Arthur D Little

Energy & Utilities

Two Realities for Renewables

The Search for Profit in a Booming Industry

Content

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Executive summary

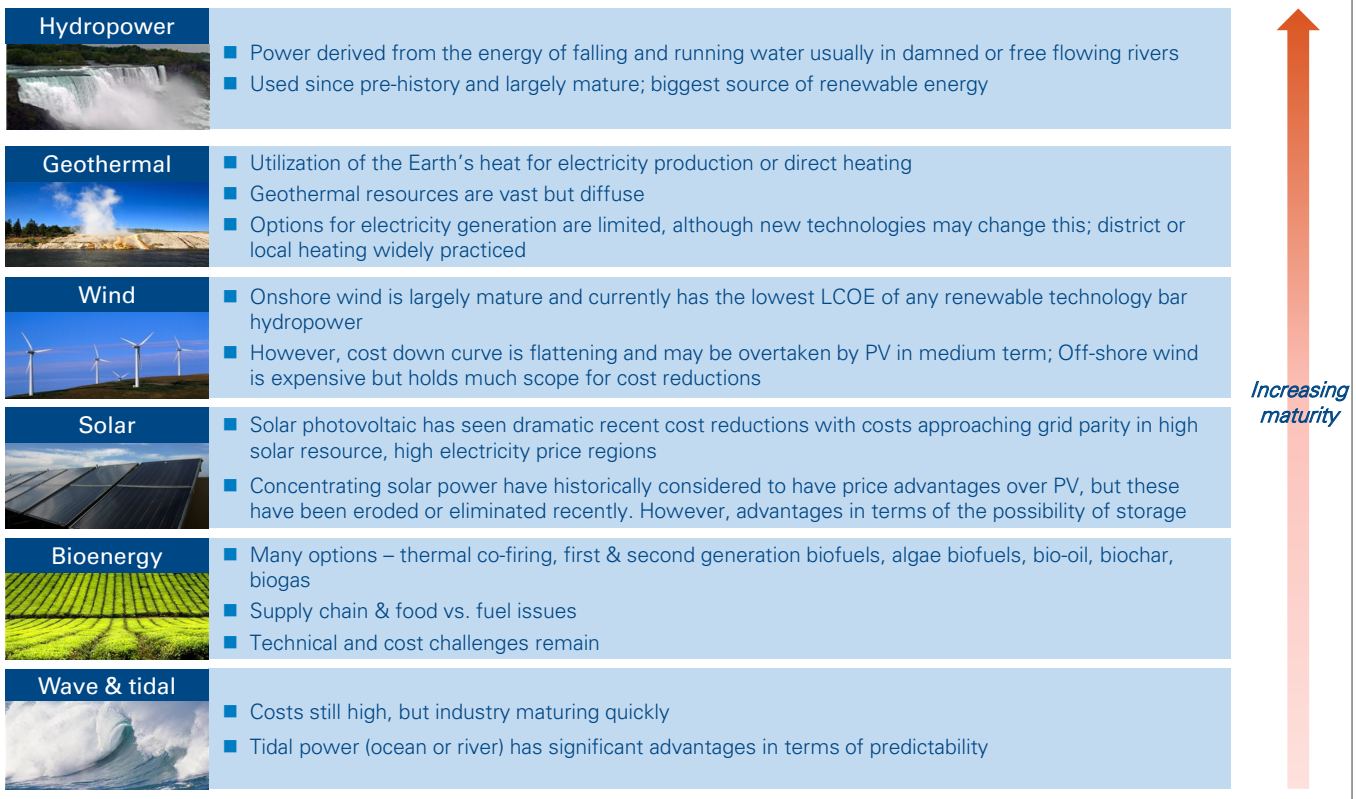
Large scale commercial deployment of renewable energy is now a reality – hydro and geothermal power are well established, the growth of wind and solar capacity continues to be dramatic; while the fall in the cost of solar power has been so spectacular that it threatens to disrupt the established electricity generation industry and profoundly change the energy landscape.

Yet a second reality is that many companies are struggling to succeed in the industry. Waves of bankruptcies and falling profitability in many segments, rapidly changing legislation and incentive regimes, and significant reductions in investment pose a considerable challenge.

In this article we draw on recent experiences with our clients to demonstrate why some companies succeed and others fail, in order to highlight key success factors for companies operating in energy and related industries.

