rationale for this stance. As a result, there is no national carbon pricing mechanism in place in some of the countries that produce the highest volumes of the sources of GHG emissions or in five of the seven highest-emitting members of the G20.

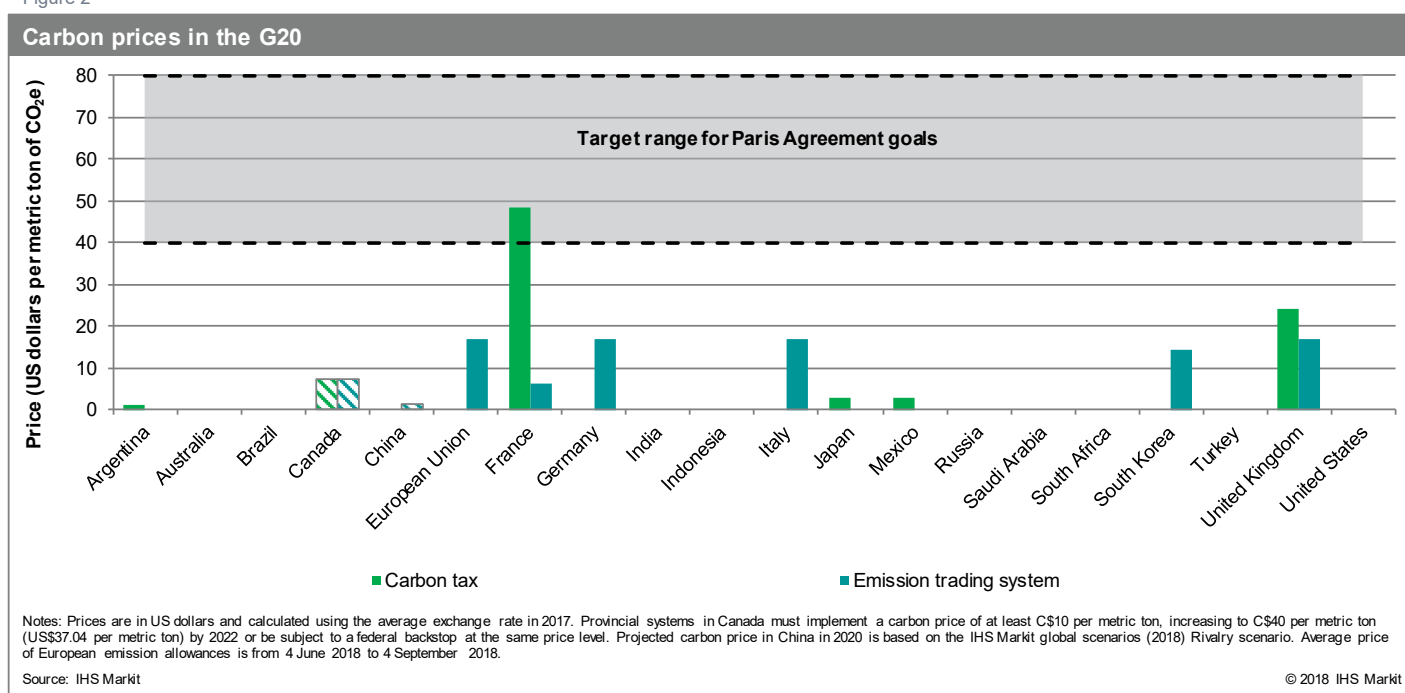
- In the G20 countries that have implemented a carbon pricing mechanism, the intensity of the price signals generally remains well below the price thought to be necessary to induce changes in behavior to achieve the Paris Agreement goals. One estimate is provided by the Carbon Pricing Leadership Coalition (CPLC). According to the High-Level Commission on Carbon Prices, convened by the CPLC in 2017, the economywide carbon price needed to achieve emission reduction targets consistent with the Paris Agreement is US\$40–80 per metric ton of CO₂ by 2020 and US\$50–100 per metric ton of CO₂ by 2030.⁶ Only six countries worldwide (France, Finland, Norway, Liechtenstein, Sweden, and Switzerland) currently have a carbon pricing system

