Focus

February 2012

The risks and challenges of renewable energy in a fast changing environment

SCOR Global P&C

Summary

Foreword

In recent years, the insurance industry has seen an increasing number of requests for all kinds of risk transfer coming from various players in the Renewable Energy industry: manufacturers, contractors, operators and lenders. In many instances the lawmakers, regulators, financiers, engineers, and developers have made or will make decisions without verifying the risk transfer mechanisms available. While Renewable Energy is now becoming a reality in today's world, and is certainly key to the future development of our economies, the (re)insurance sector still views this industry as an emerging one. At the present time, the primary objective of the (re)insurance sector with regard to Renewable Energy is to build and work with balanced portfolios.

The various means of harvesting energy (wind, solar, tides, etc.) or generating power (waste to energy, hydropower, biomass) do not provide sufficient homogeneity to an industry that is, in fact, several industries at once, with some areas being very advanced while others are still at the initial stages, i.e. not even tested industrially. Prototype technologies and ramp up phases are not generally attractive to underwriters.

SCOR Global P&C's Business Solutions division, which is dedicated to large corporate risks, has been dealing with Renewable Energy for some time, working on many different products at various levels. Our work principally consists of discussing risk exposures and risk transfer parameters with the insured, in order to ensure that adequate solutions are found and that the insured understands the equations faced by underwriters.

Communication is key to this process, and disclosure is an excellent way of finding insurance solutions. In an attempt to contribute to the exchanges between the two industries, we decided to organize a seminar on the challenges linked to Renewable Energy. Rather than simply giving a lecture on insurance matters, we wanted, through our SCOR Campus training seminars, to give the various players a platform from which to present their technologies, their views and also their actions or plans. SCOR representatives also contributed their opinions from an insurance point of view.

This SCOR Focus is based on the presentations made by the speakers at our SCOR Campus seminar. We hope that it will be a valuable source of information and will contribute to your knowledge of Renewable Energy.

Lastly, we would like to thank all the speakers and participants who contributed to this event and this publication. Their biographies are included in this SCOR Focus. We would also like to thank all those who helped us on the organizational side: Jaap Vrolijk of Bechtel, Nicolas Bentz of the BFCE, Scott McGuigan of CH2MILL, and Pierre-Denis Treillard and Thomas Thomsen of AREVA Wind, who presented their company's business proposal during the seminar.

We hope you enjoy our SCOR Focus.

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ALTERNATIVE RISK TRANSFER SOLUTIONS FOR THE RENEWABLE ENERGY INDUSTRY: FOCUS ON "RESOURCE RISKS"

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Energy is essential to our society to ensure our life style and to support all other elements of our economy. Renewable energy technologies offer the promise of clean, abundant energy gathered from self-renewing resources such as the sun, wind, water, biomass and geothermal. Virtually all regions of the world have renewable resources of one type or another, which currently account for only a fraction of the world-wide energy consumption, most of it being hydropower. Wind, solar, biomass and geothermal technologies are about to be further developed and are making important steps towards broader commercialization.

Concerns over climate change impacts and the projected depletion of fossil fuels has urged more governments to adopt policies that stimulate renewable energy technologies to spread, mostly through state-subsidies. This, together with increased commercialization, increase the dependencies of societies to the availability of such renewable energy sources. Hence, a need for insuring this risk is born!