Two Realities for Renewables: 1. Significant installations on the ground

Figure 1: Renewable energy technologies



Source: Arthur D. Little

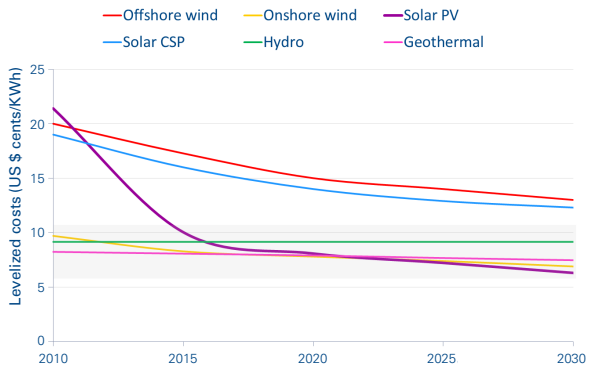
Today, renewable energy is an established component of the energy generation landscape. In 2012 renewable energy accounted for 23% of European electrical power production[1], 13% of US generation and 21% of Chinese production. Globally there is roughly 1,450 GW of installed renewable capacity on the ground.[2]

Moreover, several recent developments have highlighted the fact that far from being "tomorrow's technology," renewables are now a mainstream part of the energy mix:

- In Q1 2013, Portugal produced 70% of its electrical power from renewable sources
- In March 2013, wind and solar broke through the 50% barrier for total electricity generation several times in Germany
- Renewables represented 82% of new US electrical generating capacity in Q1 2013
- Solar power is nearing or has reached grid parity[3] in Italy, India, and Australia
- China's wind power production increased more than coal power production in 2012, while hydropower production increased by more than 15 times

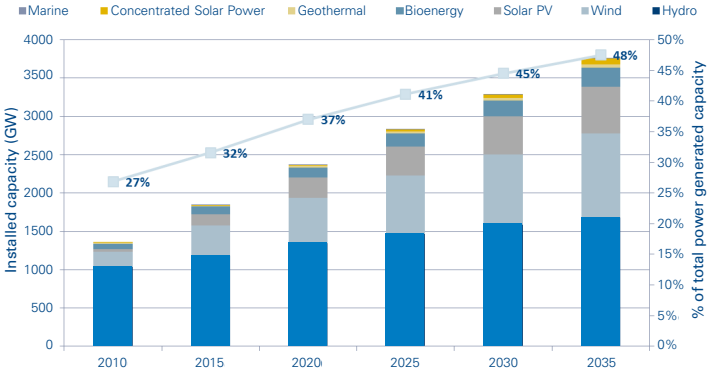
1 Of this ~45% was hydropower, ~30% wind, ~15% biomass & waste, ~8% solar (mostly PV), and ~2% other
2 Source: IEA, Bloomberg New Energy Finance
3 Grid parity is generally defined as the point at which the levelized cost of energy reaches the average residential price of electricity in a region. Retail prices are generally much higher than wholesale prices.

Figure 2: Levelized costs projection



The grey box shows the approximate range for fossil fuel generation in the OECD.
Source: IEA, NREL, BNEF, IRENA, Arthur D. Little.

Figure 3: Renewables installed capacity 2010-2035



Source: IAE, World Energy Outlook 2012 (New data expected to be released very soon)

Until recently, growth in renewable energy has largely been driven by government subsidy. In recognizing the potential for renewables to mitigate the emission of greenhouse gases and enhance energy security, governments worldwide have deployed a variety of support mechanisms with varying degrees of effectiveness. These subsidies have been a vital element in transitioning renewables from developmental to relatively mature commercially viable technologies.

However, while subsidies remain vital to support the large scale deployment of renewables, particularly of less mature technologies such as wave and tidal, the industry is on the cusp of a historic transition to true unsubsidized cost competitiveness versus conventional technologies. This dramatic change is driven by the rapid falls in the costs of renewable energy technologies, most notably in solar PV (see figure 2[4]). According to some reports, new wind energy is already cost competitive with new gas in high priced gas markets (e.g. Japan and some other parts of Asia)[5], solar is approaching cost parity in some regions of the world (with high solar potential and high electricity prices e.g. India, Italy),[6] while geothermal and hydropower are already commercially established technologies in certain circumstances. By 2020 renewable technologies are expected to be cost competitive with conventional generation technologies in many situations, with potentially extraordinary implications for the whole dynamic of the power sector (see box 1 overleaf).

This shift is expected to continue to fuel significant growth (see figure 3). By 2035, renewables are expected to account for >25% of global electricity generation, with Europe leading the way. Total installed capacity of renewables is expected to reach 50% of overall capacity, with hydropower continuing to form the largest segment. However, wind, solar PV and bioenergy will also contribute greater than half of the renewable generation capacity (see figure 3).

Yet despite all this positive news, many technology companies in the industry continue to face significant difficulties. Why?

4 The levelized cost of energy (LCOE) is the constant unit value (usually expressed in $/kWh) of a payment stream that has the same present value as the total cost of building and operating a generating plant over its life, including capital cost, operating costs, fuel costs (where relevant) & financing costs. Levelized cost projections can vary significantly depending on the specific nature of particular projects and the assumptions used.

