

# Managing the risk in renewable energy





# Contents

<b>Foreword</b>	<b>2</b>
<b>About the survey</b>	<b>3</b>
<b>Executive summary</b>	<b>5</b>
<b>Part I. The growing importance of renewable energy risk</b>	<b>7</b>
Box: When risks materialise	12
<b>Part II. Managing and mitigating renewable energy risk</b>	<b>14</b>
Box: Benefits of scale in risk management	19
<b>Part III. Transferring renewable energy risk</b>	<b>20</b>
Box: Obstacles to more effective risk management	24
<b>Conclusion</b>	<b>26</b>
<b>Appendix: Survey results</b>	<b>27</b>



## Foreword

**I**n 2010 global investment in new renewable energy projects exceeded investment in new fossil fuel-fired plants for the first time, largely driven by a mix of renewable energy incentives and political pressure to invest in less emission-intensive energy production. Yet although investments in renewable energy plants are growing, so are the risks. Political/regulatory risk and financial risk are on the rise against a backdrop of macro-economic uncertainty, while weather-related volume risk is rising up the agenda as investments in offshore wind farms accelerate. At the same time, the availability of risk management resources—including risk expertise, industry data and insurance cover—in the renewable energy sector remains limited, potentially restricting the sector’s access to development capital.

*Managing the risk in renewable energy* is an Economist Intelligence Unit report that discusses the risks inherent in renewable energy projects, the approaches that sponsors of renewable energy developments are taking to manage these risks, and the mechanisms they are using to transfer risk to third parties. The research was sponsored by Swiss Re. The Economist Intelligence Unit bears sole responsibility for the content of this report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor. Christopher Watts was the author of the report, and Aviva Freudmann was the editor.

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## About the survey

In July-August 2011 the Economist Intelligence Unit conducted a survey of over 280 senior executives in the renewable energy industry, based in western Europe (Germany, the UK, Denmark, Spain and Italy), North America and Australia. Around one-half of respondents (48%) were C-level executives or above. The largest group of respondents (37%) represented companies that operate renewable energy plants; a further 20% represented firms that distribute and sell power. Some 51% of respondents came from organisations with more than US\$500m in global annual revenue. In addition to conducting the survey, the Economist Intelligence Unit interviewed 15 renewable energy executives and other experts on the risks inherent in owning and operating renewable energy projects. This paper is based on the results of the survey, and on the insights from the in-depth interviews.

The Economist Intelligence Unit would like to thank all survey respondents, as well as the following executives (listed alphabetically by organisation name) who participated in the interview programme:

- Michael Grundmeyer, vice-president of business development, North America and Europe, 3TIER, US
- Torsten Musick, managing director, 8KU Renewables, Germany
- Claus Burkhardt, project leader, Alpha Ventus, Germany
- Konstantin Graf, consultant, Altran, Germany
- Eugenio Montrucchio, head of risk control, Enel Green Power, Italy
- Kathryn Coates, executive manager, hydro and wind, Eraring Energy, Australia
- Christian Kjaer, chief executive, European Wind Energy Association, Belgium
- Gunter Fischer, principal officer, Global Energy Efficiency and Renewable Energy Fund, Luxembourg
- Thomas J Timmins, lead, renewable energy, Gowling Lafleur Henderson, Canada
- Jan Mumenthaler, head, insurance services group, Business Risk Department, International Finance Corporation, US
- James Green, leader, renewable energy practice, JLT Specialty, UK



## Managing the risk in renewable energy

- Janine Hoey, general manager, group operations and commercial, Pacific Hydro, Australia
- Hans Bünting, CFO, RWE Innogy, Germany
- Tobias Reichmuth, CEO and co-founder, SUSI Partners Sustainable Investments, Switzerland
- Ross Edwards, general manager, generation development, TRUenergy, Australia



## Executive summary

**I**nvestment in renewable energy projects is now outpacing investment in new fossil fuel-powered generation capacity, according to data from the United Nations Environment Programme and Bloomberg New Energy Finance. These data indicate that the level of investment in renewable energy projects surged by 32% in 2010, largely driven by a combination of incentives to invest in renewable energy and political pressure to reduce emissions. For the growing volume of planned renewable energy developments, risk management is a critical element in securing project financing.

As investments in renewable energy plants grow, so too do the risks inherent in owning, building and operating such plants. In particular, political and regulatory risk and financial risk are becoming acute, as the macroeconomic outlook for many countries deteriorates. In addition, weather-related volume risk is particularly acute as investments in wind farms continue to expand. Yet, the risk management resources—including industry expertise, operating data and specialised risk transfer products—available to the renewable energy sector remain, in some respects, limited. This raises important questions over the future development of the renewable energy sector worldwide.

This paper, based on a survey of over 280 senior executives—as well as 15 in-depth interviews with renewable energy executives, investors and other industry experts—documents the risk management challenges that the renewable energy industry must confront. The research examines the most significant risks facing renewable energy projects; the ways that industry executives are managing and reducing these risks; and the instruments they are using to transfer some of the remaining risks.

The key findings of the research are highlighted below.

### **The significance of renewable energy investment is growing strongly.**

Although 33% of survey respondents say that renewable energy is highly significant for their business strategy today, 61% expect this to be the case in three years' time. Almost one-half (46%) of respondents expect annual growth in their firms' renewable energy investments of over 15%. Projects are growing in scale and complexity, most notably in the area of offshore wind.

### **The early stages of renewable energy projects are the most risky—especially financing.**

Financial risk is the most significant risk associated with renewable energy projects, highlighted by 76% of respondents. Other significant risks include political and regulatory risk (flagged by 62%), and



weather-related volume risk (mentioned by 66% of respondents involved in wind power). These risks are heightened by the gloomy macroeconomic outlook for many countries.

### **The renewable energy sector faces significant obstacles in managing its risks.**

Although 70% of respondents say they are successful in identifying risks, fewer say they are successful at mitigating and transferring risks—61% and 50% respectively. Obstacles to more effective risk management include restricted availability of industry data and of suitable risk transfer mechanisms. On the plus side, scale appears to offer larger power companies advantages in managing the risks associated with renewable energy plants.

### **Renewable power executives rely on diversification to mitigate risk.**

Numerous industry executives interviewed for this research point to diversification across geographies and technologies as the single most powerful tool to mitigate regulatory risk and weather-related volume risk. In addition, 55% of respondents say they mitigate operational risk by relying on proven technologies in their renewable energy developments.

### **Insurance is the most common mechanism to transfer risk to third parties.**

A total of 60% of respondents use insurance policies to transfer risk to third parties, making it the most common mechanism to transfer risk. The use of alternative risk transfer mechanisms such as weather-based financial derivatives appears to be growing, however, and the renewable energy sector also makes heavy use of service contracts with hardware suppliers to transfer operational risk. But some renewable energy executives say they retain regulatory and weather-related volume risk because they see few cost-effective alternatives.

**The renewable energy sector expects to use a broader range of risk transfer products in the future.** Over the next three years, 38% of executives expect to make additional use of financial derivatives to transfer risk, and 34% expect to make additional use of special purpose vehicles. Just over one-half (55%) expect to make additional use of insurance. Renewable energy executives are expecting wider availability of more-standardised products, notably weather derivatives, insurance and hedging contracts.



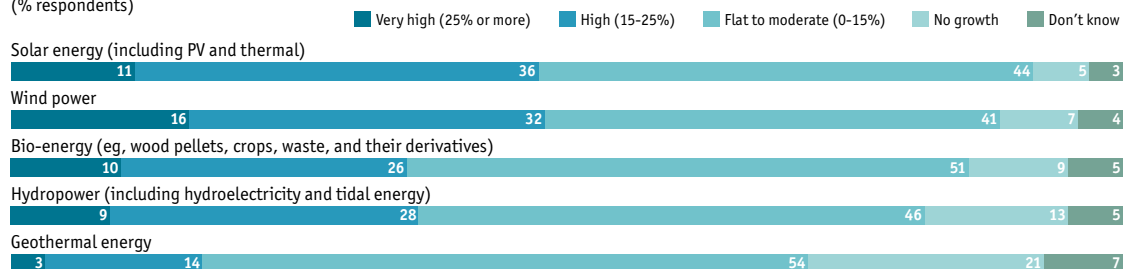
## Part I. The growing importance of renewable energy risk

Levels of investment in renewable energy projects are higher than ever. The factors driving this investment include a need to meet carbon emissions reduction targets, secure long-term energy supplies and reduce dependence on fossil fuels. In addition, China is investing heavily in renewable energies to bolster its clean-tech industry, and in the wake of Japan’s Fukushima crisis, Germany is phasing out nuclear power, sharpening the focus on renewable energies.

Global investment in renewable energy projects jumped by 32% in 2010 to a record US\$211bn, according to the 2010 *Global Trends In Sustainable Energy Investment* report published by the United Nations Environment Programme and Bloomberg New Energy Finance. This compares with total investment in renewable energy of only US\$30bn in 2004. Renewable power accounted for 47% of the 180 gigawatt (gw) of net power additions worldwide in 2010—with investments in renewable energy projects exceeding those in new fossil fuel capacity for the first time.

### Thinking about the renewable energy industry as a whole over the next three years, how significant do you expect growth in installed capacity to be in each of the following industry segments?

(% respondents)



This surge in investment is not an isolated phenomenon. Our survey results indicate that investment in renewable energy will continue to rise over the next three years, with wind power and solar energy growing the fastest. Just under one-half (48%) of respondents believe that growth in installed wind power capacity will be “high” or “very high” over the next three years. A similar proportion (47%) says the same about solar energy. Ross Edwards, general manager of generation development at TRUenergy,

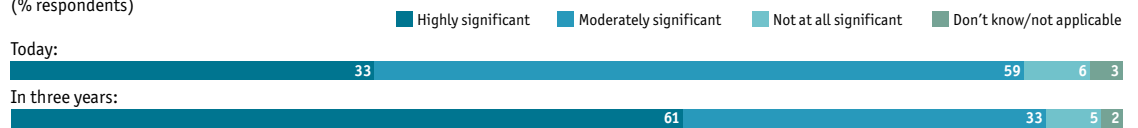


an Australian utility, says that where his firm currently operates two wind farms, totalling some 150 megawatt (mw) in capacity, it plans to add the equivalent of that amount of capacity in each of the next three years.

Respondents tend to have the highest growth expectations for the type of renewable energy technology in which they themselves are actively involved. For example, while 48% of the total survey sample expect “high” or “very high” growth in installed wind power capacity, among wind energy firms the figure is 73%; and while 47% of the total sample expect “high” or “very high” growth in solar energy capacity, the figure among solar specialists themselves is 86%.

**How significant is renewable energy to your company’s overall business strategy today, and how significant do you expect it to be in the coming three years?**

(% respondents)

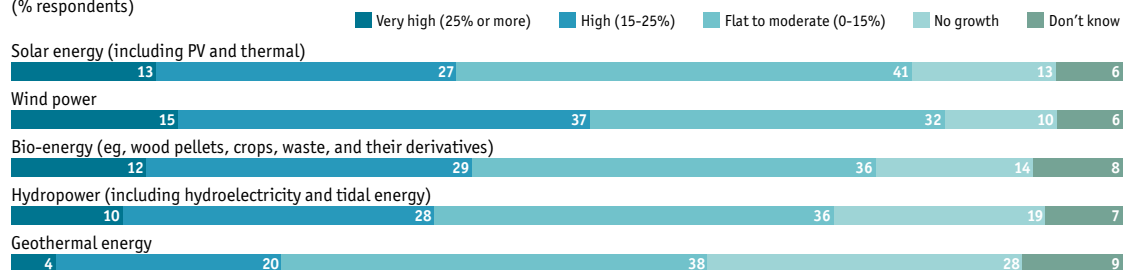


*Six-tenths of respondents see renewable energy as highly significant to their business strategy three years from now.*

Against this background, renewable energy is growing in importance to the business strategy of the companies surveyed. For one-third of the sample, renewable energy is “highly significant” to their company’s business strategy; fully 61% expect that this will be the case in three years’ time.

**Thinking about your company in particular over the next three years, how significant do you expect growth in installed capacity to be in each of the following industry segments?**

(% respondents)



**Please estimate the average year-on-year change in your company’s total investment budget for renewable energy power projects over the next three years.** Please choose one answer only.