6. The carbon price provided by the commission was developed based on economywide carbon pricing models. According to the commission, “While there is a consensus across models on the technical changes that are needed to maintain climate change below 2°C, models fail to agree on the carbon price required to trigger those changes. Based on the assessment provided in IPCC (2014c), scenarios that limit warming to below 2°C with a greater than 66 percent probability imply carbon prices increasing throughout the 21st century, but with prices ranging from US\$15 to US\$360 (in 2005 United States dollars) per tCO₂e in 2030, and from US\$45 to US\$1,000 (in 2005 United States dollars) per tCO₂e in 2050.” Models differ in baseline scenarios, policy assumptions, and modeling framework assumptions. The commission imposed lower and upper bounds on these values, with the lower bound assuming that very low prices would not efficiently signal the transition to investors and consumers and could lead to misallocation of efforts, while the upper bound assumes that more pessimistic assumptions regarding technological change, socioeconomic trends, and policy environments do not hold true. See Carbon Pricing Leadership Coalition, *Report of the High-Level Commission on Carbon Prices* (Washington, DC: World Bank, 2017), retrieved 21 August 2018.

in place that meets the commission's recommendations, but, critically, the systems do not cover a significant portion of the countries' GHG emissions.⁷

- France is the only G20 country that currently has an explicit carbon price within the range set by the commission (see Figure 2). France added an emission component based on carbon content of fuel to the *taxes intérieures sur la consommation des produits énergétiques* (TICPE), the excise duty on the purchase and sale of fossil fuels for heating and transport.⁸ In 2018, France taxed carbon emissions at a rate of €44.6 per metric ton of CO₂, but this tax covers only 35% of the country's emissions.⁹ It does not cover air, rail, and maritime transport; public transport; and taxis. Sectors that are covered by the EU ETS, which include stationary sources that represent some of the highest sources of emissions—including power and heat generation and energy-intensive industry—are also exempt from this tax; these sources are subject only to EU ETS prices, which are trading at less than half the TICPE duty at the time of writing.

Figure 2



In the G20, most carbon prices are closer to US\$20 per metric ton of CO₂, aside from France's carbon tax and the United Kingdom's £18 (approximately US\$24) per metric ton of CO₂ carbon price floor, designed to supplement EU ETS allowance prices. EU ETS price formation has rallied notably over the past 12 months in response to market reforms and movements in other European commodity markets. Despite these examples, the average price today across the G20 is US\$16.02 per metric ton of CO₂.¹⁰ At that low level, carbon pricing

7. Sweden, Switzerland, Liechtenstein, Finland, Norway, and France have carbon taxes ranging from US\$139 per metric ton of CO₂ (Sweden) to US\$55 per metric ton of CO₂ (France). However, the carbon taxes in Sweden, Switzerland (US\$101 per metric ton of CO₂), Liechtenstein (US\$101 per metric ton of CO₂), and Finland (US\$77 per metric ton of CO₂) cover 40% or less of each country's emissions. Sweden's high carbon tax applies to emissions from transport and buildings. Most operators covered by the EU ETS are exempt, as are certain industries; export of fuels; fuels used in train, shipping, and aviation; and power production. Switzerland and Liechtenstein provide exemptions for large energy-intensive companies if the companies agree to meet emission reduction targets. Finland's carbon tax includes several exemptions, including for electricity production. The carbon tax in Norway covers 62% of the country's emissions, but the tax rate ranges from US\$4 to US\$64 per metric ton of CO₂ depending on fuel type, and operators covered by the EU ETS (except offshore oil production) and export of fuels are exempt or partially exempt. See World Bank and Ecofys. 2018. "State and Trends of Carbon Pricing 2018 (May)", by World Bank, Washington, DC. Doi: 10.1596/978-1-4648-1292-7, retrieved 21 August 2018.

8. Partnership for Market Readiness (PMR) 2017. *Carbon Tax Guide: A Handbook for Policy Makers*. World Bank, Washington, DC., retrieved 21 August 2018.

9. Bate Felix and Geert De Clercq, "France Raises Carbon Taxes, to Repay EDF Renewables Debt," Reuters, retrieved 28 August 2018.

10. Based on maximum carbon prices in countries that have carbon pricing mechanisms in place. The average price of carbon across all G20 countries, including those that do not place a direct price on carbon, is US\$7.21 per metric ton of CO₂.

mechanisms alone are unlikely to trigger the needed changes in investment, production, and consumption patterns.