5 Source: Citi Research

6 Source: Deutsche Bank, Citi Research

Box 1: The Emerging Solar Energy Revolution: Winners and Losers in a dramatic shift in the energy landscape

It is becoming abundantly clear that developments in the solar industry have the potential to cause a disruptive shift in the energy landscape. While wind power has traditionally captured most of the attention of the public, governments and even power companies, industry observers are now increasingly viewing solar as the technology with the most potential to dramatically shake up the energy industry, on a timescale previously unthinkable. Falls in the cost of solar PV modules have exceeded the most optimistic projections of even relatively recent forecasts. PV modules are now available for significantly under $1/Wp (versus >$5/Wp only 5 years ago) and costs are being projected by some observers to fall to $0.25/Wp or less in the next few years.* While there will no doubt be bumps along the road and it is questionable whether the recent pace of cost reduction can be sustained, as a result of these falls predictions of when solar will reach grid-parity in different countries is to be brought forward significantly. Some reports suggest that even relatively cloudy and Northern countries such as the UK and Germany will reach grid parity by 2020.

While this is great news for customers and the environment, the dramatic cost reductions present a massive challenge for solar module producers as they either have to compete with these low costs, or fade out. A striking feature of the reduction in solar module costs is that it has been achieved not as a result of the development of fundamentally new technology but primarily due to increases in production efficiency of the oldest and most established solar technology, crystalline silicon, a technology that was once thought to have a limited potential for cost reduction versus newer approaches such as thin-film and organic cells. Indeed the market share of these new approaches has actually been falling and many of the recent casualties of the on-going solar shake out are companies which have been attempting to develop new technologies such as organic PV technologies sold around sales features such as bendability or superior aesthetics. Where successes have been realized in newer technologies, the focus has largely been in process innovation focused on cost efficiency and process optimization rather than new technology development. First Solar, now back into profit after a few tough years, is a good example of this in the CdTe (Cadmium Telluride) thin film space. First Solar has relentlessly focused on production efficiency alongside incremental technology development and as a result has, at least to date, managed to stay competitive on a $/W basis with ultra-low cost crystalline silicon producers. Companies which can find a way to compete at these cost levels stand to reap the potentially vast rewards associated with a new energy paradigm.

The wider implications for the electricity industry of the reduction in solar PV costs are potentially seismic. Conventionally electricity generation has followed a centralized model in which coal or nuclear power plants provide base load power which is topped up by more expensive gas or hydro power at peak times. Historically the spot price of power has therefore tended to peak at times of maximum demand (usually round noon and in the evening). However, if large quantities of essentially zero marginal cost solar power comes online, often reasonably well synchronized with peak demand, then this correlation will break down, smoothing the peaks, driving down the average spot price of electricity and eating into utility profits. This has already been clearly demonstrated in Germany, the country with more PV installed relative to its summer peak demand than any other. Studies have shown that the average wholesale price of electricity has dropped 10% on average between 2007 (before most PV was installed) to 2011, with reductions peaking at up to 40% in the early afternoon when the most solar power is generated.

As the penetration of renewables continues to increase the implications for the profitability of utilities is severe, since they cannot influence the wholesale price and any increase in retail prices will only increase the economic incentive for consumers to deploy even more renewable technologies. Ultimately this may completely destroy the current utilities business model. It will of course, take many years for this to play out, and issues relating to the variability of renewable power generation and the costs of storage remain significant. However, given the rapid pace of development of solar (and other renewable technologies) and the extremely long timescales associated with deployment of conventional power generation, expect this issue to rise rapidly up the agenda over the coming years.

* Note: Overall installed system costs are much higher, typically several $/W, but are also dropping rapidly as the modules fall in price and balance of system components and installation methodologies are optimized.

2. Tough times for companies

Despite the positive overall growth story, many companies operating within the renewable energy space have faced a harsh reality over recent years. Bankruptcies, exits, consolidation, significant losses and confusion over subsidies are increasingly recurring features of the renewable energy landscape, and are reducing investor confidence. Notable examples of this include:

- Losses and consolidation in the wind energy value chain:
  - Vestas has suffered from declining profitability which has led to several redundancy programs in recent years
  - Chinese manufacturer Goldwind has seen sales fall by almost 50%, forcing severe cost cutting
  - Suzlon Energy has suffered from severely declining sales and increasing losses
- An on-going shake-out in the solar industry, where numerous bankruptcies, most particularly in the US, the UK and Germany, have resulted in significant casualties and much controversy:
  - Many German solar companies have gone bankrupt in recent years, including Q-Cells, Solen, Conergy and Gehrlicher Solar, despite Germany being the world's biggest market for solar PV
  - Bosch and Siemens both announced exits from the solar business in the first half of 2013 -despite total investment of well over €3 billion
  - Several US companies have also been forced to close down over the past couple of years, notably Solyndra, only months after it received >$500 million loan from the US government
  - LDK Solar Co. Ltd. has seen sales revenue plunge by two thirds in the fourth quarter of 2012 while fellow Chinese manufacturer Suntech went bankrupt in March 2013
  - Suntech Power Holdings, the China-based solar product manufacturer, defaulted on a $541 million bond repayment
- Significant scaling back of activities in the biomass sector as uncertainty over government support increases:
  - In early 2013, UK biofuel company Ensus halted production at its £300 million ethanol plant due to the slow development of European and UK markets and uncertainty over support measures
  - Colorado-based cellulosic ethanol biorefinery developer Zeachem scaled back operations at its demonstration plant in Oregon and laid off an undisclosed number of employees
  - UK power company Drax withdrew plans to build dedicated biomass power stations and UK utility Centrica also dropped plans for a biomass new build
- A withdrawal of investors from the market as bankruptcies and losses dent confidence:
  - While investment in renewables was expected to increase monotonically, the reverse has actually happened: clean energy investment dropped to a four-year low in Q1 2013.