(% respondents)





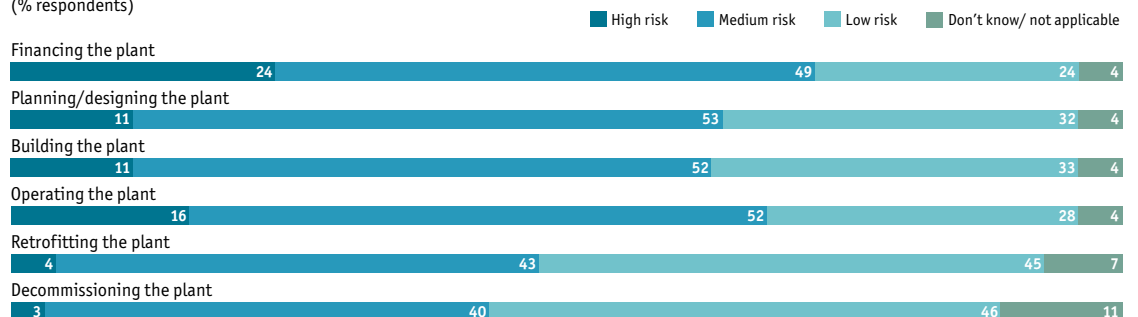
Accordingly, survey respondents indicate that their companies' investment budgets for renewable energy projects will grow over the next three years. Thirty-six per cent of the sample expect their company's annual investment budget for renewable energy developments to increase by 15-25% over that period. A further 10% expect annual investment growth of 25% or more.

### Risk considerations come to the fore

As companies expand investment in renewable energy projects, funding is a particular challenge. A deteriorating macroeconomic climate and questions over national commitments to tackling climate change are among factors that cast doubt on the availability of financing for renewable energy projects. As Christian Kjaer, chief executive of the European Wind Energy Association based in Belgium, points out: "There is still some uncertainty within the financial community, which of course affects wind energy, in part because it's a very capital-intensive technology." Sound risk management is critical in securing funding.

#### As a general matter, how would you assess the overall degree of risk associated with each of the following stages of building and operating a renewable energy power plant?

(% respondents)



### Different types of risk: Counting the ways

- **Building and testing risk:** Risk of property damage or third-party liability arising from mishaps during building or testing of new plants.
- **Business/strategic risk:** Risk affecting the viability of the business, for example, risk of technological obsolescence.
- **Environmental risk:** Risk of damage to the environment caused by the power plant, and the liability arising from such damage.
- **Financial risk:** Risk of insufficient access to capital.

- **Market risk:** Risk of an increase in the price of commodities and other inputs, or decrease in the price of the electricity sold.
- **Operational risk:** Risk of unplanned plant closure, for example owing to unavailability of resources, plant damage or component failure.
- **Political/regulatory risk:** Risk of a change in public policy, for example subsidies policy, affecting plant profitability.
- **Weather-related volume risk:** Risk of a fall in volume of electricity produced owing to lack of wind or sunshine.

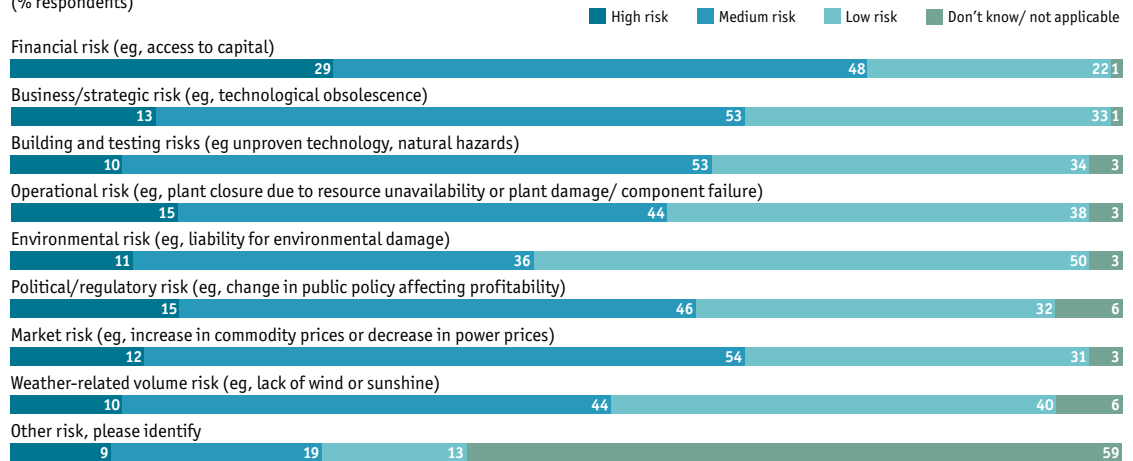
The general perception among interviewees and survey respondents is that the earlier stages in the lifecycle of a renewable energy plant are often riskier than the latter stages. Thomas J Timmins, who



leads the renewable energy practice at Gowling Lafleur Henderson, a Canadian law firm, comments: “The earlier you are, the more risk is associated with the project.” The early stages are focused on land acquisition, permits and approvals, gathering weather data—and, of course, securing financing. During this time, Mr Timmins says, “you’re not sure if your project is going to fit into the current policy regime, so you’re exposed to policy risk, in that it might be three or four years before you’re ready to operate and you don’t know what kind of an off-take contract you’re going to get, or under what policy mechanism.”

**How would you rate the significance of each of the following types of risk to your renewable energy projects?**

(% respondents)



*High financing risks seen, especially in capital-intensive, highly leveraged and complex projects.*

Indeed, 24% of respondents assess the financing stage of renewable energy project development as “high risk”, more than any other stage. Similarly, when asked about the significance of various types of risk to their renewable energy projects, 29% of respondents rate financial risk as a “high” risk; a further 48% categorise financial risk as “medium” in its significance. This is particularly evident among respondents from companies with revenue of below US\$500m: 30% describe the overall degree of risk associated with financing the project as “high”, while among larger companies the figure is lower, at 18%. Thus, financial risk is the risk that is most likely to have materialised in a major way for their business, according to survey respondents (see box: *When risks materialise*).

The perception that financial risk is high—and that the financing stage of the plant’s development is the riskiest—is particularly significant because renewable energy projects are often capital-intensive, and are typically highly leveraged, with up to 70-80% of the project total being financed through debt, according to interviewees. As projects gain in scale and complexity, risks rise too, and financing may become more difficult. Financial risk has several aspects, including raising the capital needed to fund the development of the project, and covering interest payments on debt in the project’s initial years of development and operation.

Despite the perception of financial risk as the most significant risk in renewable energy projects, it is by no means the only risk. Political and regulatory risk is another important risk—in particular as it



relates to government support for renewable energy. Several executives interviewed for this research emphasise the importance of policy support in making renewable power economically viable—meaning that a layer of regulatory risk hangs above most developments. According to Standard & Poor’s, one of the three main rating agencies, subsidies to solar power projects in Europe can account for up to 85% of their initial revenue. “This, in our view, illustrates the importance of predictable, ongoing financial support for renewable energy projects,” the agency commented in a July 2011 report, *Why Regulatory Risk Hinders Renewable Energy Projects in Europe*.

In line with the importance of government support for renewable energy projects, interviewees and survey respondents alike point to political and regulatory risk in renewable energy projects as one of the most significant risks they face. Among survey respondents, 15% rate political and regulatory risk as a “high” risk, second only to financial risk in importance, while a further 46% of respondents classify political and regulatory risk as a “medium” risk.

It may be all the more worrying for project developers that political and regulatory risk appears to be increasing. Surprisingly, a big contributor to heightened political and regulatory risk is a factor that might otherwise be seen as a positive one for the industry, namely the dramatic fall in hardware costs. The cost of solar modules, for example, has fallen by 60% since mid-2008, according to Bloomberg New Energy Finance estimates. This fall in price, caused by strong competition and excess capacity among the hardware manufacturers, has led to surging investment in renewable energy projects, which in turn has burdened governments’ renewable energy support schemes. At the same time, governments are looking to cut expenditure in the face of gloomy macroeconomic forecasts. As Standard & Poor’s comments: “Budgetary constraints in the public sector and the need to implement severe austerity measures in some countries are calling into question the sustainability of financial support for renewable energy development in Europe.”

*Cuts to renewable energy subsidies change the commercial equation for many projects.*

For an example of how political and regulatory risk can materialise, consider the moves by Spain and the Czech Republic in 2010 to introduce cuts to feed-in tariffs for existing solar projects of up to 45%, clearly undercutting the rationale for having invested in those projects. Across Europe, according to Standard & Poor’s, recent changes to renewable energy subsidy programmes have led to cuts in solar feed-in tariffs for new projects ranging from 15% in Germany to 70% in the UK. It is therefore unsurprising that investors and project developers worry that some of the other 100 or so governments that support renewable energy investments will cut that support as part of austerity packages.

While total worldwide investment in renewable energy projects grew strongly in 2010, investment slumped dramatically in some countries where government support lessened. In Spain, for example, renewable energy investment dropped by more than one-half to US\$4.6bn in 2010, according to Bloomberg New Energy Finance. James Green, who heads the renewable energy practice at JLT Specialty, a UK insurance broker, recalls: “In the UK I was looking at 40 or so 5-mw ground-mounted solar installations, which we were asked to insure. And overnight when the UK government said that it was going to cut the feed-in tariff, the 40 installations literally went down to four.”

Besides financial risk, and political and regulatory risk, a third important risk for sponsors of renewable energy investments is weather-related volume risk. The risk is more acute for wind and hydropower projects than for solar and for other renewable energy technologies such as biomass



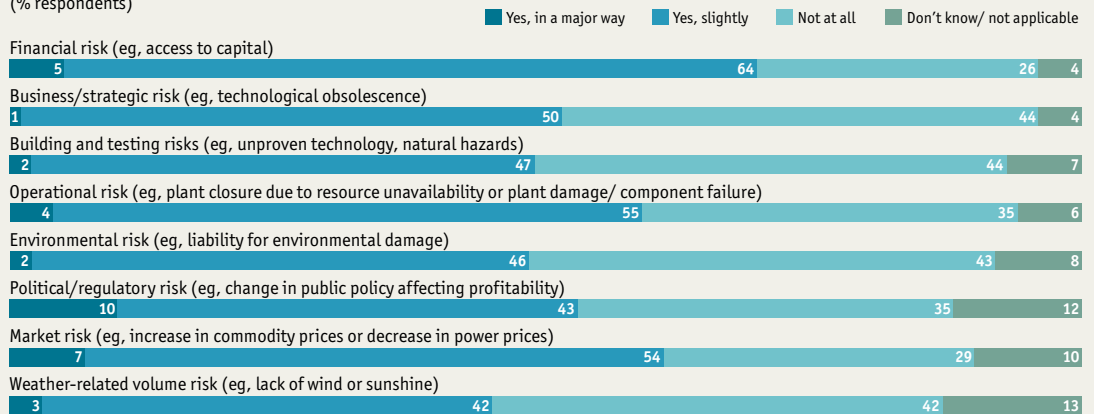
and geothermal energy. Where wind volumes may deviate by 25% from normal values in any given year, solar radiation levels typically deviate by no more than 4% from normal levels. Among survey respondents from the wind sector, 18% describe weather-related volume risk as a “high” risk (with a further 47% describing it as a “medium” risk), in contrast to 7% of respondents from the solar sector who describe weather-related volume risk as a “high” risk, and 41% who describe it as a “medium” risk.

If weather-related volume risks materialise, they can have two types of effect for developers of wind farms and other renewable energy projects. One is that output falls short of estimated levels, so that revenue comes in consistently below projections over the life of the project. In some cases, such shortfalls are attributable to inadequate weather data used in the planning phase. Kathryn Coates, executive manager of hydro and wind at Earing Energy, an Australian renewable energy producer,

### When risks materialise

#### Has any of the following types of risk materialised in your renewable energy business?

(% respondents)



Survey respondents are more likely to describe a risk as “high” or “medium” than they are likely to have been affected by an actual risk. This, at the very least, indicates that risk awareness does not lag behind actual experience. Nevertheless, some types of risk have proven to be more than just abstract possibilities; that is, the feared events have actually happened. When asked whether they had experienced certain types of risk events in their businesses, most respondents say “yes, slightly” to most types of risk.

Of all the types of risk to have actually materialised, the most likely is financial risk: fully 69% of respondents say they have experienced financial risk first-hand. Of these, 5% of the sample say it materialised “in a major way”, and 64% say it materialised “in a slight way”. Political and regulatory

risk is the type of event that respondents are most likely to say has materialised in a major way, with 10% of the sample having experienced such risk. Among solar operators, the figure is as high as 21%, and among wind operators it is 15%.

Interestingly, larger power companies—with over US\$500m in global annual revenue—are more likely to have seen risks materialise than smaller ones. For example, in the case of weather-related volume risk, 52% of respondents from large companies say they have seen this risk materialise; among respondents from smaller firms, the figure is lower, at 37%. This indicates that larger firms are exposed to a broader range of risks and a greater volume of risk, because of their larger and more diverse renewable energy portfolios.



highlights the case of its Crookwell Wind Farm, a 4.8-mw power facility with eight turbines that opened in 1998. “Crookwell Wind Farm was supposed to have had one of the best wind sites in New South Wales, according to the people who did the surveys,” she says. “But it only has a capacity factor of about 25%, well short of the 35% predicted. This means there is a significant shortfall of generation and income compared to the predicted level.” In the future, climate change may increasingly lead to such shortfalls, too.

