This chapter looks not just at the capacity investment discussed in Chapter 1, but at the overall flow of capital into all parts of the renewable energy value chain – what the Global Trends report calls the ‘financing continuum’.

Total investment in renewable energy worldwide, including early-stage and corporate-level funding as well as the financing of new capacity, was $288.3 billion in 2018. This was 11% down on 2017’s record $325 billion.

The fall was entirely due to the decline in investment in new capacity, as discussed in Chapter 1. The main causes of this were lower equipment costs globally, and China’s switch to a more restrictive allocation of feed-in tariffs for solar projects.

Non-capacity types of investment all rose in 2018. Corporate research and development was up 12% at $7.6 billion, and government R&D 8% higher at $5.5 billion. Equity raising by specialist renewable energy companies on public markets increased 6% to $6 billion.

Venture capital and private equity investment in renewables businesses jumped 35% to $2 billion last year, but remained far below the peak figures recorded around the turn of the decade.
CHAPTER 2

FINANCING CONTINUUM

The Global Trends in Renewable Energy Investment report has, over the years, tracked the flow of finance into the sector along a ‘financing continuum’. This is shown in Figure 18. At the left-hand side of the diagram, there is pure technology funding. Some of this is extremely early-stage and often financed by government research and development programs, or in the R&D budgets of large companies. An important additional element is paid for by start-ups and young companies, in turn drawing their resources from the purchase of new shares by venture capital and private equity investors.

The private equity element, in particular, takes growing companies specializing in renewable energy into the next phase, which is scaling-up either of manufacturing or of service offerings, including project development. This stage also sees an important role for investors on public stock markets, providing new capital via share issues by specialist renewable energy companies.

In the ‘rollout’ phase, on the right of the diagram, are the asset finance of utility-scale renewable energy projects such as wind farms, solar parks and biofuel plants, and the funding of ‘small distributed capacity’ (solar systems of less than 1MW in capacity). Asset finance, the largest element of the continuum by far, relies on-balance-sheet capital from large developers such as utilities; and a mix of equity and debt from infrastructure investors and banks. This second type is known as ‘non-recourse project finance’ because the equity and debt is provided directly to the project, and its risk lies with the performance of the project not with the fortunes of the developer.
Acquisition activity, both of companies and of projects, is another important element in the financing continuum since it enables money to be recycled into new opportunities in the renewable energy sector. It is shown in the bottom right of Figure 18.

This chapter looks at the shifting volumes of finance going into these different elements of the continuum. Other chapters look in more detail at each of those elements – capacity investment (the rollout stage in Figure 18) has been introduced in Chapter 1, and will be examined more comprehensively in Chapters 3, 4 and 5; earlier-stage investment (on the left and centre of Figure 18) is covered in Chapter 6; the acquisition stage (on the far right of the continuum) is explored in Chapter 7.

Looking at the different stages of the continuum is important in order to understand the dynamics of overall investment. The growth of renewable energy can be put in jeopardy if capital dries up in any stage of the continuum – for instance the funding of new technology or the recycling of finance via acquisitions.

Indeed, other stages of the financing continuum were more resilient last year. Taking them in turn, corporate R&D advanced by 12% to a record $7.6 billion worldwide, while government R&D rose 8% to $5.5 billion, also the highest in any year to date, although by only a narrow margin over the previous record set in 2009.

Public markets investment in renewable energy companies increased 6% to $6 billion, but was below the five-year average of $8.9 billion and far below the most recent high, of $14.9 billion reached in 2014.

Venture capital and private equity investment in renewables rallied 35% to $2 billion in 2018, but this was also below the five-year average and far less than in the peak years around the turn of the decade. The reasons for the changes in financial flows to these types of investment are discussed in Chapter 6.

Last year marked a pause in one long-term trend, which has been the increasing dominance of the ‘rollout’ phase (asset finance of utility-scale
projects and the funding of small distributed capacity) within overall new investment in renewables, reflecting the ever-increasing maturity of the sector, particularly wind and solar technologies. Since 2010, the ‘rollout’ phase has increased its share of that total from 85% to 93%—despite a fractional move downwards in 2018.

Also evident in Figure 20 is the scale of acquisition activity—mergers and acquisitions, buy-outs, refinancings and asset purchases. This amounted to $149 billion in 2018, up 4% on 2017. Together with the new investment categories discussed above, it took total transactions in renewables to $437 billion.

Figure 21 is a regular fixture of the Global Trends Report: a convenient breakdown of total renewable energy investment since 2004, by type, by sector and by region. It shows the compound annual growth rate for each item. Some of the most impressive CAGRs over the 2004–2019 period are for investment in China and that in the Middle East and Africa, at 30% and 27% respectively, and that for project acquisition and refinancing, at 25%.

At the other end of the scale, some corners of renewable energy investment have seen negative annual growth rates over the 15 years to 2018.

FIGURE 20. GLOBAL TRANSACTIONS IN RENEWABLE ENERGY, 2018, SBN

SDC = small distributed capacity. Total values include estimates for undisclosed deals. Figures may not add up exactly to totals, due to rounding.