How can we rationalize the apparent contradiction between these two realities?

While the reasons behind each case are many and varied, our analysis has revealed several common themes as to why so many businesses find themselves unable to maintain profitability despite the overall growth of the industry:

- **Brutal intra-industry competition and resulting overcapacity and margin pressure**
  Attracted by the prospect of rapid and continued growth and government support, numerous companies have entered the industry; particularly in solar and wind leading to massive overcapacity which in turn has driven down prices and destroyed margins. While in some cases this has benefitted the consumer, many companies, especially those in higher cost locations, have simply been unable to compete.
- **Too much focus on technology and not enough on market needs**
  Customers don't buy technology, they buy solutions. Technology rich companies often forget this, frequently pushing technologies without clear evidence of customer demand. Solyndra is an example of this, pushing an expensive cylindrical technology when all evidence pointed to the customer wanting lower cost.
- **Overdependence on unpredictable legislation**
  Subsidy regimes can change suddenly and unpredictably

lead to investor uncertainty and threaten violent competitive changes in the industry. Examples are legion, but include the fiasco of UK changes to solar FiT regime (where tariffs were slashed without consultation or notice) and U-turns on support for first generation biofuels in both the EU and US.

- A belief in the status-quo
  Companies often assume that what exists today will continue in the future. For example, thin film PV technology companies that based their business cases on polysilicon prices staying at $400/kg, rather than today's price of <$100/kg, have withered.

Lessons to learn

The evolution of the renewables industry over the past few years offers the following lessons for companies operating in the industry and beyond:

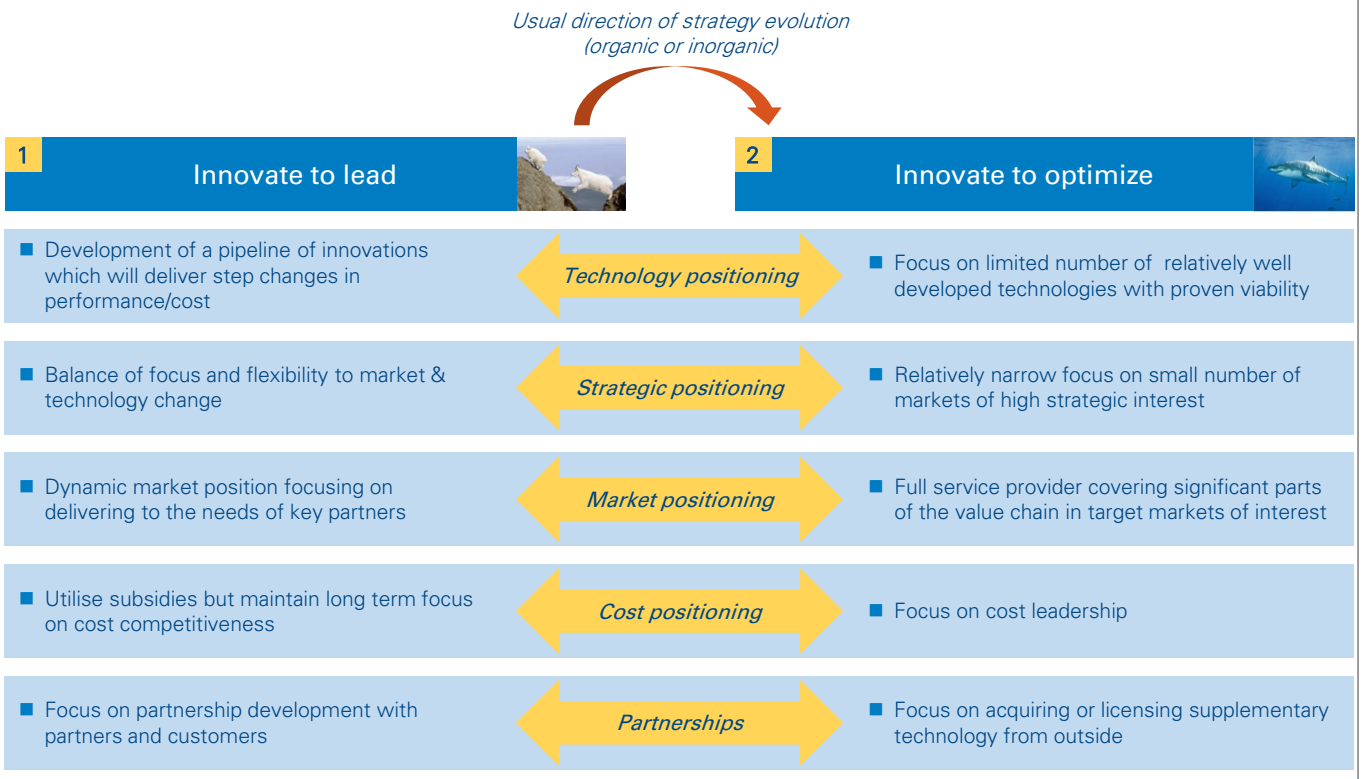
- Fast followers and "last-movers" are often more successful than trailblazers
  Companies that trail-blaze in an industry are not necessarily the ones that reap the benefits that come once the industry is established. The travails of many companies operating in the renewables space is a powerful reminder that even in emerging industries, having an innovative and superior technology is not a sufficient condition for commercial success. Later players to the party benefit from the use of more recent and efficient technologies, and can learn from the failures of others. Companies must therefore balance the need to be innovative with the risks that come with developing early stage unproven technologies.
- "It's the cost, stupid" – Focus on the things that really matter
  Energy technologies are sold primarily on the cost of energy, with all other factors secondary, except in limited niches. Across the renewables industry, companies that have maintained a focus on cost have generally prospered, while those that have forgotten this fact and focused on the development of technologies of unproven customer value have floundered. Companies and technologies that cannot compete on cost will be unsuccessful.
- Focus on what works now
  Technologies can always be improved but they can also be made obsolete if other technologies become established. An adequate but imperfect technology in the hands of customers is much more useful than a technology being endlessly perfected on the laboratory bench. Successful companies will get products into the field, even while they improve the technology back at base.
- Take advantage of subsidies, but don't become addicted
  Companies that base their plans on continued subsidy or other government support can become trapped in a development cul-de-sac, exposing themselves to risk of being unable to compete if subsidies are changed. Developing products that customers would buy in the absence of support must remain the goal, and subsidies should be used to assist that goal, rather than substitute it.
- Don't underestimate incumbent technologies
  A consistent theme of all new technology developments is an underestimation of the ability of incumbent technologies to innovate, improve performance and reduce costs. New technologies must offer step changes in performance to compete. Incremental improvement over existing technologies will not justify additional risk of investment in unproven approaches.
- Continue to innovate, but do so strategically
  While fundamental innovation is risky, standing still is also not an option. In the solar industry, companies that sat on expensive 15% efficient solar panels are no longer with us. The key is to strategically focus innovation efforts on the things that are most critically important for customers, primarily cost of energy.

Strategic implications

Given the difficulty of translating technology into commercial return, what are the possible approaches companies can pursue to maximize their chances of success?

Our work in the renewables industry suggests two routes that give the greatest chance for success. The first, which we term *"Innovate to Lead",* adopts a strategy of technology leadership

Figure 4: General strategies for success



Source: Arthur D. Little

coupled with a nimble business approach which responds rapidly to market changes. The second, termed *"Innovate to Optimize,"* applies excellence in operations and management to optimize the performance of technologies once a certain level of maturity is reached. The main features of these approaches are shown in figure 4, while the rationale and key success factors for each approach are explored below.

Innovate to Lead: Small and agile

This strategy emphasizes defendable technology leadership as a key aspect, but couples it with a highly market focused approach which responds rapidly to changes in the market including competitive threats, regulatory changes, or customer demand changes. A flexible and diversified "platform" approach is essential to be able to adapt to a changing market environment and to mitigate technology developmental risks.

The following key success factors are seen as being the most important for this approach:

- **Diversify the technology base –** Don't rest on the laurels of one technology, ensure there is a pipeline of innovations coming through. A diverse base of technology makes the company inherently less vulnerable to market changes and significantly reduces the "trailblazer" risk of focusing on a single technology.
- **Be ambitious –** Focus only on technologies that will achieve step changes in performance and/ or cost to mitigate against competitive response of incumbent technologies (this means a minimum threefold improvement). Go for the big prize – ultimate goal must be game-changing, even if the steps along the way are less dramatic.

- **Balance focus and flexibility –** Strategic focus is essential for any organization, particularly those operating in a dynamic, technology rich area. However, too narrow a focus leads to vulnerability as markets change and competitors develop their own technologies.
- **Align the market pull –** Make early and continued engagement a key part of your strategy, even at the concept stage. Make sure there is a real market demand for what you are developing and make the strategy market focused not technology focused.
- **Follow the money** – Fully utilize government subsidies, but maintain focus on true cost competitiveness and avoid reliance on fiscal incentives. Develop fall backs in case cost competitiveness proves to be an unlikely goal.
- **Proactively develop partnerships** – Don't assume you have all the best technologies or can develop the market on your own. Actively seek out partnerships with both customers and other technology developers. This could include companies outside of the energy sector, since many large multinational companies in many sectors have ambitious targets for renewable energy use and are therefore actively looking for technology partners (P&G, Coca-Cola, and GSK are just some of many examples).