The other possible impact of weather-related volume risk is that output, and therefore revenue, are volatile throughout the life of the project, sometimes exceeding expectations but sometimes falling short of them. Hans Bunting, CFO of RWE Innogy, a German renewable energy facility, says that although such variations might smooth out over the long term, “the main risks coming from instability are on the shorter-term weather risks. It creates volatility of earnings year to year.”

Whether the impact is long or short term, weather-related volume risks can threaten the economic viability of renewable energy projects. Tobias Reichmuth, CEO and co-founder of SUSI Partners Sustainable Investments in Switzerland, explains: “In a business plan, you assume that you have a certain wind volume. However, the reality is that, in a particular year, there might be 25% less wind, and this might bring your whole project into problems.” Some projects are financed with up to 80% debt, Mr Reichmuth points out, and interest on the debt remains payable every year—whether there is wind or not. Or, as Michael Grundmeyer, vice-president of business development for North America and Europe at 3TIER, a US renewable energy consultancy, puts it: “The most significant risk overall is the risk that [not] enough megawatt hours can be generated from the project to capture energy sales to pay down debt in any given quarter or year.”

*Climate change and unpredictable weather patterns can cause output shortfalls and volatile returns.*



## Part II. Managing and mitigating renewable energy risk

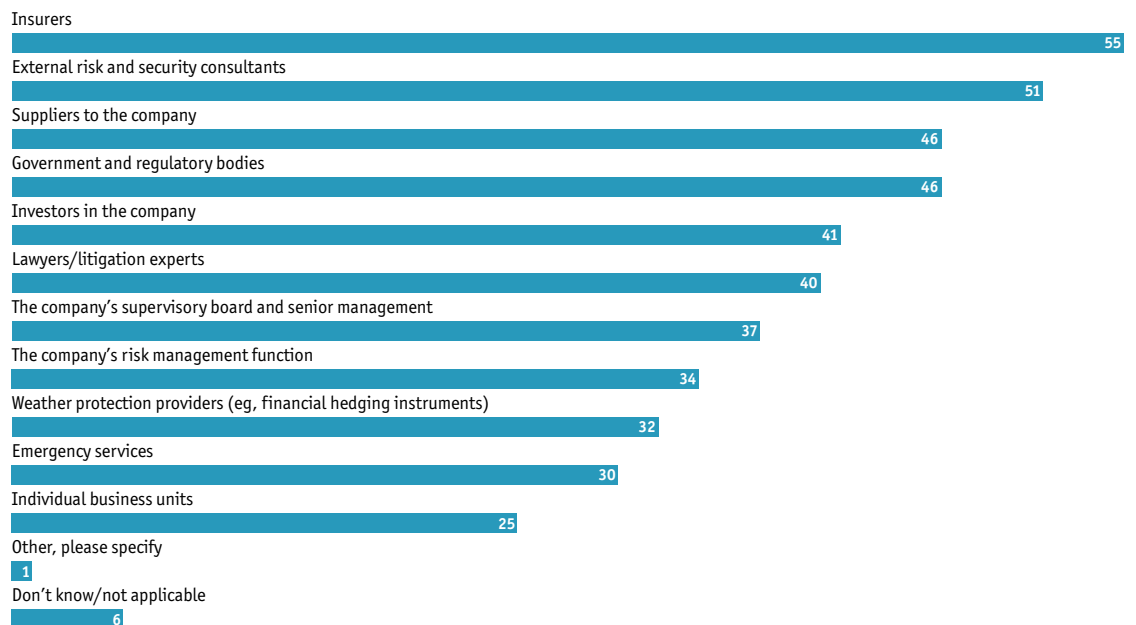
As renewable energy grows in strategic importance for power companies, and as investment in renewable energy assets expands, risk considerations are clearly moving higher up the agenda among investors in and operators of renewable energy projects. At the same time, some risks—such as financial risk, and political and regulatory risk—may be growing more acute. All this is providing new impetus, if any is needed, for power firms to scrutinise their risk management structures and processes.

How do renewable energy producers manage risk, including lowering the probability of negative events happening, reducing the impact of any risk events that do materialise, and transferring some

### In the past three years, which of the following resources has your company used as part of its risk mitigation strategy?

Select all that apply.

(% respondents)





*Most companies feel they manage their renewable energy risks competently.*

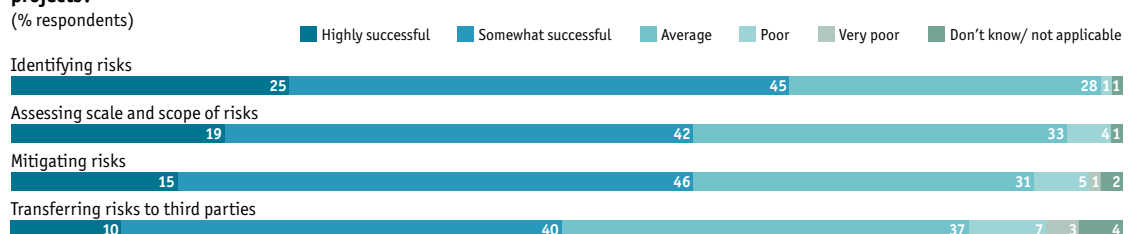
of the remaining risk to others? Survey responses indicate that energy firms rely heavily on outside support in managing risk. Fifty-five per cent of survey respondents say they have used insurers in the past three years to help manage their risks, for example. Just over one-half (51%) have called on external consultants to provide advice, while a further 46% have relied on suppliers, such as manufacturers of hardware and equipment. The same proportion has turned to government agencies.

Many large energy companies have a dedicated in-house risk management function, according to survey results. Forty-one per cent of respondents from larger companies, those with annual revenue of over US\$500m, make use of an in-house risk management function. Eugenio Montrucchio, head of risk control at Enel Green Power, a renewable energy company based in Italy, points out that his firm has its own central risk committee, which draws up risk management practices and guidelines that its local units adhere to; at the same time, Enel Green Power has full access to the risk management expertise within its parent, Enel Group. Similarly, Claus Burkhardt, project leader at Alpha Ventus, a 60-mw wind farm that opened off Germany’s northern coast in 2010, says the project’s risk management team comprises experts from within the risk management functions of the three firms in the Alpha Ventus consortium: the utilities EWE, E.ON and Vattenfall.

Smaller firms are less likely to draw on an in-house risk management function, with only 26% of respondents from these companies saying they do so. Gunter Fischer, principal officer at the Global Energy Efficiency and Renewable Energy Fund, a public-private partnership in Luxembourg advised by the European Investment Bank, says “smaller developers usually don’t have the resources to have an in-house risk management [function]”. In many cases, these firms rely more heavily on external resources, such as risk and security consultants, than they do on internal resources. Earing Energy is a case in point: “Because we’re such a small group, we don’t have a good body of technical expertise within the group,” says Ms Coates. “We have to import that expertise, so we have a fair reliance on external bodies for planning and designing new hydro and wind plants.”

Whether at large or small companies, the majority of respondents feel they manage their renewable energy risks with competence. When asked to rate their level of success in the various aspects of risk management, 70% say their companies are either “highly successful” or “somewhat successful” in identifying risks. Furthermore, 61% say they are similarly competent in assessing the scale and scope of risk. Torsten Musick, managing director of 8KU Renewables, a joint venture of eight German municipal utilities, comments: “The renewable energy sector is very good at identifying the risks before investing, because we have experienced employees and we spend a lot of money on external

**In your view, how successful is your company at the following aspects of managing risks related to its renewable energy projects?**





experts and consultants to look for anything in the project that could be risky.” At the same time, 61% feel their companies are good at mitigating risk. Fewer respondents, 50%, say their companies transfer their risk successfully to third parties.

One theme that consistently emerges from interviews is that energy producers feel they have a good grasp of general business risks such as financial risk, market risk and operating risk. “In terms of markets and environment and O&M [operation and maintenance] and things like that, we’ve got most of those risks pretty well covered,” says Ms Coates of Eraring Energy. However, some renewable energy firms appear less confident about how well they manage those risks specific to renewable energy assets—particularly political and regulatory risk, and weather-related volume risk. In part, this is because companies have little control over policy, or the weather; in part, it is because executives feel they have fewer instruments at their disposal to mitigate and transfer these risks. Worryingly, it is exactly these risks that renewable energy companies say are among the most significant in the sector.

### A focus on risk reduction

As renewable energy developers take stock of the political and regulatory risk, weather-related volume risk, and other risks they face, many are seeking to manage these risks by means of risk mitigation and risk transfer. That said, Jan Mumenthaler, head of the insurance services group of the International Finance Corporation, the World Bank unit that finances private companies in emerging markets, advises power producers to focus first on reducing risks. “What we like to do is instead of having to say, ‘well here’s a risk on your balance sheet, let’s buy insurance to deal with it’, is to work with them really to reduce risk and mitigate risk, as much as possible.”

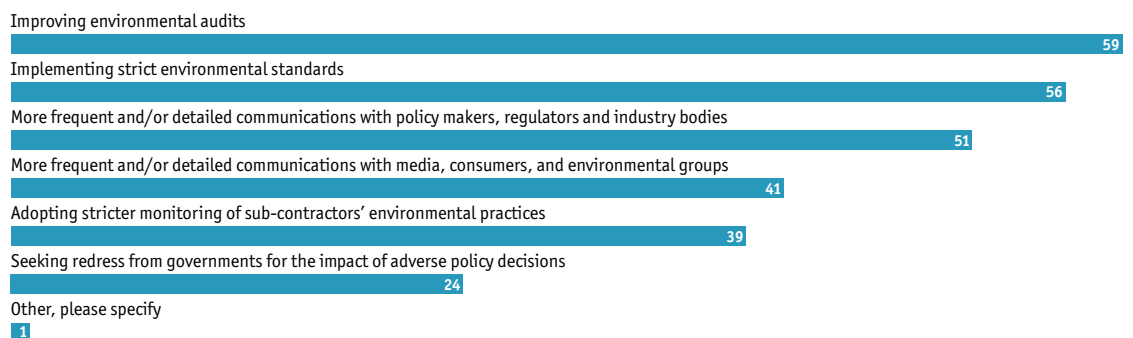
One general way to reduce business risk is to take additional equity investors into a project, or to enter a project as part of a consortium or joint venture with other renewable energy developers or financial partners. One recent example is the joint venture between DONG Energy and Siemens Project Ventures to acquire a 50% stake of Lincs, a 270-mw wind farm project situated 5 miles off the UK coast.

Another way to reduce business risk is to buy into renewable energy developments at a later stage, once the riskier early stages of development are complete, and the renewable power assets are fully permitted or operational. “Larger utilities are not very keen on a lot of risk,” remarks Mr Kjaer of the

*Risk reduction is key to success.*

### What measures does your company take to mitigate environmental and political/regulatory risks associated with renewable energy plants? Select all that apply.

(% respondents)





*Geographic diversification can mitigate both regulatory and weather-related volume risks.*

European Wind Energy Association. “So what you often see is smaller independent developers moving in, in the beginning stages, securing land leases, securing grid connection agreements, and then handing it over to larger investors, mainly utilities, at a later stage.”

Beyond such broad risk-reduction measures, many developers and operators of renewable energy projects seek to mitigate specific financial, political and regulatory, operational and other risks. For example, the main way renewable energy producers mitigate political and regulatory risk is to intensify communications with policymakers, regulators and industry bodies. This approach is cited by just over one-half (51%) of the sample. Yet, even with well-developed communications with government and policymakers, many energy companies concede that political and regulatory risk remains difficult to mitigate.

Many renewable energy companies also mitigate risk through geographical diversification, if they have the scale to do so (see box: *Benefits of scale in risk management*). RWE Innogy is one such utility. “I think it is very important not to put all your eggs in one basket,” comments Mr Bunting. “That means diversifying your portfolio across several regulatory regimes.” Besides mitigating political and regulatory risk, diversification has the potential to mitigate weather-related volume risk, operational risk, and more. If a firm operates a portfolio of assets, Dr Bunting says, it is possible to calculate the degree to which the risks across the total portfolio balance each other out—and then to take action in response to any imbalance.

Mr Reichmuth of SUSI Partners points out that diversification in different technologies helps to reduce weather-related volume risk. “Wind is highly volatile, while solar is not,” he observes. “So if you invest in both wind and solar in your portfolio, the solar can basically take out some of the variations you have from the wind side.” Pacific Hydro is one company that has balanced its portfolio this way. “Given our Australia, Chile and Brazil strategy, there is a large geographical diversification,” explains Janine Hoey, general manager of group operations and commercial. “We have primarily wind in Brazil, hydro in Chile, and a mix of wind and hydro in Australia, in addition to interests in solar and geothermal.”

Mitigating financial and market risk is also an important element of most renewable power companies’ risk management efforts. For example, almost one-half (46%) of survey respondents use hedging instruments to lessen the impact on their business in the event of a fall in the price of power (see Part III—Transferring renewable energy risk). Further measures to mitigate financial and market risk include improving legal/regulatory compliance (45%), and improving corporate governance structures (42%).

