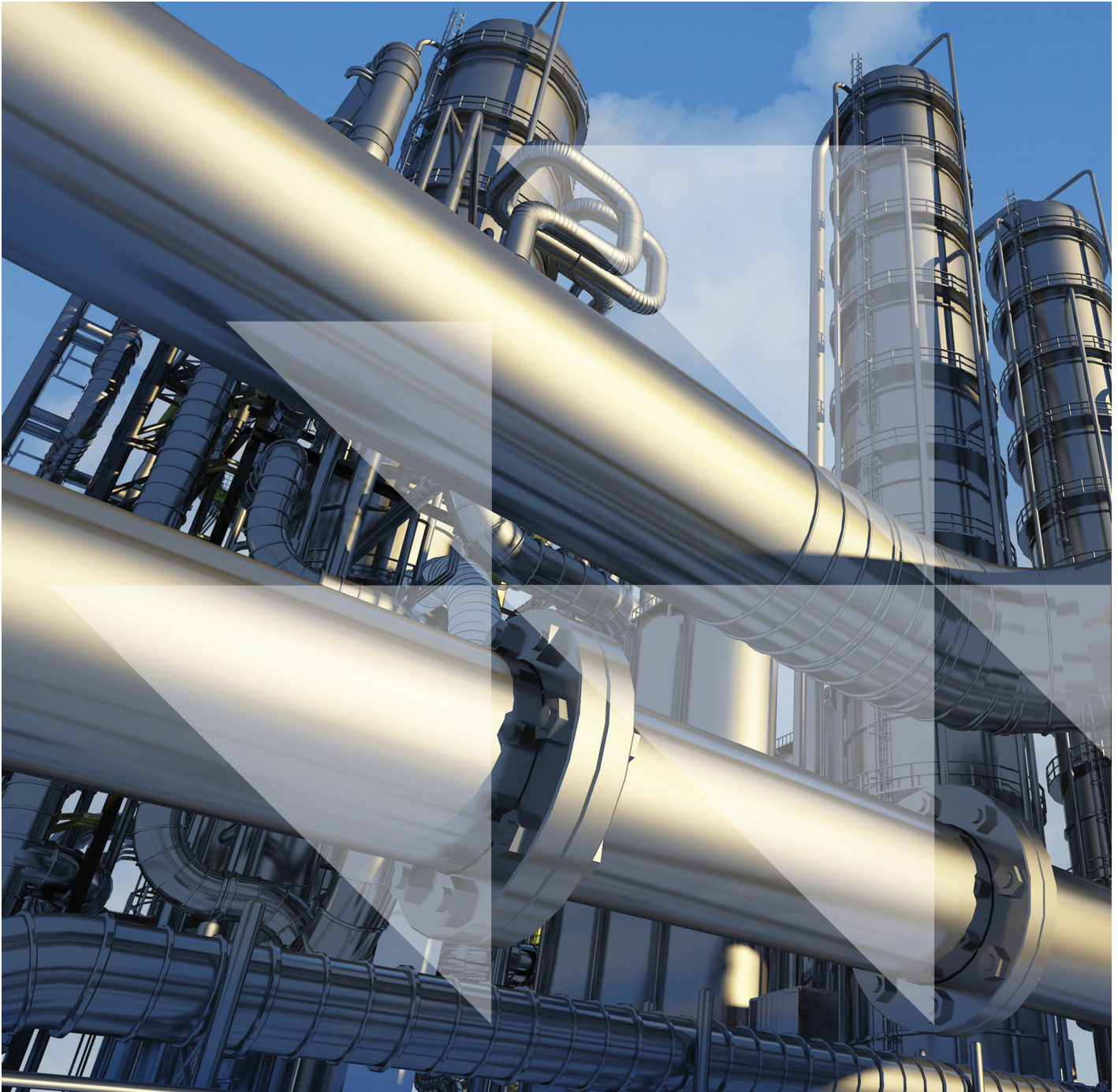


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Are global chemical companies innovating for a low-carbon future?