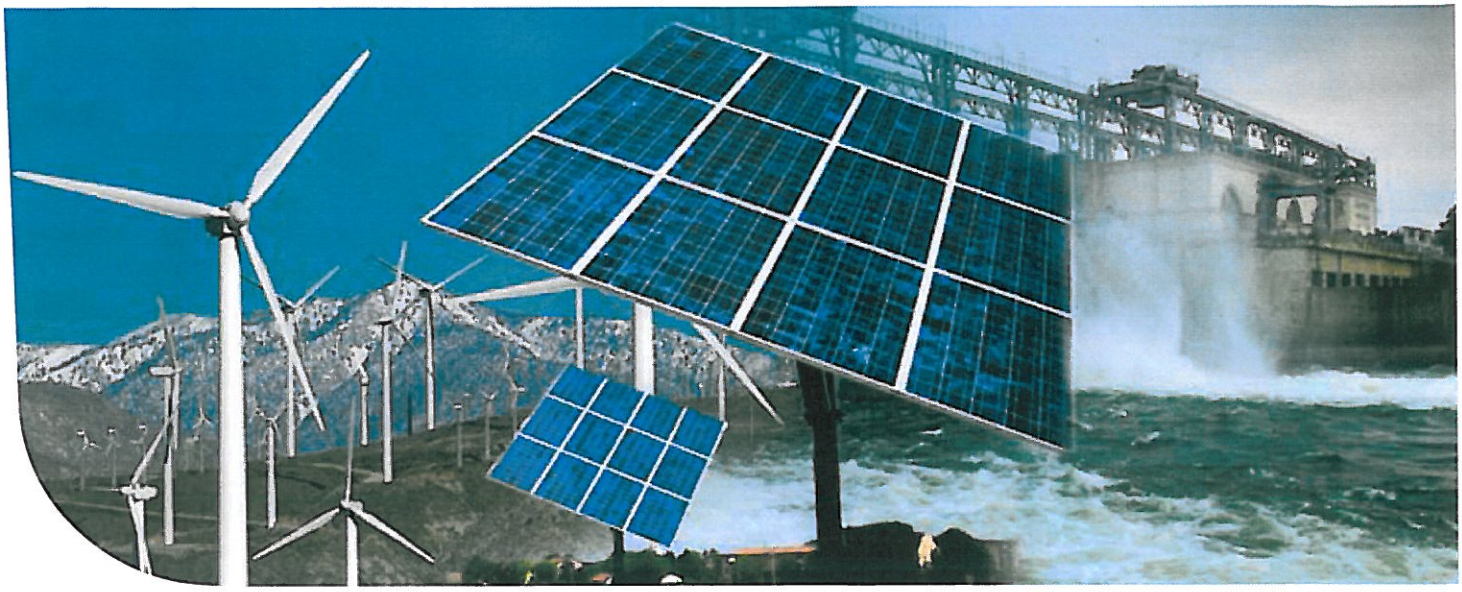
Therefore, the purpose of this article is twofold. Firstly, it explains what specific (re)insurance or risk transfer needs the Renewable Energy Industry has and, secondly, it gives some concrete (re)insurance case studies for such risks. The article will close explaining what future role the (re)insurance industry could take in this area.

Resource risk is defined as the uncertainty about the availability and profit-generating ability of energy resources over time. It is a major issue currently being tackled by renewable energy experts, who look for risk transfer solutions to accompany the development of such risk.

Banking professionals propose specialized capital market products for hedging these risks whereas (re)insurers address this risk category by proposing their own alternative risk transfer products as well. Considering the specific needs of this industry, (re)insurers have to define the resource risks in their own actuarial way and study what makes these risks (re)insurable, that means to assume the risk on their own (re)insurance balance sheet.

On the other hand banks are exploring ways to bundle such risks and then to sell them to investors via capital market instruments.

For both, banks and (re)insurers it is important that exposures and hazards are carefully analysed in order to precisely define what the resource risk actually is, and in order to subsequently develop the most appropriate forms of risk transfer and design a (re)insurance or capital market product to hedge such risks (ceding such risks to a third party).



I. What is resource risk?

Resource risk is defined by the following equation:

Resource Risk = Volume Risk x Price Risk

Volume risk is a natural risk, while price risk is an economic risk:

- Volume risk is the sheer uncertainty about the availability of a particular energy source on time
- The price risk as an economic risks is the uncertainty about the profit-generating ability through this particular energy source due to its dependency from market (trading) price fluctuations over time.

Banks and (re)insurers have different approaches towards risk: (Re)insurers are initially concerned with analysing natural risks, whereas banks are more focused on price risks, i.e. economic risks.

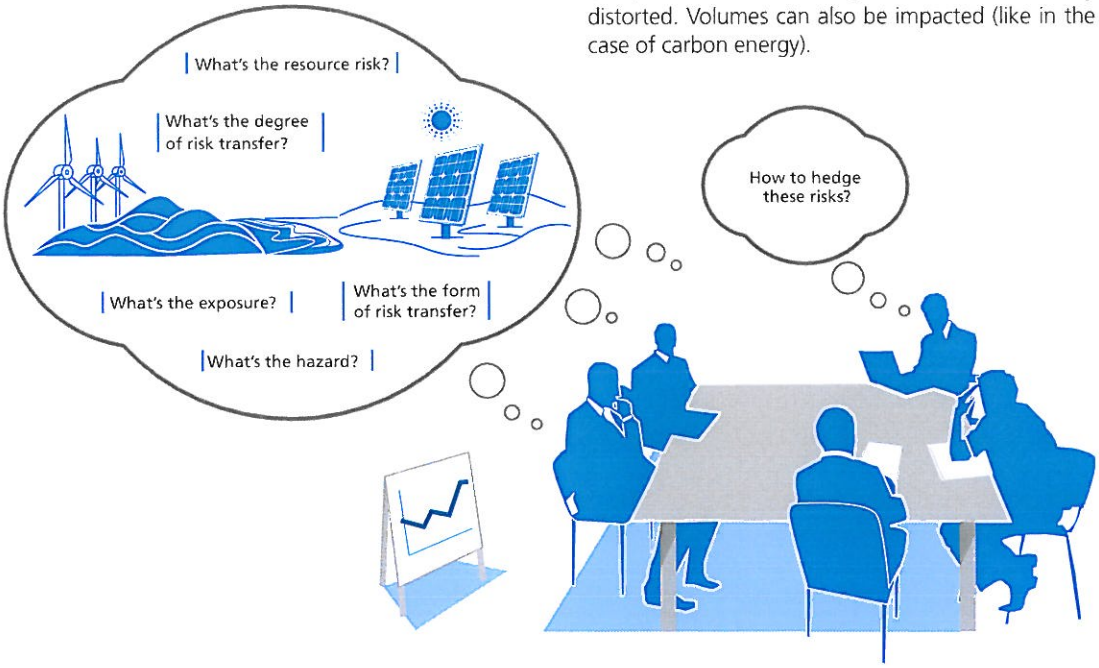
Volume risk can be split into:

- The expected volume over a given period of time. It is worth noting that the disruptive potential of climate change may also be considered in the calculation.
- Volatility risk (period-to-period uncertainty concerning the availability of the natural resource in question).

Price risk is often "man-made" and influenced by markets or governments.

Looking at renewable energies, they can also be split in a different way, which can be relevant for (re)insurance techniques:

- Well-known resources, benefiting from long time statistics. Wind, and sun-based energies fall into this category, with a strong natural supply and direct access.
- Geothermic and carbon related energies are subject to state intervention, and heavy regulation. Prices for those sources of energy are set by authorities, and can therefore be subsidised, and therefore artificially distorted. Volumes can also be impacted (like in the case of carbon energy).



Hedging instruments can either focus on volume risk, price risk or the multiplication of one by the other, i.e. resource risk. Hedging resource risks (weather risks such as wind, sun and water) involves ceding a price to a carrier such as a bank or a (re)insurer, and therefore has an impact on the planned financial return of the ceding company. Weather hedges are based on data concerning volume and price risks over a long period stretching from the past into the future (multi-year approaches). The quality of the underlying data set impacts the business success and possibly also the State subsidies of the company in question (in Germany, for example, the German Government strongly supports solar panels).

II. What are the specific issues for the (re)insurance industry in terms of resource risk?

When deciding whether to use existing or new risk transfer technologies, it is crucial to take into account the way in which triggers are defined. Parametric triggers must be distinguished from indemnity triggers (the difference between parametric and indemnity triggers is the basis risk, the non-correlation between trigger and actual loss). The scope of cover could be much broader when covering a multi-year period (compared to a one year period only) in order to benefit from the smoothing-out of results over time. The key factor here from a risk management point of view is the diversification over time. It is also highly important to integrate capital markets and/or some of their features into the industry, because there might not be enough capacity to perfectly hedge all weather risks through the (re) insurance industry. Using a larger capital market could therefore become a very significant factor.

With regard to pricing, there may be a lack of data due to the absence of loss history or to limited loss history. To calculate stochastic prices, (re)insurers often work with proxy data, building-up databases over time. Sometimes they even use satellite-based data.

Gaining a long-term view is difficult due to unknown climate change factors and, therefore, possible adverse developments in the ultimate loss burden vis-à-vis the model ("model instability"). Three to five-year aggregate contracts with revolving periods are more efficient in terms of minimizing hits on such products.

Basis Risk (for the buyer/cedant) must be as limited as possible, with regard to both the license used (bank or (re)insurance) and all the accounting implications for the cedant. If the cedant's basis risk is too high, the instrument will be accepted not as a (re)insurance product but as a "speculative" asset (derivative product as an investment).

III. What are the specific needs of the renewable energy sector?

When considering the Renewable Energy Industry, the techniques used for Risk Transfer (hedging) Products can be applied as follows:

- "Long-term" programme (Multi-year aggregate covers may be efficient if the available date is limited).
- Multi-perils, which are not a standard risk for the traditional (re)insurance industry, could play a vital role for future products in the renewable energy sector.
- Self-Participation is a basic instrument used to mitigate certain risks in a (re)insurance product in the event of insufficient data, or when new risks have to be assessed. Self-Participation (Self Insured Retention) is also advantageous when risks turn out to be better than expected. It creates an alignment of interest between the ceded part of the risk and the risk taker.