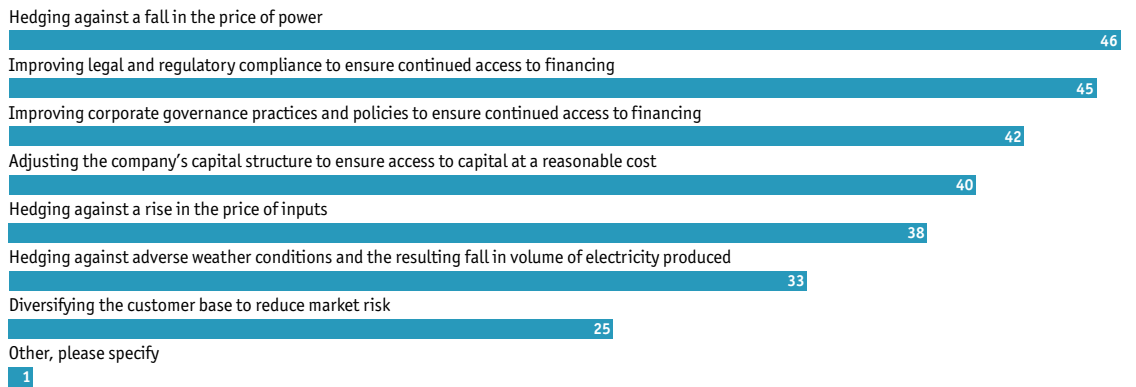
Price volatility in the marketplace can be as risky for energy companies as the risk of insufficient wind for wind power producers, or the risk of insufficient radiation for solar power producers. To counter this risk, many producers seek long-term power purchase agreements to secure a fixed price for the power that the renewable energy plant produces. Mr Reichmuth says that his firm has a number of such power purchase agreements in various European countries. He comments: “If you have a twenty year off-take agreement in solar, or a ten or fifteen year off-take agreement in wind, you should be on the safe side.” In these cases, he says, “the counterparty is often not a state, but a utility company. Right now, a north European utility, for example, is probably a better long-term partner than many



## Managing the risk in renewable energy

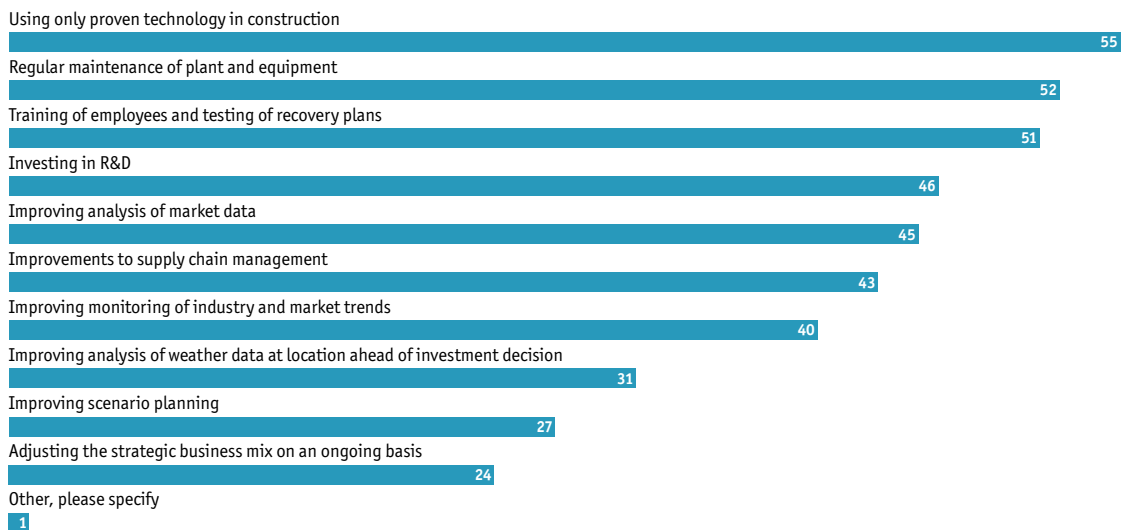
### What measures does your company take to mitigate financial and market risks associated with renewable energy plants?

Select all that apply.



### What measures does your company take to mitigate business/strategic, operational and construction risks associated with renewable energy plants? Select all that apply.

(% respondents)



states.” (As such, power purchase agreements serve not only to mitigate market risk, but also to eliminate a degree of political and regulatory risk.)

Many renewable power companies also seek to mitigate business and strategic risk, as well as operating and construction risk, by relying on proven technologies. This approach is flagged by 55% of respondents. “Project developers usually don’t want to take technology risks,” says Dr Fischer of the Global Energy Efficiency and Renewable Energy Fund. “So they want to have a technology that has been around for at least five years—established technology from Germany and Switzerland.” Further measures include paying close attention to plant and equipment maintenance (mentioned by 52% of the sample), and ensuring reliable recovery plans in case of an outage (51%).

As projects gain in scale and complexity—for example as developers launch plans for ambitious



### *Reducing risk by dealing with tried-and-tested suppliers*

offshore wind projects, or vast solar energy towers—use of newer technologies may be unavoidable. But whatever the scale and complexity of the project, developers can mitigate risk by using hardware from well-established suppliers. In some cases, a conservative approach is encouraged by the insurer or insurance broker. “If it’s a wind farm, is the project sponsor using Vestas, or Siemens, or GE, or any of the other major tier one wind turbine manufacturers, as the technology for the project?” asks Mr Green of JLT, “or is the project sponsor trying to reduce costs by using one of the new emerging, and maybe less proven, manufacturers?” Making a similar point, Konstantin Graf, a consultant at Altran in Germany, cautions that cheaper solar modules are likely to lead to quality problems for solar power producers.

In the long term, one further route to more effective mitigation of business and operational risks may be closer industry collaboration, both in developing reliable sources of industry performance data and in building and operating renewable power plants. “The European utilities have traditionally been in competition, but now increasingly as the renewables projects are getting larger, they’re building them in consortia,” notes Mr Green. Pooling of maintenance equipment and critical spare parts, such as cables for offshore wind farms, will enable operators of renewable energy plants to respond more quickly to operational problems. Mr Green explains: “What happens is, if there is a cable loss, then you have the potential for a large delay in start-up or business interruption claim—in the middle of winter you’re talking about each turbine losing between 4,000 and 6,000 euros of revenue per day.” The quicker firms can rectify such damage and get sites up and running again, adds Mr Green, the lower the total operational risk that the sector is likely to seek to transfer to insurers.

### **Benefits of scale in risk management**

As the renewable energy industry continues to expand rapidly, the scale of the renewable power generation portfolios of many developers and operators is growing. “Ten years ago, we were dealing with developers with one project or five projects,” says Thomas J Timmins, who leads the renewable energy practice at Gowling Lafleur Henderson, a law firm based in Canada. “Now we’re dealing with developers with fifty, sixty, a hundred projects on three continents, four continents.”

Scale appears to influence how energy producers can manage and mitigate risks associated with renewable energy assets. Interviewees mention a number of ways in which scale offers potential advantages to renewable energy developers when it comes to risk management. Here are four:

**Diversification.** Larger energy producers are in a better position than smaller ones to mitigate political

and regulatory risk and weather-related volume risk by means of diversifying their plants in both geographical and technological terms.

**Financing.** Larger renewable energy developers—especially those that are part of multinational concerns—often have easier access to finance than smaller ones. They generally are also in a position to shift investments around, for example in response to macroeconomic and political changes.

**Expertise.** Larger firms typically can draw on deeper pools of internal expertise, including engineering, legal, risk management, public relations and lobbying expertise.

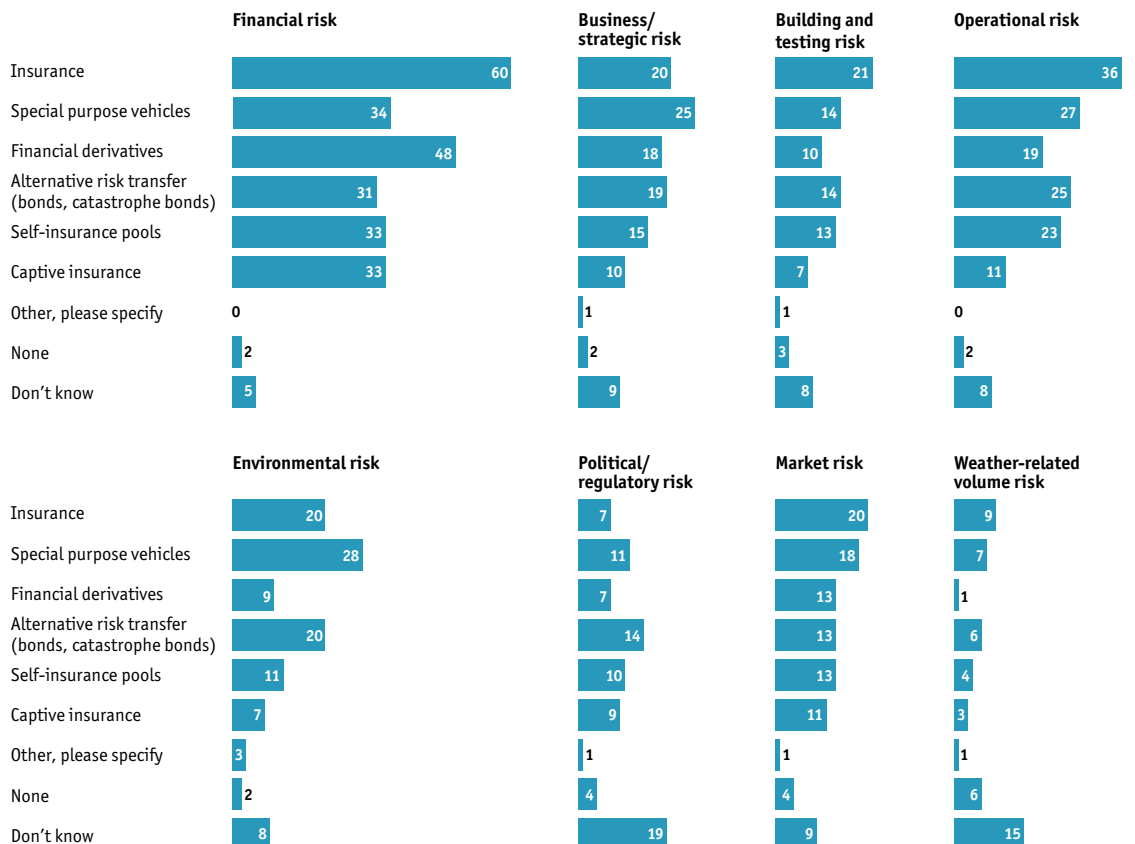
**Products.** Larger firms in the renewables sector typically use a broader array of risk transfer mechanisms, including sophisticated hedging instruments and customised insurance packages. The scale of their operations also enables the provision of tailor-made products such as insurance cover.



## Part III. Transferring renewable energy risk

Beyond mitigating risk, power producers are confronted with decisions about how much further risk to retain, and how much to transfer to others. Our survey shows that renewable energy producers tend to retain large proportions of certain types of risk—mainly because they see little choice. Dr

**Which risk transfer mechanisms are you currently using in renewable energy projects, and for which risks?** Please select all that apply for each column (ie, for each type of risk). (% respondents)





*Some types of risk are retained, for lack of a viable alternative.*

Fischer of the Global Energy Efficiency and Renewable Energy Fund explains: “Most of the risks are borne by the investors directly, and are not outsourced, because there is currently no efficient price for these risks on the market.” (See box: *Obstacles to more effective risk management*).

Furthermore, because operating margins in many areas of renewable energy production are relatively thin, the cost of transferring risk can appear high, affecting financial performance by eating into earnings and cash flow. On the other hand, say industry experts, transferring risks can reduce earnings volatility and improve earnings visibility, which in turn may lower the project’s cost of capital. In weighing up the options, says Mr Reichmuth, “you have to think about the value of stable income, and the value of low volatility of earnings. What does it mean for your balance sheet?”

In practical terms, most renewable energy companies seek to transfer at least a portion of risk onto third parties. A clear majority (60%) use insurance for this purpose. The use of financial derivatives is also widespread, with almost one-half (48%) of survey respondents saying they use financial derivatives to transfer financial risk, for example. Beyond that, the propensity of renewable energy producers to transfer risk depends on the nature of the risk involved.

For example, many power producers use hedging instruments to transfer market risk. One company that does this is Pacific Hydro, according to Ms Hoey. She observes that in Australia, a liquid secondary market for energy derivatives allows the company to consider hedging contracts and other market instruments. “Approximately 50% of our portfolio is in power purchase agreements, or longer-term contracts, and then 50% in shorter-term contracts, for which we use financial hedges or financial derivatives to hedge our position,” says Ms Hoey. She believes that the calculation whether to place short- to medium-term hedges in the market is based on internal modelling and simulations.