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The CDP Quarterly Sector Research series provides investors with the best and most tailored environmental data in the market. Each quarter CDP's team of analysts takes a detailed look at one high-emitting sector. The first report, *No room for passengers: are auto manufacturers reducing emissions quickly enough?*, was published in February 2015 and the second, *Flicking the switch: Are electric utilities prepared for a low carbon future?*, was published in May 2015. Further sectors include: metals and mining, oil and gas and consumer goods.

For more information see

<https://www.cdp.net/en-US/Pages/events/2015/sector-research-for-investors.aspx>

Linking emissions-related metrics to earnings for global chemical companies

- ▶ We launch our Super-League Table for global chemicals, ranking the companies based on a number of emissions-related metrics which in aggregate could have a material impact on company performance.
- ▶ Leaders are: DuPont, DSM and AkzoNobel.
- ▶ Laggards are: Ashland, Solvay and Eastman.

Overview

This report is the third in a series of quarterly reports covering six high-emitting sectors (transport, electric utilities, materials, metal & mining, oil & gas, and consumer goods). In February, we published our first report in the series, covering the global auto manufacturers and launching our new Super-League Table (SLT) approach. Since then we published a second report, on the European electric utilities, in May. The CDP Super-League Table ranks companies in an industry grouping on a number of environmental metrics relevant to that industry, which in aggregate could have a material impact on company earnings and therefore investment decisions.

In this report, we launch a Super-League Table for global chemical companies. We rank 18 of the largest (by market cap) and highest-emitting chemical companies¹, based on a number of different emissions-related metrics. When taken in aggregate, we believe these metrics could have a material impact on a company's earnings.

Scope of report: key areas

There are six key areas in our SLT:

- ▶ **Process and energy efficiency:** against the backdrop of global energy security, rising energy prices and resource scarcity, leaders in process and energy efficiency will gain a competitive advantage and potentially enhance earnings. Using emissions-reduction data as a proxy for process and energy efficiency, we assess both historic trends and future targets for the companies in our study to give investors a sense of the leaders and laggards.
- ▶ **Product innovation:** companies provide varying levels of detail on green or eco-products and LCA (Life Cycle Assessment) to CDP and in public information sources; some qualitative, some quantitative and with significant inconsistencies and differing levels of quality. We try to make sense of this information and differentiate between the companies in our study.
- ▶ **Supply chain optimization:** we assess companies' supply chain management, analyzing how they engage with their suppliers and customers on environmental topics and how they manage their supply chain emissions.
- ▶ **Carbon exposure:** we assess the carbon emissions exposure of the chemical companies in our study and the impact on earnings under different carbon price scenarios.
- ▶ **Carbon regulation readiness:** we adopt InfluenceMap's² proprietary analysis to assess readiness for a shift towards a low carbon regulatory framework. We believe that truly supportive firms are the most likely to benefit should the regulatory regime change quickly in their favour. InfluenceMap analyses the behavior of the chemical companies regarding the key regulatory items affecting their business.
- ▶ **Water risk:** worsening water security may constrain the growth of water-intensive chemical companies both directly and indirectly via the supply chain. We assess the companies' exposure to water risk and how they react to mitigate these risks.

1. Selected from diversified, specialty and commodity chemicals (and not fertilizers or industrial gases).

2. A UK-based not-for-profit whose remit is to map, analyze and score the extent to which corporations are influencing climate policy and legislation. <http://www.influencemap.org/>

