AGENDA
Methodology
Respondent Profile
Main Findings
Summary

Presented by:
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Reed Business Information
November 2017
Method

- Online questionnaire including version for mobile devices

Audience

- Targeted ICIS branded email
- Respondents completing questionnaire entered into a prize draw to win an iPad mini
- Also promoted via social media & in newsletters

Timings

- Fieldwork, data processing and analysis took place in October & November 2017.

Results

- Results are shown on those answering each question
The sample has a mix of producers, users & distributors

- 28% Primarily a producer of basic, intermediate or specialty chemicals (2014 25%)
- 22% Primarily a user of chemicals/producer of finished chemical products (2014 29%)
- 15% A chemical distributor (2014 20%)

('Other' 35% 2014 26%)

Q5: Is your company...?
SUSTAINABILITY RESEARCH NOVEMBER 2017

MAIN FINDINGS – CONTENT LED QUESTIONS
Q33: In five years from now, do you believe renewables-based chemicals will be in common use?

Over two thirds of respondents believe renewables-based chemicals will be in common use in five years time.

Yes, 71%
No, 29%
One third of producers have fully adopted / implemented sustainable chemistry practices, compared to one quarter of users / distributors.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>3</th>
<th>4</th>
<th>Fully adopted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Producers</strong></td>
<td>4%</td>
<td>7%</td>
<td>31%</td>
<td>22%</td>
</tr>
<tr>
<td><strong>Users / distributors</strong></td>
<td>13%</td>
<td>20%</td>
<td>42%</td>
<td>11%</td>
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</table>

Q6 & 20: To what extent has your company adopted and implemented sustainable chemistry practices? (please select on a scale of 1-5, where 1 is 'not at all' and 5 is 'fully adopted').
Q21: In which of the following ways do you work with your suppliers to improve the sustainability of your products and processes?

**Users / distributors**

- Require information from them on their sustainability practices: 60%
- Already using some renewables based chemicals in commercial offerings: 46%
- Require information from them on the environmental footprint of the chemicals we buy from them: 44%
- Jointly develop approaches to improving sustainability: 33%
- Include sustainability as a factor on supplier scorecard ratings: 21%
- Provide measurable sustainability requirements to suppliers: 19%
- Drop suppliers that don't meet sustainability criteria: 17%
One in three producers are currently investing in Research & Development whereas users / distributors are more likely to already be using renewable chemicals

Q7 & 22: Which of the following describes your company's strategy with regard to the use of renewable feedstocks, such as sugars, starches or biomass?

In which of the following ways do you work with your suppliers to improve the sustainability of your products and processes?

**Producers**

- Currently investing in research and development: 32%
- Considering: 28%
- Have strategic commitment to the use of renewable feedstocks: 23%
- Already using some renewable feedstocks in commercial offerings: 23%
- Currently partnering with other companies: 23%
- Actively investigating and planning: 18%
- Little or no interest at this time: 16%
- Currently investing in renewables-based production facilities: 5%

**Users / distributors**

- Already using some renewable chemicals in commercial offerings: 41%
- Considering: 37%
- Currently investing in research and development: 22%
- Actively investigating and planning: 22%
- Strategic commitment to use of renewables-based chemicals: 21%
- Currently partnering with other companies: 16%
- Little or no interest at this time: 11%
- Strategic interest to back-integrate and produce the chemicals we need using...: 9%
- Currently investing in renewables-based production facilities: 8%
Two in five producers are already offering more sustainable versions of the chemicals they produce and a third of users / distributors are already using them.

Producers

- Yes - we already are, 42% (2014 31%)
- Yes - within the next year, 16%
- Yes - within the next 2-3 years, 21%
- No, 21%

Users / distributors

- Yes - we already are, 31% (2014 33%)
- Yes - within the next year, 19%
- Yes - within the next 2-3 years, 39%
- No, 11%

Q8: Do you expect to offer more sustainable versions of the chemicals you produce?
Q23: Do you expect to use more sustainable versions of chemicals to make your products?
A similar proportion of those who are already offering / using sustainable versions of the chemicals they produce describe their commitment as ‘solid’

**Producers**

- **Solid commitment:** we have made and will implement further tangible steps going forward, 42%
- **Very likely:** we are applying substantial energy in that direction, 19%
- **Likely:** it's one of our initiatives and it has good management support, 26%
- **Maybe:** it's one of our objectives and we're going to try to make it happen, 13%

**Users / distributors**

- **Solid commitment:** we have made and will implement further tangible steps going forward, 20%
- **Very likely:** we are applying substantial energy in that direction, 27%
- **Likely:** it's one of our initiatives and it has good management support, 27%
- **Maybe:** it's one of our objectives and we're going to try to make it happen, 27%
Producers estimate on average 21% of the chemicals made by their company in three years will be made using renewable feedstocks and users / distributors 16%.