The bioenergy space provides several examples of companies that have successfully adopted the small and agile approach to achieve success, despite the challenges facing the overall sector. Lanzatech, which is developing a waste gas to biofuels/ biochemicals approach, is one such example. Lanzatech has exemplified many of the characteristics of the "small & agile" approach, diversifying both their market focus & technology base and adopting a flexible approach to developing their business. Lanzatech target both the utilization of waste gases from a range of industrial processes such as steel, cement and production, and the production of materials and fuels from gasified biomass or waste. They do this by exploiting their core proprietary microbe technology and supplementing this specialist large scale purification technology and engineering know-how. Using this approach Lanzatech has been notably successful in developing business with an impressive array of blue-chip partners. Novozymes is another notable example,

Box 2: Case example: Innovate to Lead: Novozymes A/S

Novozymes is one of the few high technology companies turning a consistent profit in the bioenergy sector in recent years (some $190m in 2012). Novozymes manufactures some 47% of the world's industrial enzymes and addresses the household care, food and beverage and agriculture, as well as some 16% of its business coming from the bioenergy sector*.

Some key success factors (KSF) of Novozymes' approach include:

- Becoming very good at one component of the bioenergy value chain: Novozymes has focused on enzymes and microorganisms as a core competence for just under 75 years - and becoming very good at it in the process
- Innovating through collaboration to anticipate future market needs and reduce risk: Novozymes conducts most of its market and technology innovation activities through working with early stage customers, and adjacent businesses in the value chain. It also co-invests in riskier or more unstable markets. Its strong core competence allows it to quickly respond to new market opportunities arising from this collaboration
- Maintaining a broad product portfolio to buffer against fluctuations in less stable markets: In instances where markets are less stable or are taking longer than expected to develop, Novozymes can fall back on more stable performance in household care and food and beverage markets – and then reap the benefits when bioenergy markets pick up

A combination of a strong core competence serving a broad range of markets, and rapid responsiveness by anticipating market demand has made Novozymes particularly successful in the bioenergy sector.

* Novozymes Annual Report 2011-12

having built a highly profitable biotechnology business with a highly diversified product and technology portfolio, which includes bioenergy but also biochemicals, food & drink ingredients, and biopharmaceutical products (see box 2).

Innovate to Optimize: Big and cheap

The strategy emphasizes incremental innovations to refine relatively proven technologies. Excellence in operations and management to optimize the performance is central to this approach.

The following key success factors are the most important for this approach:

- **Fast follow** – Fast follow or buy-in once a winner is established. Limit significant early stage investment in high risk, high cost R&D but invest significantly once technologies have proved their viability and been substantially de-risked. Many companies will invest small amounts in many technologies in a target area before making the big bet on a "winner".
- **Focus on technology application –** Apply well proven technologies at scale rather than engaging in fundamental R&D. Once technologies have established themselves, don't keep investing in further fundamental R&D, but apply those technologies at scale and competitive cost.
- **Play to your strengths –** Apply existing, established capabilities sensibly and/ or at the appropriate stage of the maturity of the business – understand where your company's capability can be applied to drive dominance in markets of interest.
- **Build across the value chain –** Development of full service provision can be a major differentiator, as is the ability to deploy large capacities quickly.
- **Establish low cost facilities or partnerships in low cost locations from the start** – the importance of competing on cost and rapid commoditization cycles means that low cost manufacturing must be built into the plan from the very start, not an add-on once the market is established.
- **Apply an open innovation approach as a matter of course** – Use well targeted acquisitions and licensing activities to continue to add "best of breed" technologies which enhance the overall technology value proposition.

Siemens' activities in the marine industry are an excellent example of how to make this strategy work. Rather than engage in extensive internal high risk R&D, Siemens chose to make limited investments in companies developing technology in this space, in particular Marine Current Turbines (MCT). Once the technology had reached a suitable degree of maturity and proven performance, Siemens acquired MCT in its entirety and is now applying its world leading manufacturing and operational capabilities, to optimize, scale-up and reduce the cost of the technology prior to wide scale deployment. By adopting this strategy, Siemens limited its early stage risk while still building a leadership position in an emerging market. Both Siemens and GE have successfully applied the same strategy to the more established wind industry (see box 3 overleaf).

Strategic choices

It might be thought that the "Innovate to Lead" is primarily a small company play, while the "Innovate to Optimize" is a large company strategy. And indeed it is true that many smaller companies will naturally tend to aspects of the former, while larger companies may struggle to maintain a nimble stance but often excel at the latter. However, in general this is an oversimplification.