Fossil fuel subsidies: Removal would avoid price signal distortion

Carbon pricing mechanisms are nonexistent or insufficient to reach the Paris Agreement targets in G20 governments, and the price signals that are in place or may be implemented in the future may be distorted by the persistence of fossil fuel subsidies in the G20.¹¹

In 2009, the G20 agreed to phase out “inefficient” fossil fuel subsidies in the “medium term” to reduce wasteful consumption and enhance energy security and climate change mitigation efforts, and a subset of countries reinforced this pledge in 2016 when the Group of Seven (G7) announced that members would phase out fossil fuel subsidies by 2025.¹² However, IHS Markit research indicates that shifting subsidies away from fuels with high emission intensity is one of the least common market mechanisms employed by G20 countries.

As of 2017, fewer than half of the G20 members had made concrete steps to lower subsidies to fossil fuels over the past nine years, and no country has eliminated this support entirely. Studies by the Overseas Development Institute indicate that G20 members still provide about US\$444 billion in fossil fuel subsidies every year. Among the G7, five members—Canada, France, Germany, Italy, and the United Kingdom—have lowered fossil fuel subsidies, but these countries still provide more than US\$100 billion in fossil fuel support annually.¹³

Continued support for fossil fuels has a bearing on the performance of climate change mitigation policies and measures. Fossil fuel subsidies essentially act as a negative emission price and can counteract market-based mitigation mechanisms, but they are not sufficient on their own to reduce emissions enough to reach targets. A recent study found that removal of fossil fuel subsidies may reduce emissions by 1–5% by 2030 relative to business as usual. This study also found that in some regions, the removal of oil, gas, and electricity subsidies may lead to increased usage of coal, biomass, or charcoal among lower-income populations unable to afford other fuels without subsidies or other incentive programs.¹⁴ That could lead to an increase in domestic emissions. Even if fossil fuel subsidies were completely phased out, they are unlikely to send a strong enough price signal to hit the Paris Agreement target without additional policies in place.

Subsidies for low-carbon technologies: Potential to close the gap between current and target carbon price signals

Subsidies such as public finance and tax incentives can complement other market-based mechanisms for mitigation. This is achieved by lowering the cost of low-carbon alternatives to emission-intensive technologies. However, the effect of these incentives on emission reductions is limited. Unlike command-and-control regulations or carbon pricing mechanisms, subsidies cannot regulate or impose a direct cost on existing assets.

11. Subsidies are defined by the World Trade Organization as “any financial contribution by a government, or agent of a government, that is recipient-specific and confers a benefit on its recipients in comparison to other market participants.” This includes direct transfer of funds, forgone government revenue, government provision or purchase of goods below market value, and income or price support. See S. Whitley et al., *G7 Fossil Fuel Subsidy Scorecard: Tracking the Phase-Out of Fiscal Support and Public Finance for Oil, Gas and Coal*, Overseas Development Institute, London, 2018, retrieved 21 August 2018.

12. “Given the fact that energy production and use account for around two-thirds of global GHG emissions, we recognize the crucial role that the energy sector has to play in combatting climate change. We remain committed to the elimination of inefficient fossil fuel subsidies and encourage all countries to do so by 2025.” See “*G7 Ise-Shima Leaders’ Declaration*,” retrieved 20 August 2018.

13. Canada reformed the Canadian exploration expense to reduce available tax deductions for upstream oil and gas; France has removed subsidies for coal mining operation; Italy eliminated all public financing for coal mining; and Germany has phased out fiscal support for coal- and gas-fired power generation as well as fossil fuel exploration. The United Kingdom increased the climate change levy on natural gas and LPG. See S. Whitley et al., *G7 Fossil Fuel Subsidy Scorecard: Tracking the Phase-Out of Fiscal Support and Public Finance for Oil, Gas and Coal*, Overseas Development Institute, London, 2018, retrieved 21 August 2018.