Condensed summary of the Super-League Table (SLT) for chemical companies

| SLT rank | Companies | Country | Market cap 2015 YTD (USDm) | Overall SLT Score | Process and energy efficiency grade | Product innovation grade | Supply chain optimisation grade | Carbon exposure grade | Carbon regulation readiness grade | Water risk grade | CDP performance band (2014) |
|-----------------------------|---------------------|-------------|----------------------------|-------------------|-------------------------------------|--------------------------|---------------------------------|-----------------------|-----------------------------------|------------------|-----------------------------|
| 1 | DuPont | USA | 65,523 | 6.12 | A | A | D | B | A | B | B |
| 2 | DSM | Netherlands | 10,223 | 6.87 | A | A | B | D | A | B | C |
| 3 | AkzoNobel | Netherlands | 18,380 | 6.88 | C | C | A | C | A | A | B |
| 4 | Sumitomo Chemical | Japan | 8,582 | 7.40 | B | C | B | C | B | E | B |
| 5 | BASF | Germany | 86,043 | 7.45 | B | A | C | B | E | A | B |
| 6 | Bayer | Germany | 120,252 | 7.76 | C | C | A | A | E | A | A |
| 7 | Mitsubishi Chemical | Japan | 8,777 | 8.32 | B | C | D | D | C | B | B |
| 8 | Asahi Kasei | Japan | 13,149 | 8.72 | C | B | B | B | D | E | B |
| 9 | Dow Chemical | USA | 56,932 | 8.89 | A | B | D | E | D | C | B |
| 10 | PPG | USA | 31,206 | 9.76 | C | D | E | A | C | D | D |
| 11 | LG Chem | South Korea | 14,427 | 9.84 | D | D | C | E | C | B | A |
| 12 | Shin-Etsu | Japan | 27,799 | 9.85 | E | E | A | C | C | B | B |
| 13 | Toray | Japan | 13,625 | 10.05 | D | B | A | D | E | E | B |
| 14 | Evonik | Germany | 16,353 | 10.52 | C | E | C | D | D | N/A | B |
| 15 | Nitto Denko | Japan | 11,838 | 10.63 | D | E | E | A | C | D | C |
| 16 | Eastman | USA | 11,132 | 11.08 | E | D | D | C | B | E | E |
| 17 | Solvay | Belgium | 11,908 | 11.37 | E | C | C | E | D | C | B |
| 18 | Ashland | USA | 8,599 | 13.30 | E | E | D | B | B | N/A | D |
| Weighting for each area (i) | | | | | 40% | 15% | 10% | 10% | 10% | 10% | 5% |

(i) the weightings are adjusted for Evonik and Ashland, as they were not sent our CDP water questionnaire.

Source: CDP

Non-responders to CDP

| Company | Country | Market cap 2015 Ytd (USDm) | Business activities |
|---------------------------|-------------|----------------------------|--|
| LyondellBasell Industries | Netherlands | 41,889 | Production of chemicals and plastics: mainly olefins and polyolefins. Also, refinery: production of gasoline and diesel fuel |
| Nan Ya Plastics | Taiwan | 17,239 | Production of electronic materials, petrochemicals, plastic products, polyester fiber and utility products |
| Formosa Plastics | Taiwan | 15,382 | Production of olefins, polyolefins, vinyl, specialty polyvinyl chloride, chlor-alkali, and oil & gas |
| Formosa Chemicals & Fibre | Taiwan | 13,217 | Production of petrochemicals products, plastic products, textile and fibre products |
| Petronas Chemicals | Malaysia | 11,912 | Production of olefins, glycols & derivatives, polymers, aromatics and MTBE, methanol, ammonia and fertilizers |
| Westlake Chemical | USA | 8,881 | Production of basic chemicals, vinyls, polymers and fabricated building products |
| Celanese Corporation | USA | 8,871 | Production of advanced engineered materials, consumer specialties, industrial specialties, acetyl intermediates |

Source: CDP, company data

Scope of report: company selection

We selected the group of companies for our study as follows:

- Started with the 80 chemical companies that responded to CDP's 2015 climate change questionnaire;
- Added Bayer (often classified as pharmaceuticals);
- Ranked the companies by market cap and selected the top 30 companies (this equated to companies with a market cap greater than US\$8bn);
- Ranked the 30 companies by emissions (scope 1+2³) and selected the 20 highest-emitters;
- Removed Ecolab as its activities are much more downstream than the other companies, and we also removed PTT Global Chemicals as approximately half of its revenue is from O&G production.