Firstly, it is by no means the case that larger companies cannot recreate aspects of the "small and agile" model within their corporate structures. One approach is to set up "incubation teams" which have a remit to develop a profitable business in specific areas, but which are isolated from the normal day-to-day constraints and which have the flexibility and mandate to evolve their strategy to adapt to market and technology changes. Often these incubation teams are managed within a development team part of whose function is to manage the "graduation" of successful initiatives to normal operation management as per mature businesses.

Box 3: Case example: Innovate to Optimize: GE & Siemens

GE and Siemens are two examples of companies which have successfully managed to build profitable positions within the wind industry by following some of the principles of the "Innovate to Optimize" strategy.

GE Wind has successfully developed a 'total service provider' model in wind power, leveraging its financial strength as an industrial group, as well as its broad capabilities and footing in the energy value chain. Its total service provision includes turbine manufacture, monitoring, service, direct investment and vendor financing. GE's 1.5MW model enjoys the largest share of the US large wind turbine market.

Some KSFs of GE's approach include:

- **Financial 'muscle':** enabling the provision of vendor financing and directly investment in wind farms
- **Value chain coverage:** GE Wind is positioned as a fully integrated total service provider (covering manufacturing, O&M, installation, onsite supports, project development and planning) – a 'winning recipe' in onshore wind and may also be replicated in the offshore segment
- **Capability leverage:** on the issue of supply chain and manufacturing, there is considerable synergy between GE Wind and other GE energy-related businesses (e.g. gas turbines, transmission); offering the potential to cross-sell core wind services with other capabilities along the energy value chain
- **Partnership:** the opportunity to leapfrog into the direct-drive offshore wind turbine market, which is seen as the technology option of the future, through acquisition of Scanwind (Nordic) in 2009 (note that direct-drive turbines eliminate the use of gearbox and hence drives down the need for maintenance)

Siemens has also built a strong position in the wind industry. The company is able to draw on its broad energy portfolio, financial capability and position across the value chain in order to place itself as a leading onshore and offshore player. Siemens has pursued an 'aggregator strategy' across the supply chain with elements on vertical integration. Siemens Wind Power itself was formerly Bonus Energy, which was sold to Siemens in 2004; in 2010 SWP acquired 49% of A2SEA (an offshore wind farm installation company) from DONG Energy.

Its commercial strategy is based on cross- and up-selling of products within its energy division (grid connection, balance of plants etc.). Siemens is increasing its presence in China and is now expanding wind turbine manufacturing, sales and service units in China through two ventures with Shanghai Electric Group. As noted above, Siemens is pursuing a similar strategy in marine power.

Likewise there is nothing to say that smaller companies cannot adopt the "Innovate to Optimize" approach to development, at least for parts of their business, once their technologies and the markets they serve reach a suitable level of maturity. First Solar could be considered to be an example of this, beginning as an R&D focused company, but transitioning to a scale and cost driven manufacturing strategy several years ago with significant success. (Although First Solar also continues to develop the performance of its products to maintain market position.)

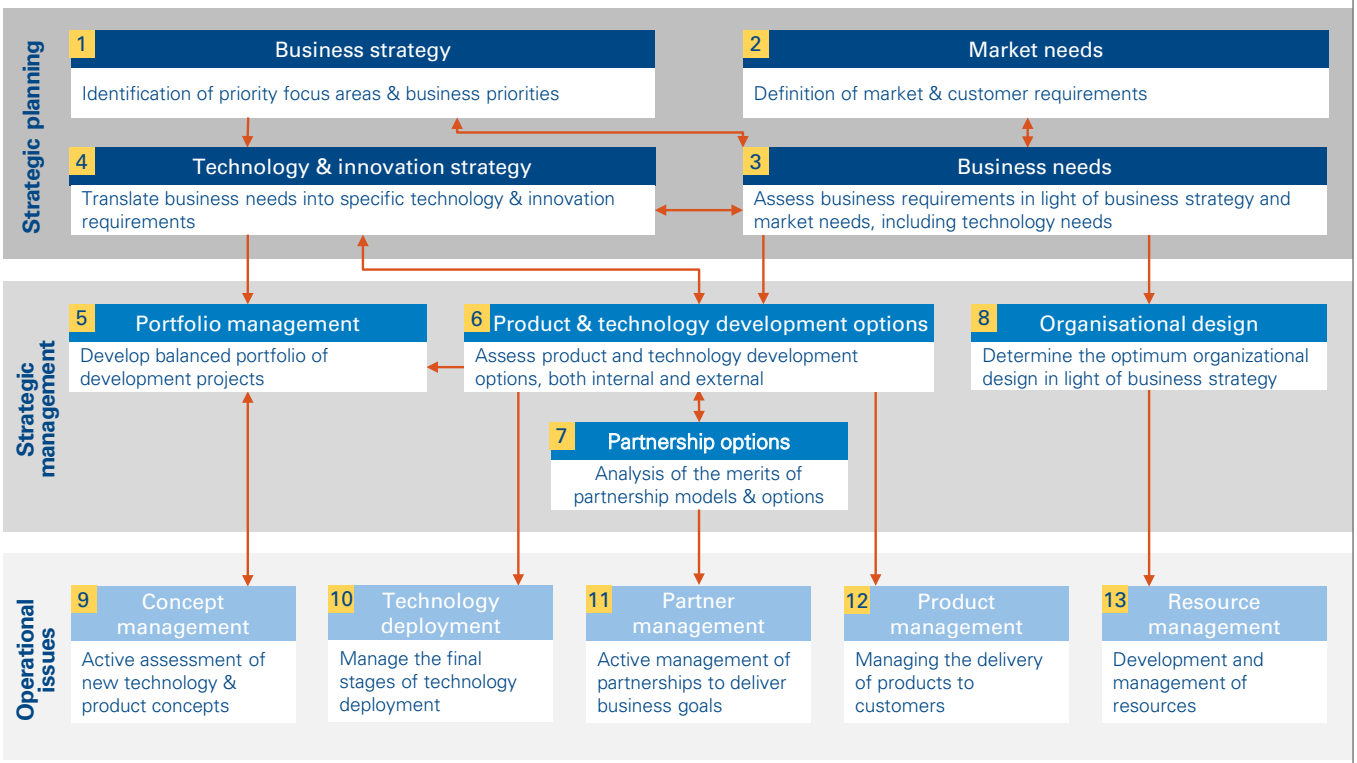
A key challenge for companies in the sector is how to manage the transition from agile to focused, either organically as the company grows and matures, or inorganically following an acquisition or merger event. In the case of organic growth, a key factor is recognizing when change needs to be effected. All too often otherwise successful companies can flounder because managers and investors failed to recognize that fundamentally new people, competencies, organizational models and processes were needed to take the company to the next phase of development.