When it comes to transferring operational risk, respondents use a variety of mechanisms. For example, 36% rely on insurance. One factor driving the take-up of insurance to transfer operational risk appears to be the trend towards building large-scale developments financed by broad consortia, in which each investor has its own risk expectations. Dr Bünting of RWE Innogy says: “We are thinking about taking financial co-investors on board. They are, of course, very keen on insurance.” Mr Green of JLT echoes the point: “The banks will typically stipulate that you have to have a comprehensive package of insurance, including insurance against a delay in start-up and business interruption, so that they can ring-fence their investments.”

Yet interviewees point out that many of the insurance products on offer are tailored products, suitable only for very large projects, and are not within reach of smaller developments. As Dr Fischer explains: “The insurance available is still only on bigger projects. We don’t see it in our smaller IPP [independent power producer] level projects—it’s not standardised enough yet.” However, he says that availability of insurance is growing: “What we see on the market in general—but we don’t in our projects yet—is that there are new insurance products appearing.” These may be policies that cover the performance of solar panels, for example, or that cover the exploration risk in geothermal drilling.

In the meantime, power producers find a number of other ways to manage risk by retaining it or sharing it with industry peers. For example, one-third of survey respondents rely on self insurance pools or on captive insurers to manage financial risks. Mr Mumenthaler of the IFC comments that captive insurance subsidiaries are popular among large utilities that are expanding their activities



*Operational risk can be transferred to hardware manufacturers as well as insurers.*

in developing markets. One driver of demand for captive insurance structures, he points out, is the wider insurance markets: companies tend to turn more towards captive structures as the wider market for insurance hardens. Another driver of risk retention is information asymmetry, in which a power producer sees the risks of a particular plant as lower than the insurer—making risk retention a more cost-effective option.

When power producers transfer risk, it is not exclusively to insurers. Many say they transfer operational risk onto suppliers of hardware, such as wind turbine manufacturers. For example, a service agreement might guarantee the utility a minimum availability, such as 97% availability over a 15-year period. Manufacturers receive a fee per kilowatt hour (kwh) generated, in return for which they carry out maintenance and repair. This transfers operational risk and mitigates the potential for earnings volatility caused by downtime.

One industry executive who uses such contracts is Mr Musick of 8KU Renewables. “We try to transfer all the operational risks to the turbine manufacturer by negotiating long-term service contracts,” he says. “It’s a 15-year service contract with very, very transparent pricing—more or less one euro cent per produced kilowatt hour per year.”

Beyond that, some producers use alternative risk transfer instruments that spread their risks via financial markets. About one-third (31%) of our respondents say they use alternative risk transfer mechanisms to transfer financial risks of renewable energy plants. Enel Green Power, for example, uses such instruments to mitigate market risk. Mr Montrucchio explains: “We mitigate our exposure to market price fluctuations by means of forward selling of energy, via mid- and long-term contracts. In Italy and Spain, energy is sold forward both [via] physical contracts and financial derivatives.” Mr Green of JLT provides another example of how renewable energy companies are using alternative risk transfer methods: “With offshore wind, the industry is worried about a large European windstorm event that could do serious damage to a turbine field,” he says. “To cover a large event that does cause a lot of damage, they’re looking at alternative risk transfer products like catastrophe bonds.”

### Risk transfer mechanisms: Tools of the trade

- Captives Insurance companies financing parent company’s risks.
- Catastrophe bonds: Risk-linked securities transferring risks to investors.
- Derivatives: Contracts specifying payment in the event of certain changes, such as in weather measurements (rain, wind) or energy prices.
- Insurance: Contract providing third-party coverage in case of loss.
- Self-insurance: Setting aside specified amounts against future loss.

### Future expectations

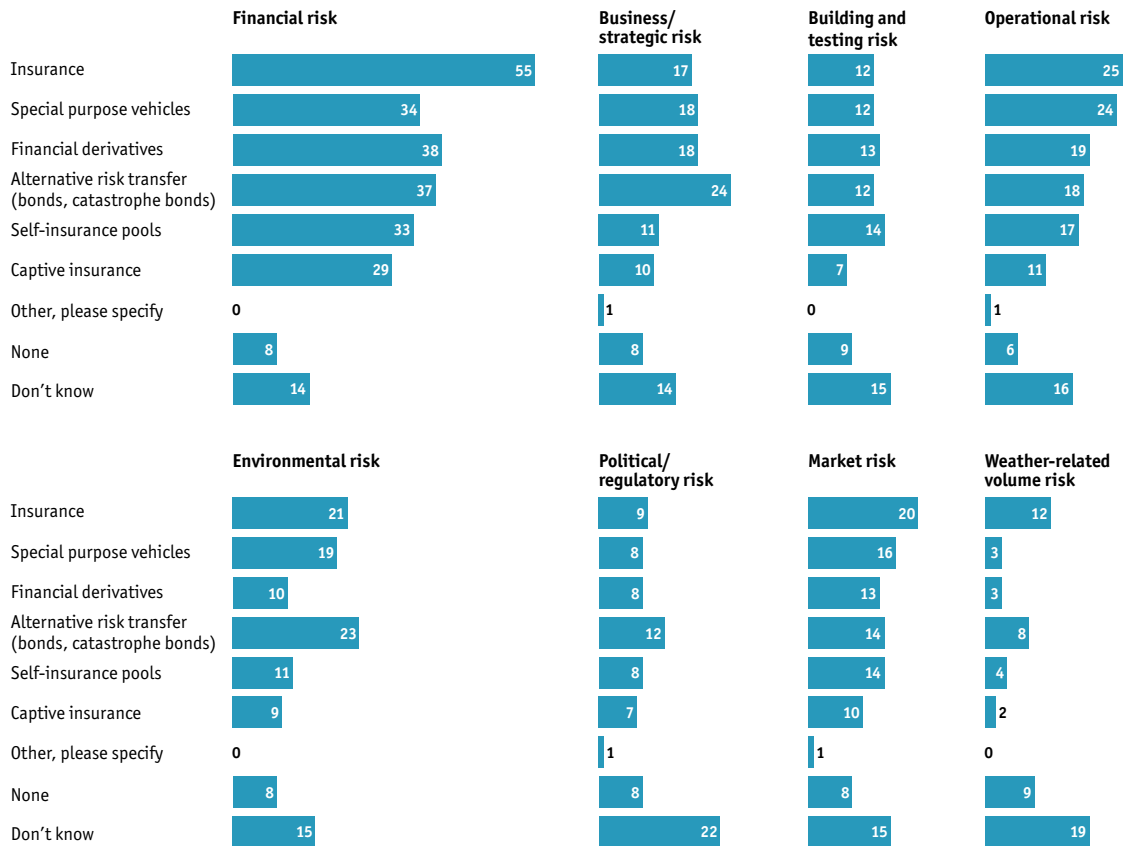
While operational risks are typically transferred to third parties, political and regulatory risk and weather-related volume risk still tend to be retained by plant owners and operators. This does not mean that the power companies involved are unaware of the risks; particularly in wind power,



## Managing the risk in renewable energy

**Which additional risk transfer mechanisms do you expect to use in renewable energy projects in the next three years, and for which risks?** Please select all that apply for each column.

(% respondents)



*Limited options are available for transferring political/regulatory and weather-related risks.*

plant owners emphasise the level of weather-related volume risk they face. Yet only 4% of survey respondents whose main renewable energy activity is wind power currently buy insurance against weather-related volume risk.

To some extent, the retention of these risks reflects a limited availability of insurance products to transfer political and regulatory risk, or weather-related volume risk. "You cannot buy an insurance policy at the moment to protect against a particular government changing or renegeing on its renewable energy subsidy [policies]," says Mr Green of JLT. "I get asked for it quite a lot, though," he adds.

While diversification will continue to provide a natural hedge for many executives, some indicate that they may also transfer more risk, if, as they expect, suitable risk transfer products become more widely available in the future. Mr Montrucchio of Enel Green Power is one: "The global growth in the renewable energy area will lead to more advanced and customised tools to hedge several kinds of risks," he says. Indeed, over the next three years, a plurality of the survey sample expects to make use of additional financial derivatives and special purpose vehicles in transferring financial risk (38% and 34% of respondents, respectively), and even more (55%) expect to make use of additional insurance.

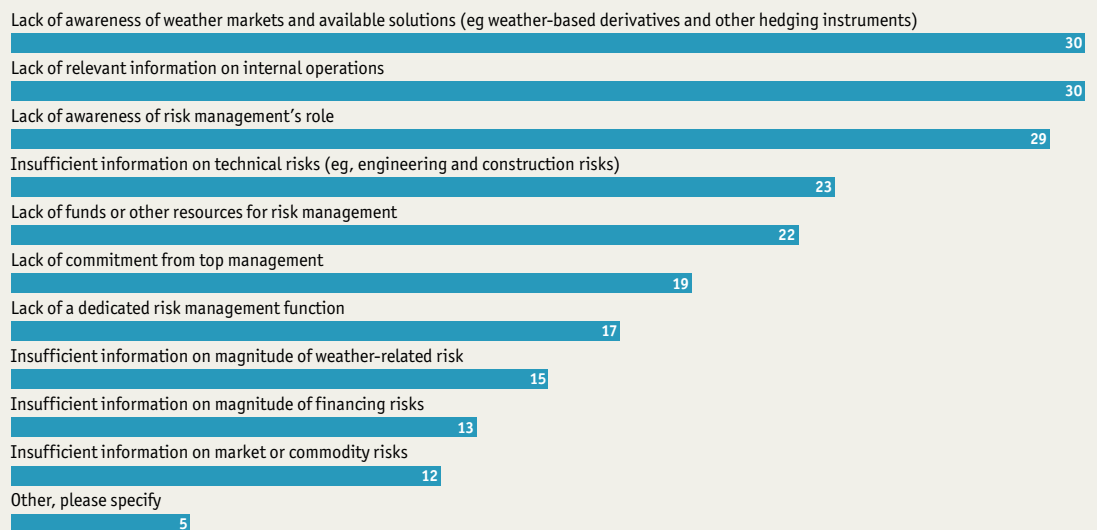


Many interviewees anticipate greater availability of products relating specifically to weather, for example to wind volume. These include weather derivatives, and similar instruments. Ms Hoey of Pacific Hydro believes that, although there is sufficient depth and liquidity in the Australian financial markets to provide the group with the products it needs to hedge some of its Australian risks, “in Chile and Brazil we would like more products in those markets, and specifically we would look at whether there are weather derivative-type products that we could access for those markets.” Similarly, Mr Edwards says that his firm, TRUenergy, buys over-the-counter financial instruments, such as temperature-related weather derivatives, and he expects a wider availability of these kinds of instruments in the years ahead. “I would say there certainly would be scope in the future for more wind-related weather derivative-type products,” he comments.

Mr Musick of 8KU Renewables also anticipates wider availability of weather-related products. He says that his firm is in “very early talks” with an insurance company to agree coverage for weather-related risks as they relate to wind power production. Mr Musick sees the possibility of insurance that covers a pre-agreed yearly energy production, for example 5m kwh a year, for a 2.5-mw turbine that might normally be expected to generate 6m kwh hours annually. Another possibility, he adds, is to hedge the risks. “You try to find a counterparty and say ok, let’s define a number, for example, 5.5m kwh, and each kilowatt hour we will produce more, we, as the owner of the turbine, will pay money to you; and if the production falls below the 5.5, we will get money from you.” Either way, he draws a clear conclusion: “Products to deal with weather-related volume risk will be the next big thing in this business.”

## Obstacles to more effective risk management

**What are the three most significant barriers to more effective management of risks associated with your renewable energy plants? Select up to three.**  
(% respondents)





What is standing in the way of more effective risk management among renewable energy producers? According to survey results, executives consider the main barriers to be a lack of awareness of weather markets and available solutions (cited by 30% of respondents), lack of relevant information on internal operations (30%), and lack of awareness of the role of risk management (29%). The survey indicates that large companies grapple with these issues as much as smaller ones—despite the benefits that scale brings to risk management.

Interviews with industry experts underscore the survey findings. In particular, interviewees say that, because the sector is rapidly evolving, industry expertise is not yet widespread. Gunter Fischer, principal officer of the Global Energy Efficiency and Renewable Energy Fund in Luxembourg, is one: “It’s still a young industry, so we’re still in the process of discovering what the real risks are,” he says. For Claus Burkhardt, project leader of Alpha Ventus, Germany’s first offshore wind farm, “only a few people have knowledge in offshore wind projects, so we need a lot

of education.”

Other executives name the lack of standard industry information as an obstacle to managing risk. “Because we’re doing things for the very first time, we don’t have a huge amount of history to fall back upon,” explains Kathryn Coates, executive manager of hydro and wind at Eraring Energy in Australia. In addition, because the technologies are sometimes new, historical operating data can be hard to come by. Konstantin Graf, a consultant at Altran in Germany, points out: “In offshore wind, there is just not enough data available.”

Finally, interviewees comment that industry-specific expertise needs to expand beyond the renewables sector, in particular into financial circles. “The large utilities that are increasingly investing in wind energy still need better interaction with the financial institutions,” notes Christian Kjaer, chief executive of the European Wind Energy Association in Belgium. “The project developers still have a job in educating financial institutions about the technology.”