14. International Institute for Applied Systems Analysis, “*Removing Fossil Fuel Subsidies Will Not Reduce CO₂ Emissions as Much as Hoped*,” ScienceDaily, 7 February 2018, retrieved 21 August 2018; J. Jewell et al., “*Limited Emission Reductions from Fuel Subsidy Removal Except in Energy-Exporting Regions*,” Nature 554, no. 7691 (8 February 2018): 229, DOI: 10.1038/nature25467, retrieved 21 August 2018.

Because subsidies do not impose negative effects on existing assets, they tend to be more palatable for governments and are the most popular market-based mechanism used by the G20. Aside from Russia (the only country not currently employing any market mechanisms for mitigation), all members of the G20 have introduced subsidies to reduce cost and increase uptake of clean energy, electric vehicles (EVs), and energy

Table 2

Subsidies for climate change mitigation

Country	Tax incentives	Rebates	Grants	Performance-based		Loan guarantee	Green fund
				incentives	Loan program		
Argentina	✓		✓			✓	✓
Australia			✓			✓	✓
Brazil	✓		✓			✓	✓
Canada	✓		✓				✓
China	✓			✓			
European Union			✓			✓	✓
France	✓	✓	✓	✓	✓		
Germany	✓	✓	✓		✓		✓
India	✓		✓	✓	✓		
Indonesia	✓						✓
Italy	✓	✓		✓	✓		✓
Japan	✓		✓		✓		✓
Mexico	✓	✓	✓				
Russia							
Saudi Arabia	✓		✓				
South Africa	✓		✓				✓
South Korea	✓		✓		✓		
Turkey	✓		✓				
United Kingdom	✓		✓	✓	✓		✓
United States	✓	✓	✓		✓	✓	

Note: Tax incentives include exemptions or deductions from corporate, personal income, property, sales, and value-added taxes as well as accelerated depreciation, deductions from motor vehicle taxes, and excise duties.

Source: IHS Markit

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efficiency.¹⁵ The most common mechanisms are tax incentives, such as deductions or exemptions for corporate and personal income tax, sales tax, property taxes, value-added taxes, and accelerated depreciation (see Table 2).

Each helps lower the price of and encourage investment in technologies such as energy efficiency, EVs and EV charging infrastructure, and renewable energy. Grants and loan programs, which reduce capital investment and facilitate access to capital, respectively, are another popular mechanism used by G20 members to encourage low-carbon technology uptake through reduced capital investment requirements. To provide this capital for low-carbon technology projects, many G20 countries have climate change mitigation-specific funding mechanisms or banks for domestic projects.

The wide array of subsidies offered by G20 governments may help close the investment gap between emission-intensive and low-carbon technology and increase energy efficiency in the long term. However, these incentives alone will not significantly reduce emissions in the near or medium term. They are ineffective in reducing emissions in existing assets without supplementary policies in place. Subsidies can help support the price signal from existing policies, but without additional efficient mitigation policies in place they

15. Russia reduced import duties on machinery for natural gas as fuel and canceled the import duty on EVs; however, these import duties were reinstated as of 1 September 2017.

are insufficient to reach emission reduction targets and cannot close the existing gap in carbon pricing mechanisms.

Existing signals out of step with Paris Agreement

Market-based mechanisms are a common climate change mitigation policy option among the members of the G20; however, this prevalence is largely based on the perceived efficiencies of such mechanisms rather than the actual emission reduction progress being made by these mechanisms today.

- Current carbon pricing mechanisms are insufficient because coverage is not broad enough and prices are significantly lower than those needed to result in the necessary emission reduction targets.
- The price signal sent by these pricing mechanisms is further distorted by the remaining fossil fuel subsidies in the majority of the G20 countries.
- The current fiscal incentives are unlikely to be able to close this gap on their own.

For the G20 to meet emission reduction targets using market-based mechanisms alone, governments will need to close the gap between the current price signal and the signal needed to push markets away from emission-intensive activities. If this gap is not filled by additional economic instruments, the G20 will likely fail to meet emission reduction requirements laid out in national policies and the Paris Agreement unless strong command-and-control regulations are used to supplement these policies.

IHS Markit Customer Care

CustomerCare@ihsmarkit.com

Americas: +1 800 IHS CARE (+1 800 447 2273)

Europe, Middle East, and Africa: +44 (0) 1344 328 300

Asia and the Pacific Rim: +604 291 3600

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