Producers
Mean: 20.87%

Users / distributors
Mean: 15.63%

Q10 & 25: What percentage of the chemicals made by your company will be made using renewable feedstocks in three years? (please enter a number between 0 and 100)
The most important factors for producers when considering renewable-based production are costs of production, availability of renewable feedstocks and smaller environmental footprint.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Very important</th>
<th>Moderately important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash costs of production</td>
<td>85%</td>
<td>9%</td>
</tr>
<tr>
<td>Availability of renewable feedstocks</td>
<td>77%</td>
<td>19%</td>
</tr>
<tr>
<td>Customer demand</td>
<td>77%</td>
<td>15%</td>
</tr>
<tr>
<td>Minimal impact on downstream products and customers</td>
<td>72%</td>
<td>23%</td>
</tr>
<tr>
<td>Capex per tonne of capacity</td>
<td>64%</td>
<td>30%</td>
</tr>
<tr>
<td>Safer operations</td>
<td>57%</td>
<td>33%</td>
</tr>
<tr>
<td>Potential performance(functionality) advantage</td>
<td>41%</td>
<td>46%</td>
</tr>
<tr>
<td>Smaller environmental footprint for chemicals</td>
<td>38%</td>
<td>57%</td>
</tr>
<tr>
<td>Disconnecting your feedstock from oil and natural gas</td>
<td>30%</td>
<td>47%</td>
</tr>
<tr>
<td>Economical to deploy smaller plants</td>
<td>29%</td>
<td>47%</td>
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Q11: How important are each of the following factors when considering renewable-based production?
The most important factors for users / distributors when considering renewable-based chemicals in their products are minimal impact on product performance & customer demand.

Users / distributors

Q26: How important are each of the following factors when considering using renewable-based chemicals in your products?

- Minimal impact on your products' performance or characteristics
- Customer demand
- Minimal impact on your production processes and facilities
- Similar costs as current non-renewable chemicals
- Ability to differentiate your products in the market
- Potential performance (functionality) advantage
- Smaller environmental footprint for your products

(2014 74%)
(2014 60%)
(2014 53%)
(2014 52%)
(2014 61%)
(2014 55%)
(2014 46%)

Very important
Moderately important
The main production issues of biobased chemicals are consistent supply of feedstock and customer qualification & acceptance

<table>
<thead>
<tr>
<th>Issue</th>
<th>2014 Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistent supply of feedstock</td>
<td>31%</td>
</tr>
<tr>
<td>Customer qualification and acceptance</td>
<td>22%</td>
</tr>
<tr>
<td>Building a plant</td>
<td>21%</td>
</tr>
<tr>
<td>Customer acceptance of biobased products</td>
<td>8%</td>
</tr>
<tr>
<td>Current and potential legislation</td>
<td>21%</td>
</tr>
<tr>
<td>Time for your customers to develop and test new products</td>
<td>8%</td>
</tr>
<tr>
<td>Operating a plant</td>
<td>13%</td>
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</tbody>
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Q12: What do you see as the main issues regarding production of biobased chemicals?
Q27: What do you see as the main issues around the use of biobased chemicals?

The main usage issues of biobased chemicals are reliability of supply and predictability of cost.

Users / distributors

- Reliability of supply of biobased chemical: 57% (2014 58%)
- Predictability of cost of biobased chemical: 50% (2014 37%)
- Effort needed to qualify and accept them for use: 43%
- Customer acceptance of biobased products: 42% (2014 22%)
- Time to develop and test new products made with them: 28% (2014 21%)
- Current and possible future legislation: 22%
Q13: In your opinion, will there be long-term economic advantage to you in switching some of the feedstocks for your chemical production to renewable feedstocks, like sugars, starches or biomass?

Half of respondents believe there will be long-term economic advantage in switching some of the feedstocks for your chemical production to renewable feedstocks.

Producers

- **Yes, 54%** (2014: 43%)
- **No, 17%** (2014: 28%)
- **Don't know, 28%**
Half of respondents believe their company should reduce its exposure to the petroleum-based commodity market.

Q14: In your opinion, should your company reduce its exposure to the petroleum-based commodity market?
Almost half believe it is important for their company to be a leader in terms of sustainable chemicals

Q15: How important is it for your company to be a leader in terms of sustainable chemicals?

Producers

- Very important, 46%
- Moderately important, 41%
- Not important, 13%
Two thirds of respondents have had customers express interest in sustainably produced chemicals

Producers

Q16: Have your customers expressed interest in sustainably produced chemicals?

Yes, 65%
(2014 62%)

No, 35%
(2014 38%)
Interest from customers in sustainably produced chemicals over the last three years has increased for almost two thirds of respondents.

Q17: In the last three years, how has the level of interest your customers have shown in sustainably produced chemicals changed?