## Conclusion

A growing number of power companies are placing renewable energy at the centre of their business strategies. Individual projects are becoming increasingly more complex, leading to higher levels of operational risk. Yet, at the same time, macroeconomic uncertainty entails significant financial risk, and political and regulatory risk, as governments cut back on support for renewable energy projects as part of austerity measures. However, while firms have some tools at their disposal to mitigate and transfer risk, availability of these instruments remains restricted—potentially hampering efforts to invest in growth projects. Effective risk management is critical in ensuring that adequate renewable energy projects are developed to mitigate climate change.

The experiences and insights of the survey respondents, and of the renewable power experts interviewed for this paper, point to a number of recommendations for energy companies for which renewable power is becoming a core component of business strategy:

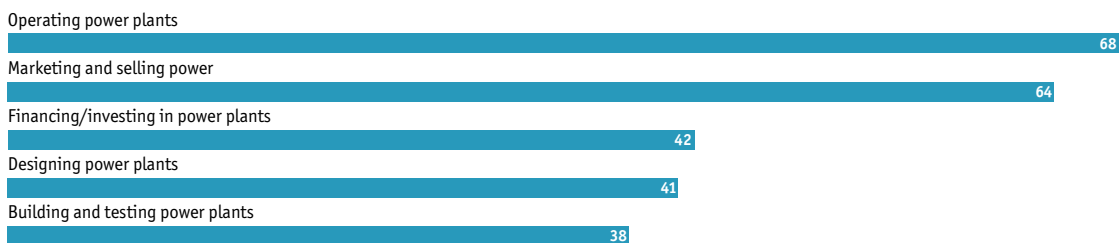
- *Intensify efforts to reduce and mitigate risk.* Renewable energy experts say that the availability of effective risk transfer products is limited. For now, renewable power developers may do well to focus on reducing general business risk—by sharing risk with joint-venture partners, or by investing in late-stage developments, for example—as well as on ways of mitigating specific risks.
- *Deepen industry collaboration to mitigate risk.* Measures including pooling of maintenance equipment and spare parts, as well as joint collection of relevant weather data, may go some way to mitigating the risk inherent in renewable energy projects. Industry partnerships may become more critical as projects become larger and more complex.
- *Foster industry expertise and product development.* More comprehensive information and data on renewable energy technologies, coupled with industry education programmes, may enable development of expertise both within the renewable energy sector and among external stakeholders—potentially paving the way for wider availability of effective risk transfer products.

## Appendix: Survey results

Any discrepancies in the figures cited in this report are due to rounding in the chart data

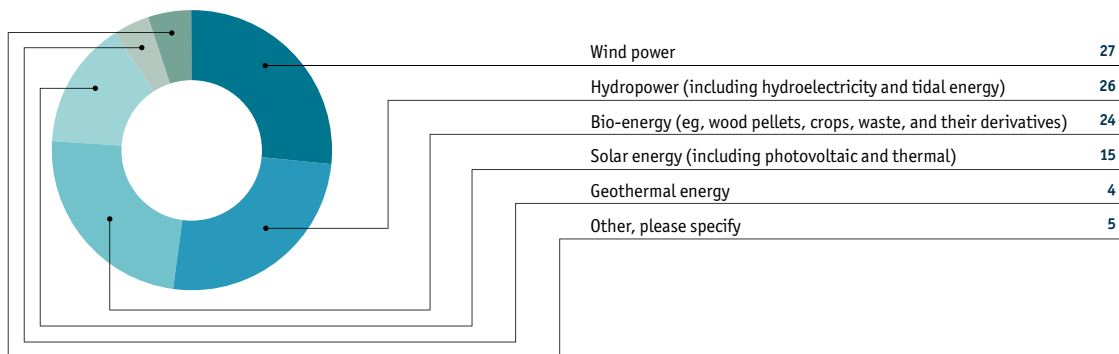
**Are you currently involved, or thinking about getting involved over the next 12 months, in renewable energy in any of the following ways?** Please choose all that apply.

(% respondents)



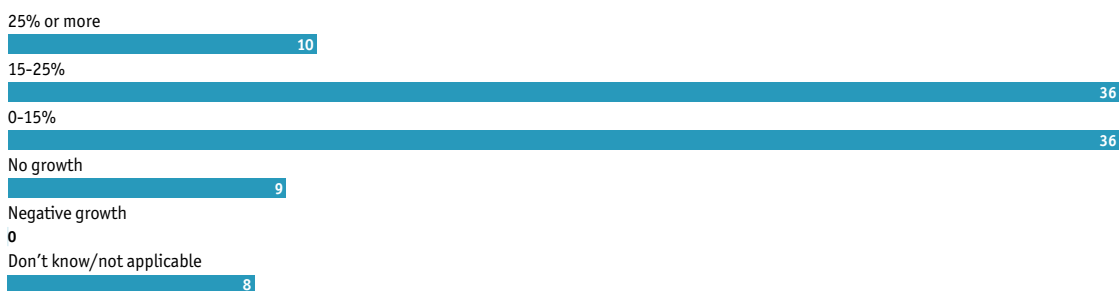
**Please indicate the main renewable fuel associated with your current renewable energy power plant activities and/or plans.** Please choose one answer only.

(% respondents)



**Please estimate the average year-on-year change in your company's total investment budget for renewable energy power projects over the next three years.** Please choose one answer only.

(% respondents)



**In which of the following regions does your company plan to make the most significant investments in renewable energy over the next three years? Select up to three.**

(% respondents)



**How significant is renewable energy to your company's overall business strategy today, and how significant do you expect it to be in the coming three years?**

(% respondents)

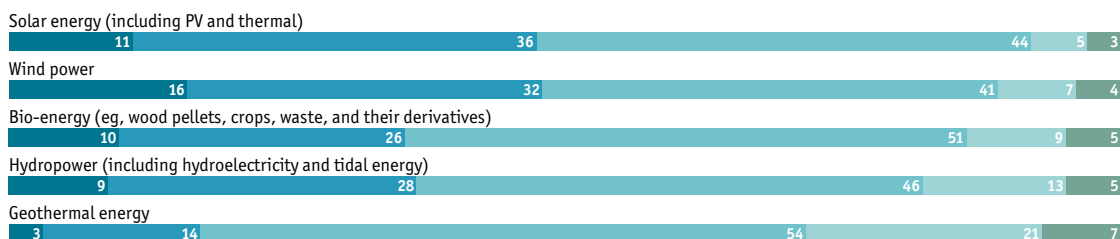
■ Highly significant ■ Moderately significant ■ Not at all significant ■ Don't know/not applicable



**Thinking about the renewable energy industry as a whole over the next three years, how significant do you expect growth in installed capacity to be in each of the following industry segments?**

(% respondents)

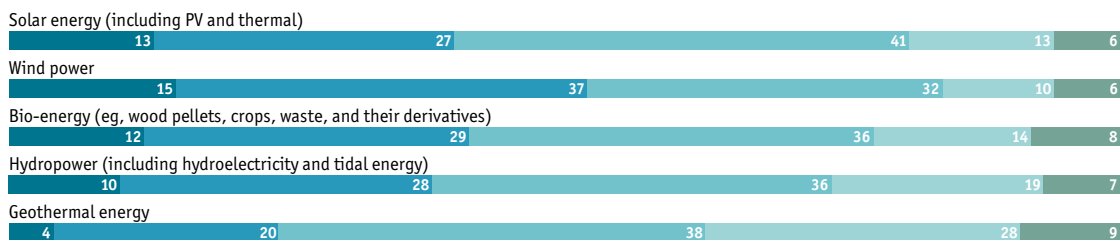
■ Very high (25% or more) ■ High (15-25%) ■ Flat to moderate (0-15%) ■ No growth ■ Don't know



**Thinking about your company in particular over the next three years, how significant do you expect growth in installed capacity to be in each of the following industry segments?**

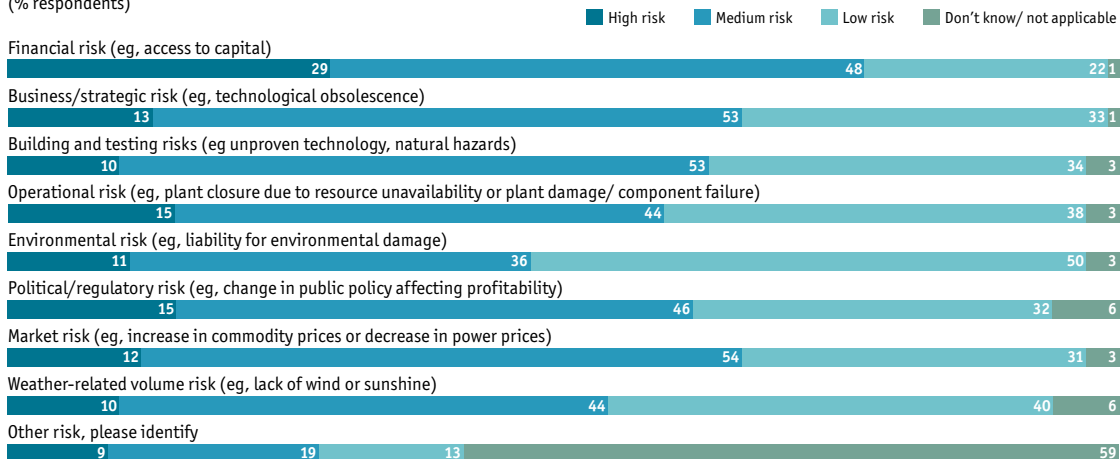
(% respondents)

■ Very high (25% or more) ■ High (15-25%) ■ Flat to moderate (0-15%) ■ No growth ■ Don't know



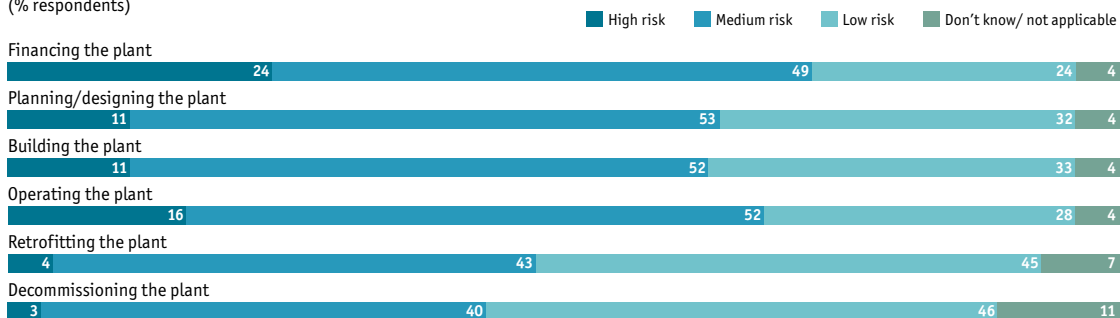
**How would you rate the significance of each of the following types of risk to your renewable energy projects?**

(% respondents)



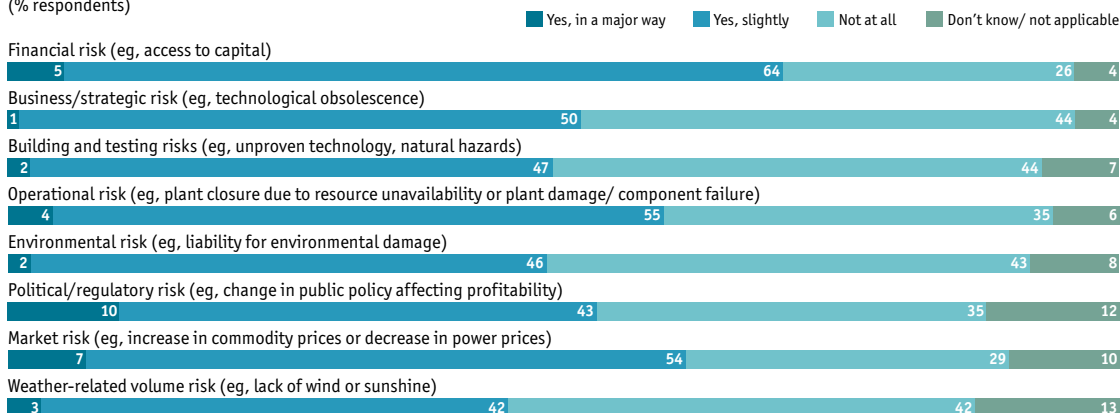
**As a general matter, how would you assess the overall degree of risk associated with each of the following stages of building and operating a renewable energy power plant?**

(% respondents)



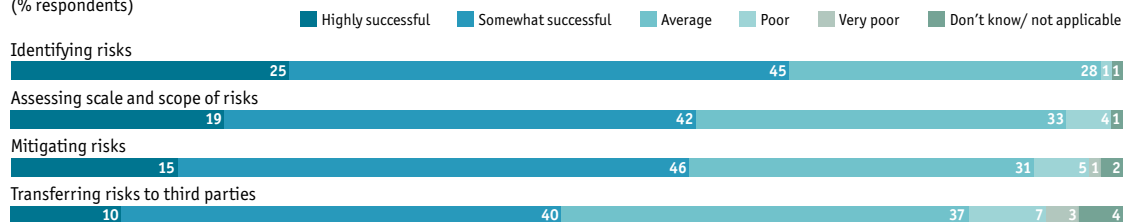
**Has any of the following types of risk materialised in your renewable energy business?**