Source: UN Environment, Frankfurt School-UNEP Centre, BloombergNEF
Investment in biofuels, for instance, climbed strongly to a peak in 2006, but then slumped so that its total for last year was less than that in 2004. Small hydro investment has also tended to decline after peaking in 2010 – although it is possible that its 2018 Figure may be revised up in due course, when more information on projects becomes available. Venture capital funding of renewables is a third line in the table to have showed a negative CAGR over the period, as its high point in 2008 gave way to a record low by 2018.

Figure 21 also reveals some interesting movements at the level of sub-categories of investment. For instance, while private equity expansion capital was relatively buoyant in 2018 at $1.8 billion, the highest for three years, venture capital financing was just $201 million, the lowest in any year covered by BloombergNEF data. VC funding has tended to decline in recent years, reflecting the fact that the dominant technologies in renewables (wind and solar) are now mature, and the scope for breakthroughs by start-up companies is much more limited than it was.

THE SECTOR DIMENSION

This section looks at time series for the categories of investment mentioned above, and how different renewable energy sectors contributed to the changes.

The rise in venture capital and private equity funding in 2018 was from a low base – because the 2017 figure, at $1.5 billion, was the smallest since 2004. So although last year saw a 35% bounce to $2 billion, that was still the second weakest total since 2005 and a far cry from the $9.9 billion record of 2008 or the $8 billion number of 2010.

Biofuels accounted for the two biggest deals in VC/PE funding for renewables in 2018, with several transactions in solar and one each in wind and in biomass and waste-to-energy making up the list of those above $50 million. Overall, solar was the largest sector for venture capital and private equity raising, as Figure 22 shows. More detail on the individual deals and the sector and region is contained in Chapter 6, later in this report.

Research and development spending by companies and governments continues to play an important role in nurturing new green energy technologies. Last year, solar made up the majority of the activity, at $6.6 billion, as Figure 23 indicates.
Wind came second at $2.7 billion, with biofuels at $1.8 billion and biomass and waste at $1 billion.

The relative importance of corporations and governments in R&D dollars spent has changed subtly over the years. Governments accounted for the lion’s share of spending during the “green stimulus” period after the 2008 financial crisis, and their lead over companies stayed in place right up to 2016. In the last two years, however, corporations have pulled ahead in terms of commitments, and the 2018 total of $7.6 billion was a clear record.

Public markets investment (see Figure 24) tends to come into play at a somewhat later stage in corporate evolution, either when a manufacturer is looking to raise money to scale up output and improve its products, or when a renewable energy developer is aiming to roll out a new wave of projects. In 2018, as Chapter 6 highlights, almost all of the sizeable public market issues in renewables were by developers, mostly of wind or solar projects, but including one large Chinese biomass and waste-to-energy project firm.
Figure 25, on capacity investment, illustrates just how dominant wind and solar have become in renewable energy. Even large hydro, which is outside the scope of most of this report, found itself dwarfed in 2018 — with final investment decisions of around $16 billion, down 64%, compared to $100 billion-plus totals for wind and solar. The other two sectors to see capacity investment of more than $1 billion were biomass and waste-to-energy, and geothermal.

**FIGURE 25. RENEWABLE ENERGY ASSET FINANCE AND SMALL DISTRIBUTED CAPACITY INVESTMENT BY SECTOR, 2018, AND GROWTH ON 2017, $BN**

<table>
<thead>
<tr>
<th>Sector</th>
<th>2018, $BN</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>133.5</td>
<td>-22%</td>
</tr>
<tr>
<td>Wind</td>
<td>139.7</td>
<td>3%</td>
</tr>
<tr>
<td>Biomass &amp; w-t-e</td>
<td>6.8</td>
<td>61%</td>
</tr>
<tr>
<td>Small hydro</td>
<td>0.4</td>
<td>-89%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>2.0</td>
<td>-1%</td>
</tr>
<tr>
<td>Biofuels</td>
<td>0.5</td>
<td>-64%</td>
</tr>
<tr>
<td>Marine</td>
<td>0.0</td>
<td>0%</td>
</tr>
<tr>
<td>Large hydro</td>
<td>16</td>
<td>-64%</td>
</tr>
</tbody>
</table>

Total values include estimates for undisclosed deals.
Source: UN Environment, Frankfurt School-UNEP Centre, BloombergNEF
The previous section of this chapter mentioned acquisition activity as being an important element in the recycling of capital through the sector, and in enabling investors to crystallize their returns. Figure 26 reveals just how much upward momentum acquisitions have had over recent years. After a fairly flat period from 2007 to 2013, the volume started to take off, and 2018’s figure of $149.1 billion was more than double that of 2013.

The growth in acquisition activity over the last five years has been logical, in that much of it has been the purchasing and sale of wind and solar projects – and those assets have multiplied in number and scale as their sectors have added more and more capacity during this decade. More gigawatts installed or under development equals more gigawatts that can be transferred to new owners, at the right price.

Overall, wind and solar played by far the largest roles in acquisition activity in renewables in 2018, contributing $81 billion and $62.7 billion respectively to the overall total of $149.1 billion. The wind figure was up 15% on the previous year, but solar was down 1%.

Total values include estimates for undisclosed deals.
Source: UN Environment, Frankfurt School-UNEP Centre, BloombergNEF