The remaining 18 companies together represent approximately US\$530bn in market cap and account for more than 60% of the combined emissions (scope 1+2³) of the 80 companies that responded to CDP. The activities of the 18 companies are fairly diversified: they manufacture both commodity chemicals and high-value chemicals (HVCs), and with varying levels of integration. Their many different products have uses spanning numerous end markets, including electronics, automotive, construction, healthcare and crop-sciences.

Leaders and laggards

The highlights of our analysis are as follows (see condensed SLT on previous page):

- The largest non-responders (by market cap) to CDP's 2015 questionnaire were: LyondellBasell Industries, Nan Ya Plastics, Formosa Plastics, Formosa Chemicals & Fibre, Petronas Chemicals, Westlake Chemical and Celanese Corporation.
- DuPont is ranked first and is a comfortable leader (with an overall SLT score of 6.12). It achieves A and B grades across all areas except for supply chain optimization where it is awarded a D-grade. We note that DuPont's response to CDP's 2015 questionnaire relates to emissions from 2014 and therefore pre-dates the spin-off of its higher-emitting performance chemicals business in June, which makes its achievement even more impressive.
- Dutch companies DSM and AkzoNobel are ranked second and third. They score three A-grades each. We note that the top three companies are the only three companies that are awarded an A-grade in our new carbon regulation readiness area, emphasizing the point that companies which are truly supportive of low carbon regulation are forward thinkers and positioning themselves as low carbon leaders.
- German companies BASF and Bayer are ranked fifth and sixth. They would have ranked higher but for their poor performance in our carbon regulation readiness area, where they both scored an E. According to InfluenceMap⁴, BASF appears to oppose a number of policies relating to climate change in the EU, including the potential reforms to the EU ETS to make it more efficient, and Bayer lacks transparency with its position towards climate change policies. This is surprising given their good performance in the other five key areas.
- There are three Japanese companies in the top half of the table and three in the bottom half. Sumitomo is the leading Japanese company in fourth place and Nitto Denko is the lowest ranking of the Japanese companies, in fifteenth place.
- Nitto Denko ranked in the bottom three on our data transparency metric (in the process and energy efficiency area). It is one of only three companies that do not receive third party verification of their Scope 1 and 2 emissions data. The other two companies are Ashland and PPG. Nitto Denko also ranked bottom three in supply chain optimization. It is one of only three companies that reported to CDP (in 2015) that does not engage with any stakeholders on emissions and strategies. The other two companies are Mitsubishi Chemical and PPG.
- The five US companies are spread throughout the table, with DuPont in first place, Dow Chemical mid-table (in ninth place) and Ashland in last place. It is noticeable that all five US companies performed poorly in our supply chain optimization area. They received D and E grades.
- Eastman and Solvay join Ashland in the bottom three of the table. They all receive at least two E-grades, including in our most important area of process and energy efficiency. Ashland is the worst performer on future emissions reduction targets, which does not bode well for its commitment to future efficiency savings. Solvay is ranked bottom on emissions-reduction performance over the last ten years.

3. Scope 1 emissions are those directly controlled by the company, both process and power-related, and Scope 2 emissions are indirect emissions from purchased power.

4. The results for the carbon regulation readiness area are based on InfluenceMap's proprietary analysis

Impact of carbon exposure on EBIT

- ▼ In our carbon exposure chapter, we consider potential future carbon cost exposure based on the companies' total global emissions. We consider three scenarios: (1) YTD weighted average carbon price for existing carbon schemes of US\$7.75 per tonne; (2) a carbon price of US\$20 per tonne; (3) a carbon price of US\$30 per tonne.
- ▼ In our scenario (3), Solvay has 34% of EBIT at risk, while Dow Chemical, LG Chem and Mitsubishi Chemical all have more than 20% of EBIT at risk. We note that scenarios (2) and (3) are for illustrative purposes as they assume zero carbon costs are passed on to customers. That said, several companies, including Ashland and Dow Chemical, admit that they are not always able to pass on carbon costs as it is dependent on market conditions.