(% respondents)



**In your view, how successful is your company at the following aspects of managing risks related to its renewable energy projects?**

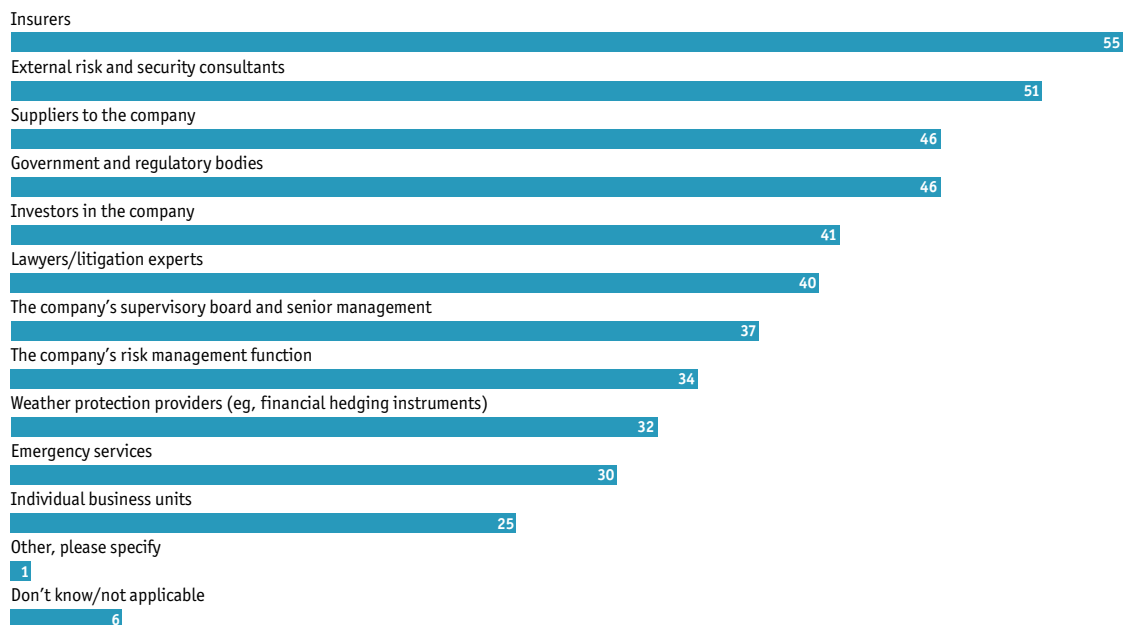
(% respondents)



**In the past three years, which of the following resources has your company used as part of its risk mitigation strategy?**

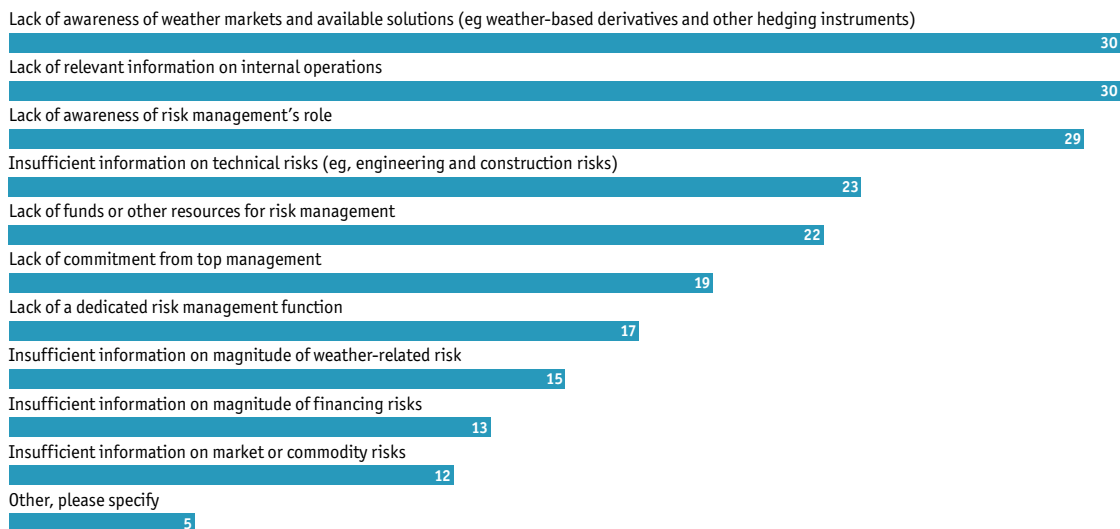
Select all that apply.

(% respondents)



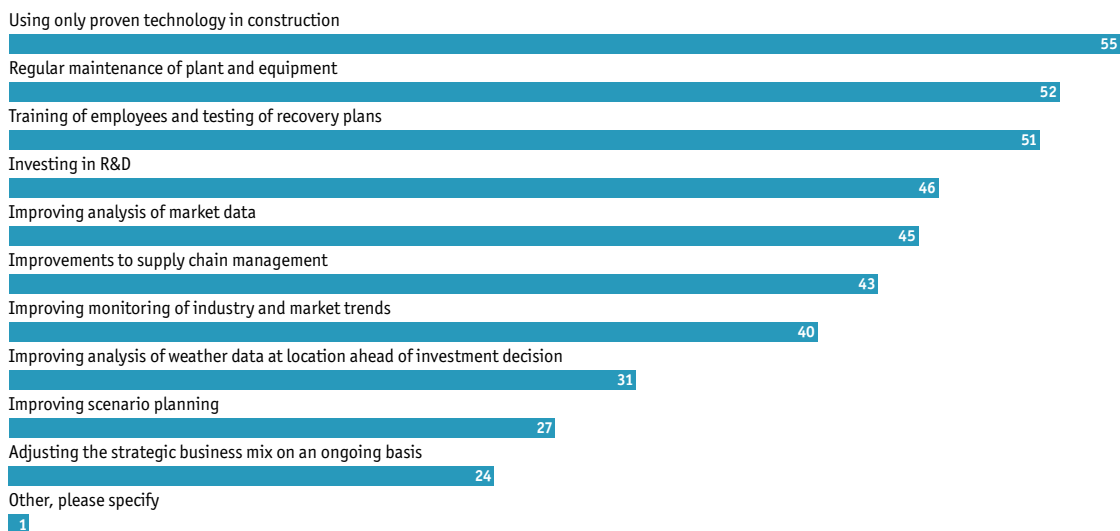
**What are the three most significant barriers to more effective management of risks associated with your renewable energy plants? Select up to three.**

(% respondents)

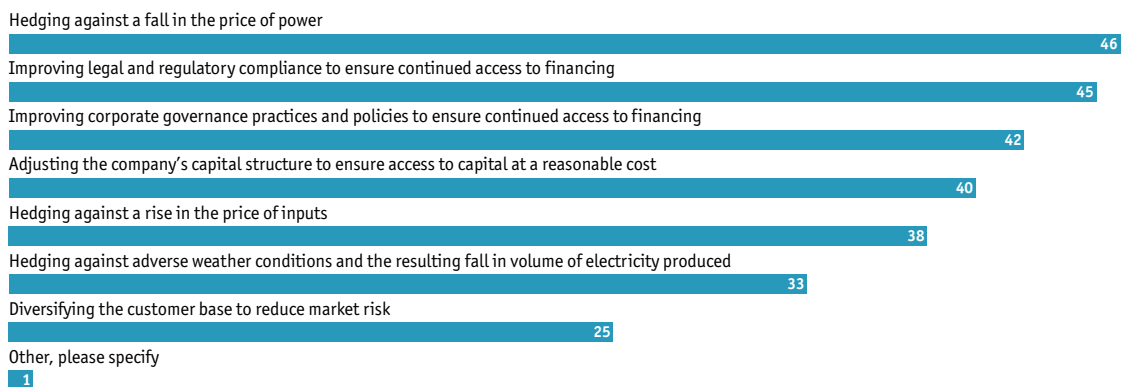


**What measures does your company take to mitigate business/strategic, operational and construction risks associated with renewable energy plants? Select all that apply.**

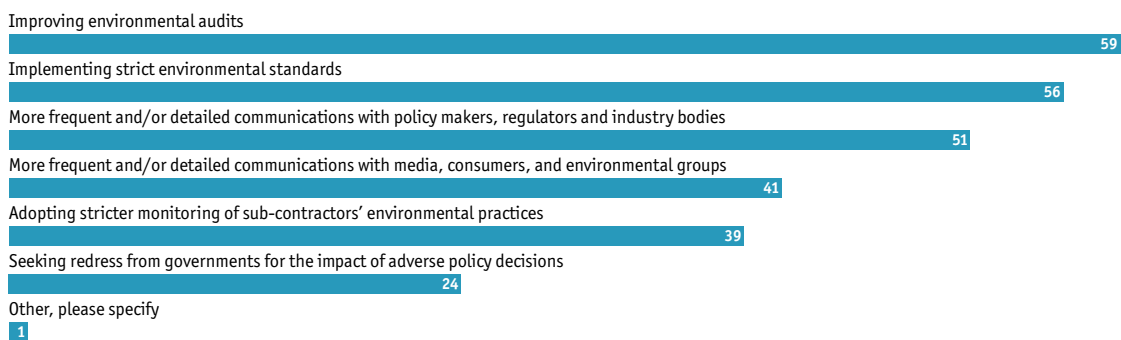
(% respondents)



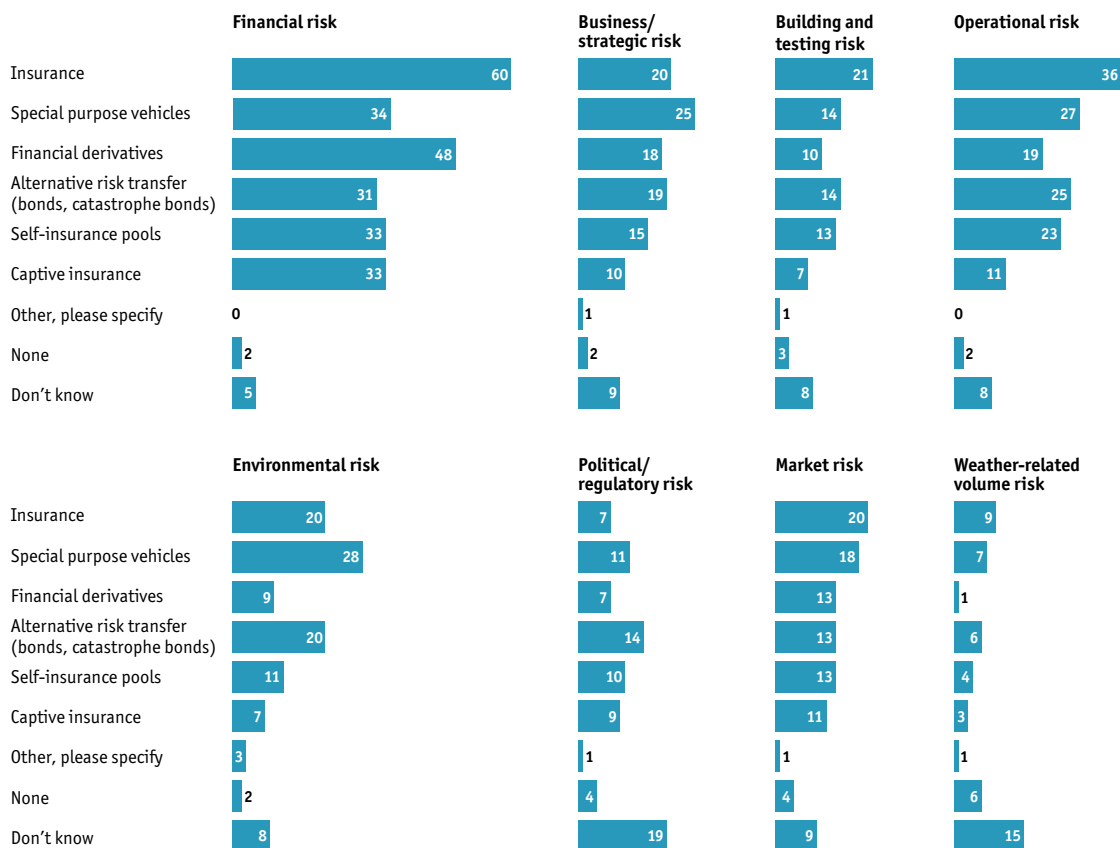
**What measures does your company take to mitigate financial and market risks associated with renewable energy plants?**  
Select all that apply.