- Much lower now: 2% (2014: 7%)
- Slightly lower now: 7% (2014: 17%)
- Stayed the same: 28% (2014: 28%)
- Slightly greater: 46% (2014: 46%)
- Much greater now: 17% (2014: 26%)

Net change: +54% (2014: +16%)

Total increase: 63% (2014: 36%)
Twice the number of producers than users / distributors set targets on all activities

### Producers

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23%</td>
<td>20%</td>
<td>23%</td>
<td>16%</td>
<td>18%</td>
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</tbody>
</table>

- Not at all
- We set targets on all our activities

### Users / distributors

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21%</td>
<td>32%</td>
<td>29%</td>
<td>10%</td>
<td>8%</td>
</tr>
</tbody>
</table>

- Not at all
- We set targets on all our activities

Q18 & 28: To what extent do you set targets for your renewables-based product efforts and benchmark them against peer performance and your past performance? (Please select on a scale of 1-5, where 1 is ‘not at all’ and 5 represents ‘we set targets all our activities’)

ICIS INSIGHT
Over a third of respondents are having proactive discussions with brand owners

**Producers**

- 39% Proactive discussions with brand owners
- 30% See what my competitors are doing
- 24% Proactive grassroots discussions with end-users
- 7% Delay changes to protect our own asset base

**Users / distributors**

- 37% Proactive discussions with brand owners
- 34% See what my competitors are doing
- 19% Proactive grassroots discussions with end-users
- 10% Delay changes to protect our own asset base

Q19 & 29: What is the primary way that your company develops and implements strategy with respect to renewables-based products?
Other comments on sustainable chemicals…

“Hopefully it will find sufficient traction (with the needed politics and society drive) to make it happen.” – Producer, Europe, CXO

“The key driver for sustainable chemicals will be legislation as customers are generally not willing to pay for it. Also there are too little choices available today.” – Producer, North America, Manager

“Comments: / 1) the push for the use of sustainable chemicals is more a marketing activity of brand owners - to get customer’s sympathy - than the push for possible environmental benefits / 2) the market of biobased chemicals will slowly grow, as economical and mechanical aspects are playing an important role, like improved studies of the total footprint of bio-culture. / 3) sustainability is a trend. No guarantee for the future.” – Distributor, Europe, EVP

“It is need of time for big company to do more R & D in making use of renewable feedstock in chemical manufacturing.” – Producer, South East Asia, Manager

“There has been increasing noise on sustainable materials for some time now, but in real terms, it still all depends on the performance and costs in the final end produced materials. There needs to be a greater draw from customers, and acknowledgement that until the scales are larger, the prices will be higher.” – Distributor, Europe, Group Technical Head

“Though future of renewable chemicals is bright still we have miles to go.” – User, India, Manager

“Transition needs to be driven also from legislative point of view also.” – User, Europe, Manager

Q34: Do you have any other comments you would like to make on the issue of sustainable chemicals?
Q30: When you think of technology leaders for sustainable chemicals, which companies come to mind?

- **BASF**: 17%
- **Genomatica**: 6% (2014: 3%)
- **Braskem**: 5%
- **CRODA**: 4%
Q30: When you think of technology leaders for sustainable chemicals, which companies come to mind?
Q31: When you think of producers of sustainable chemicals, which companies come to mind?

<table>
<thead>
<tr>
<th>First mention</th>
<th>Total mentions</th>
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<tbody>
<tr>
<td>Braskem</td>
<td>6%</td>
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<tr>
<td>Cargill</td>
<td>6%</td>
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<tr>
<td>Dow</td>
<td>6%</td>
</tr>
<tr>
<td>NatureWorks</td>
<td>6%</td>
</tr>
<tr>
<td>BASF</td>
<td>10%</td>
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<tr>
<td>Braskem</td>
<td>5%</td>
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<tr>
<td>Dow</td>
<td>4%</td>
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<tr>
<td>Bioamber</td>
<td>3%</td>
</tr>
<tr>
<td>Cargill</td>
<td>3%</td>
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<tr>
<td>NatureWorks</td>
<td>3%</td>
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<tr>
<td>ADM</td>
<td>3%</td>
</tr>
<tr>
<td>Covestro</td>
<td>3%</td>
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</table>
The brands with the most positive prompted brand impression for sustainability technology are Genomatica, Novozymes and BASF.

Q32: What is your overall impression of the following companies with regard to sustainability technology?
Summary of Findings

- The vast majority of respondents believe renewables-based chemicals will be in common use in five years time (71%). To date, a third of producers (35%) and a quarter of users / distributors have fully adopted sustainable chemistry practices.

- Strategy for producers is investing in Research & Development and users / distributors are already using some renewable chemicals in commercial offerings. Over a third of producers are already offering more sustainable versions of the chemicals they produce (42%) and a third of users / distributors are using them (31%).

- The most important factors for producers when considering renewable-based production are ‘Cost of production’, ‘Availability of renewable feedstocks’ and ‘Smaller environmental footprint’, whereas for users / distributors it was ‘Minimal impact on product performance’ & ‘Customer demand’.

- The main production issues for biobased chemicals are consistent supply of feedstock and customer qualification & acceptance. The main usage issues were reliability of supply and predictability of cost.

- Twice the number of producers (18%) are setting targets on all activities for renewables-based product efforts and benchmark them against peer and past performance, compared to 8% of users / distributors. Over a third of both producers (39%) and users / distributors (37%) are having proactive discussions with brand owners to implement strategy for renewables-based products.

- In terms of spontaneous recall, technology leaders for sustainable chemicals were most likely to be BASF, Genomatica & Dow. Producers of sustainable chemicals most recalled were BASF & Braskem. The brands with the most positive prompted brand impression for sustainability technology are Genomatica, Novozymes and BASF.