In the case of inorganic M&A driven change, the key issue is the successful integration of the acquired company and the acquirer. Frequently, however, the focus is on integration of systems,

processes, and organization, rather than on cultural issues which are often the determining factor in whether acquisition is successful or not. Acquired companies will often have a very different cultural flavor to those of the acquirer (particular in cases where the sizes or the companies are very different), and not recognizing this frequently leads to disillusionment on both sides, loss of personnel, and significant value destruction. Smart acquirers retain those successful elements that led them to want to acquire the company in the first place while injecting elements of rigor and focus as per the "Big and cheap" strategy.

Arthur D. Little has developed a suite of 13 management modules to help companies in the renewable energy industry navigate the difficult transition from the nimble, developmental phase to focused growth of optimized solutions, as shown in figure 5. All of these functions must function well for optimal performance and Arthur D. Little deploys range of diagnostic tools to help analyze where companies could improve. It is our experience that most companies could significantly increase their product and technology development success by addressing areas of relative weakness within this framework.

Figure 5: Core modules in Arthur D. Little's technology & product deployment model[1]



1. At the top is the "Strategic planning" layer where key choices are made regarding strategic focus, business needs, and technology & innovation requirements. The "Strategic management" layer translates these choices into a portfolio of development options, and analyses possible partnership and organic design options. Finally the "Operational issues" layer concerns the practical implementation of choices regarding concepts, technologies, products, resources and partnerships.
Source: Arthur D. Little

Summary and Conclusions

The renewable energy industry is maturing rapidly and is in the midst of a transition from a subsidized high cost form of energy to a commercially competitive large scale energy solution. Some renewable technologies, for example hydro, are already fully commercial, while others such as marine and biofuels, may not be competitive for many years to come. Nevertheless, it is clear that over the next 10-20 years, renewable energy technologies will be a significant part of the energy mix.

However, despite significant advancements by the industry, examples of truly successful renewable energy companies (i.e. those with track records of sustained profitability) are strikingly thin on the ground. Renewable technologies are a disruptive influence on the energy sector and companies in many spheres and at many parts of the value chain are struggling to understand how money can be made in the new paradigm. The renewables industry is another sobering example of how difficult it can be to profit from technology even in the context of a successful industry.

Nevertheless, examples such as GE, Siemens and Novozymes show that it is possible to develop a sustainable profitable position in the industry. In our report, we have outlined our experience of the key factors that companies must consider to be successful, two broad strategies that companies can adopt, and the key aspects of strategy implementation that must be optimized for success. By applying these principles, companies can maximize their chances of profiting from the continued growth of the renewables industry.

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Large scale commercial deployment of renewable energy is now a reality – hydro and geothermal power are well established, the growth of wind and solar capacity continues to be dramatic; while the fall in the cost of solar power has been so spectacular that it threatens to disrupt the established electricity generation industry and profoundly change the energy landscape.

Yet a second reality is that many companies are struggling to succeed in the industry. Waves of bankruptcies and falling profitability in many segments, rapidly changing legislation and incentive regimes, and significant reductions in investment pose a considerable challenge.

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