**What measures does your company take to mitigate environmental and political/regulatory risks associated with renewable energy plants?** Select all that apply.  
(% respondents)

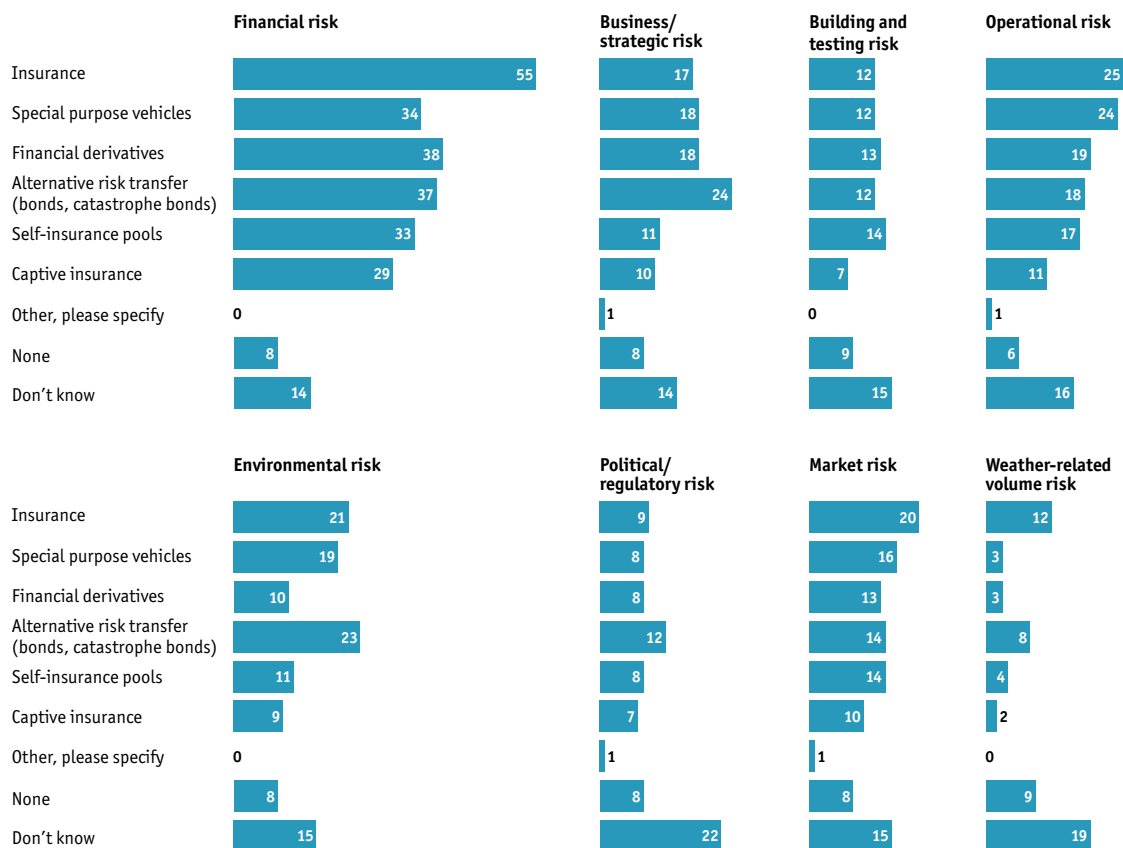


Which risk transfer mechanisms are you currently using in renewable energy projects, and for which risks? Please select all that apply for each column (ie, for each type of risk).  
(% respondents)



**Which additional risk transfer mechanisms do you expect to use in renewable energy projects in the next three years, and for which risks?** Please select all that apply for each column.

(% respondents)

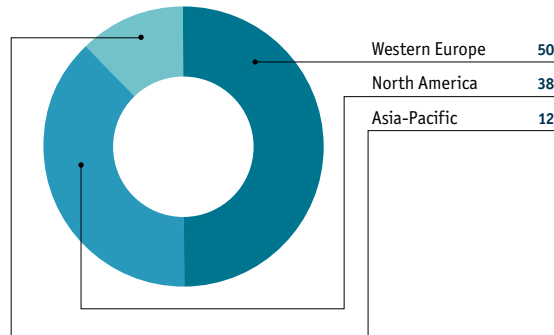


**In which country is your company headquartered?**

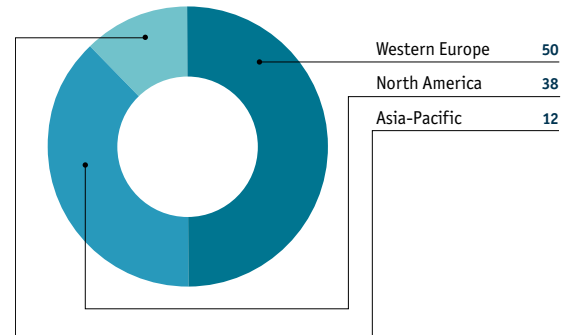
(% respondents)



**In which region is your company headquartered?**  
(% respondents)



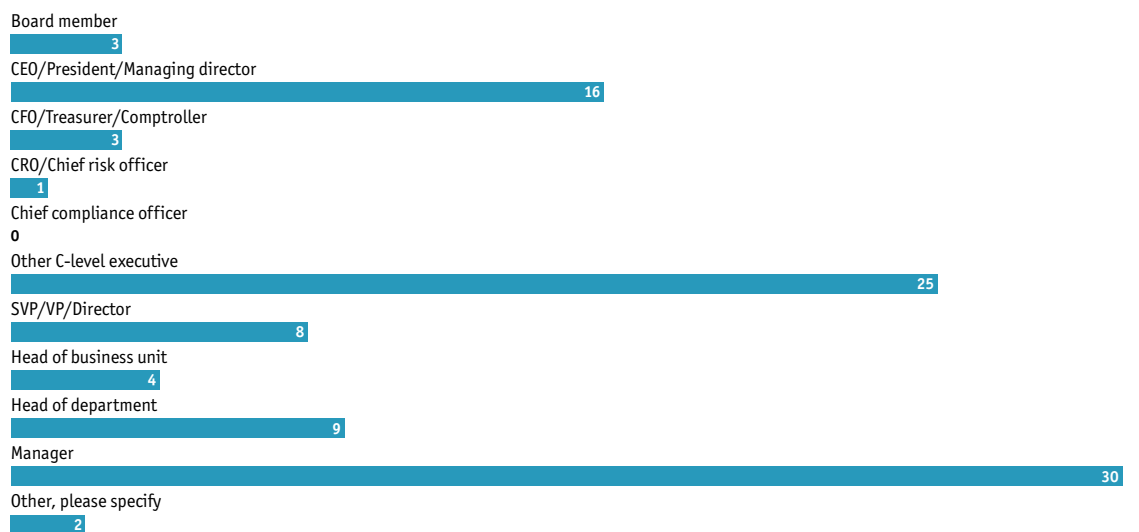
**In which region are you personally based?**  
(% respondents)



**In which country are you personally located?**  
(% respondents)



**Which of the following best describes your job title?**  
(% respondents)



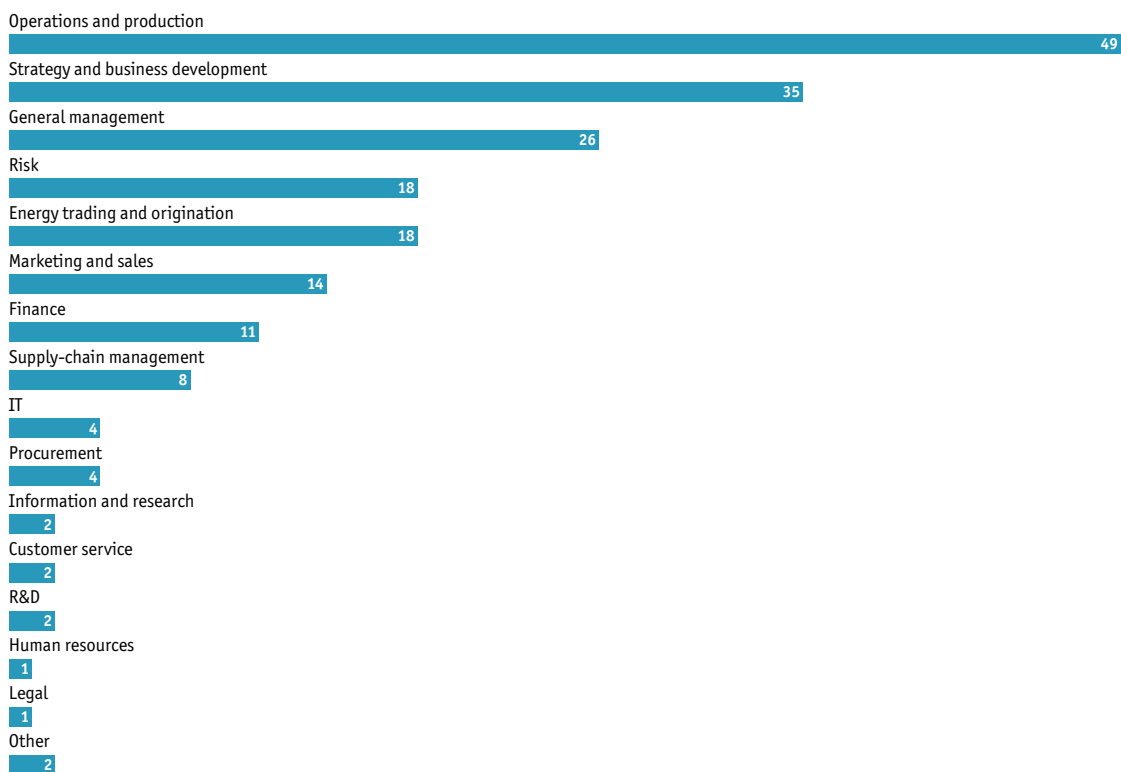
**What are your company's annual global revenues in US dollars?**

(% respondents)



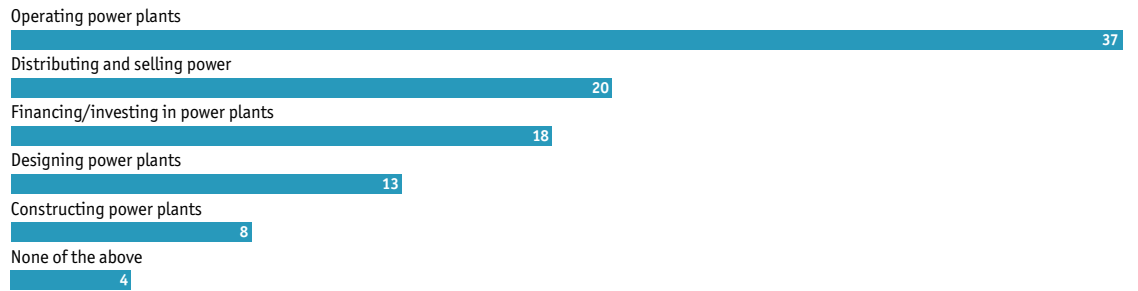
**What are your main functional roles? Choose up to three.**

(% respondents)



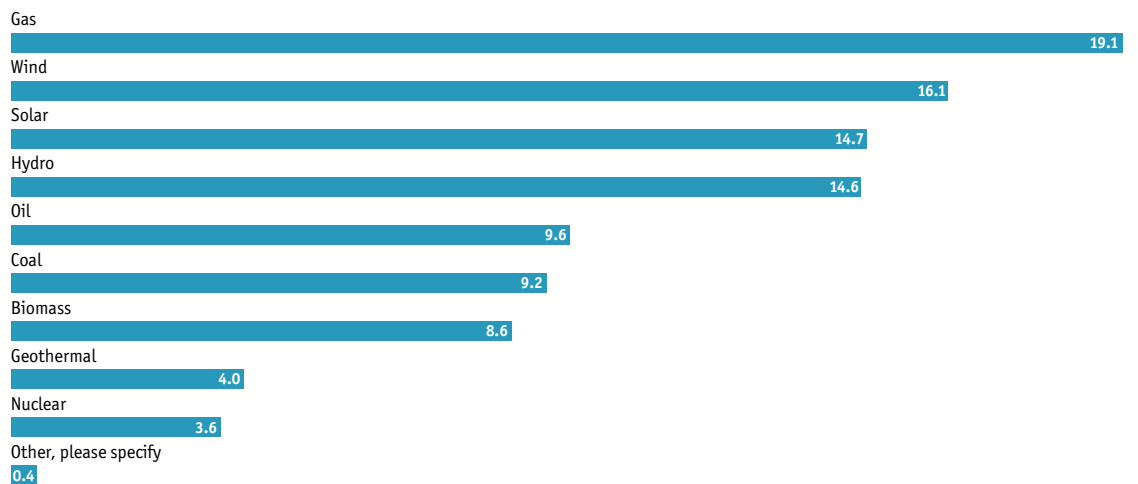
**Which is your principal business activity in the renewable energy sector?**

(% respondents)



**Please indicate which types of fuel currently make up your energy mix, and roughly what proportion of the total each fuel source represents.**

(% respondents)



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