Linking our findings to investment choices

We recognise that investment decisions are based on a multitude of different factors and that some of these factors can be misaligned with emissions reduction efforts.

Our SLT rankings are not intended as definitive winners and losers for investment purposes, more as a proxy for business-readiness in an industry where a significantly higher carbon price is required to meet stringent long term emissions-reduction targets.

We would flag that companies towards the bottom of our SLT are possibly higher risk investments from a sustainability perspective than those towards the top.

A summary of key areas, associated metrics and relative weighting within the Super-League Table

| Key area in SLT | Link to company earnings | Metric | Metric weighting within each key area | Key area weighting for overall SLT score |
|-------------------------------|--|---|---------------------------------------|--|
| Process and energy efficiency | Improvement in energy and raw material efficiency can lead to cost savings and thus enhanced earnings. | i) Emissions performance over 2005-2014 ii) Emissions reduction targets iii) Data transparency | 30% 50% 20% | 40% |
| Product innovation | Potentially high market growth in areas where carbon emissions reduction regulations are in place; first movers will benefit, laggards may miss out. | i) Green product leadership ii) Life cycle assessment (LCA) leadership iii) R&D intensity | 35% 35% 30% | 15% |
| Supply chain optimization | A sustainable supply chain may help companies manage reputational risk, reduce costs, improve quality and ultimately lead to competitive advantage. | i) Supply chain engagement ii) Supply chain strategy iii) Manufacturing emissions intensity | 25% 25% 50% | 10% |
| Carbon exposure | Cost exposure to meeting regulatory requirements on carbon emissions. | i) Current exposure to emissions trading systems ii) Total emissions exposure | 50% 50% | 10% |
| Carbon regulation readiness | Companies that are truly supportive of low-carbon regulations are more likely to gain a competitive advantage should the regulatory regime change quickly in their favour. | i) Organizational score ii) Relationship score | 60% 40% | 10% |
| Water | Potential physical risks may constrain the growth of the chemical business. | i) Water risk and opportunity ii) Supply chain management iii) Policy & regulatory compliance iv) Water withdrawal Intensity | 50% 20% 20% 10% | 10% |
| CDP performance band | A good annual CDP score is a proxy for a generally well-run company. Well-run companies are better placed to succeed in a changing marketplace. | i) CDP annual performance band | 100% | 5% |

Source: CDP

Methodology

We score each chemical company based on a number of different metrics which are first ranked and then weighted within each key area (see table on page 6 for metric weightings within each key area) to give a weighted rank for each area. We then grade each area from A to E based on these weighted ranks. We calculate the overall SLT score by weighting the weighted ranks for each key area (see table on page 6 for metric weightings for overall SLT score).

Each of the key areas has a separate chapter within this report and the precise methodology for how we rank and grade each metric is outlined in the relevant chapter.

In addition to the six key areas, we also include CDP's climate performance band for 2014 in the SLT. It scores the 1,749 companies that respond to CDP's investor-backed climate change questionnaire based on their climate change readiness. A high score can imply a well-run business with a forward looking management team, not just focused on the short term.

For further study

Interesting areas for further investigation include:

- ▼ Advanced modelling of carbon pricing scenarios, including real options analysis, which would consider companies passing on carbon costs and altering their product mixes as certain products become less economic.
- ▼ An assessment of hazardous waste for the companies, although we would require a consistent global data set to enable us to calculate meaningful metrics. During our initial investigations, such a data set does not appear readily available.
- ▼ An assessment of the economics of the numerous 'green' products that companies are offering, including analysis of end-market growth under different scenarios (related to product economics, pricing and also tightening regulation).

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