Risk management in the renewable energy sector may also be different due to the specific needs involved:

- It focuses on affinity groups, such as renewable energy providers, which involves a higher level of tailor-made pricing and marketing.
- Hedging instruments require new distribution channels through governments and banks.
- The Renewable Energy Industry manages its risks in a different way, taking a long-term view rather than focussing on short-term trading. The behavioural risk hedging patterns involved differ from traditional ones, driving a need for more personalized products.

Once the specific risk transfer needs have been analysed, the providers of such hedging and (re)insurance instruments enter into single contracts.

IV. Risk categories in a hedging product

(Re)insurance distinguishes between the different types of risk by using different forms of triggers, which impact the balance sheet:

- Underwriting risks (losses are higher than expected), which is basically the volume risk.
- Timing risks (losses occur earlier than expected), which are usually part of the (re)insurance deals.
- Financial risks or price risks, when interest rate attachment is embedded into a long-term (multi-year) type of product.

Non balance-sheet risks include other risks that are not usually part of the risk transfer, although they do play a role. For example:

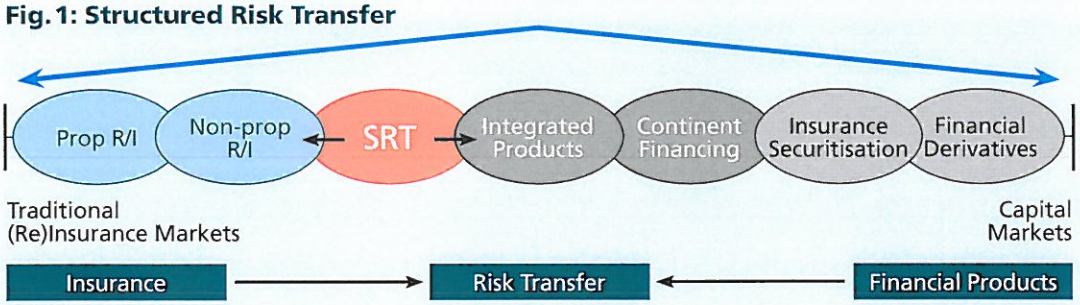
- Model risks where the assumptions set in a model prove to be wrong at a later point in time.

- General business risks (economic downturn for example) impacting the cedant's business success and possibly also its State subsidies.
- Political and reputational risks, credit risks and default risks.

(Re)insurance contracts must have sufficient risk transfer (underwriting and/or timing risks). When a hedging instrument does not provide enough risk transfer, then it becomes a banking (debt) instrument. Providers of such hedging products verify which kind of licence, i.e. banking or (re)insurance licence, should be used. Therefore, the degree of risk transfer and the risk class are key elements when deciding on a type of (re)insurance product.

As shown in the diagram above, Structured Risk Transfer (SRT) is situated somewhere between traditional (re)insurance and banking. The question is, to what degree does risk transfer penetrate (re)insurance (to the left) and banking products (to the right)?

Fig. 1: Structured Risk Transfer



V. What are the criteria used to define a trigger and which criteria are suitable for such trigger definitions?

- **Triggers must be reliable** and stable over time (the logic of the trigger must not change over the period of observation): the worst-case scenario would be to assume a risk and observe over a period of time that the trigger is adversely developing in the other direction. That would cause a systematic loss for the product provider.
- At least 10 years of **data history** are necessary to make sure that data is reliable. On some risks, time series can be much longer, beyond a 100 years.
- Avoiding **moral hazard**
- **Easy** to assess and observe
- **Low basis risk** regarding the risk to be hedged

EXAMPLES OF "GOOD" TRIGGERS

- Water (easy to measure)
- Solar irradiation on defined ground panels (stable and reliable)
- Temperatures (heating/cooling days)
- Historic data available (at least 10 years of comprehensive and stable data)

With water, solar and temperature, historic data is generally available.

EXAMPLES OF "DIFFICULT" TRIGGERS (triggers that do not fulfil one or more of the above mentioned trigger criteria)

- Wind, fog or other 'fuzzy' formulated triggers for tourism purposes for example, like snow levels in ski resorts, or distortion of a clear trigger into a fuzzy one ("sunny" to refer to radiation).
- Very complex (multi-level) triggers: fairly complex to monitor properly over a long period of time.
- Triggers with non-correlated parameters (financial indices for example) creating basis risk.

Triggers without data history: the insurance world only conducts reinsurance based on mathematical calculations, whenever it can, or uses other techniques when mathematics are of no use: when insuring new technologies or products, time series and data can simply not be available.
Other risk categories such as financial risks must not be the prime drivers but could be part of the contract.

TRIGGER: ACCOUNTING IMPLICATIONS

A key debate has always been the degree to which a buyer is allowed, from an accounting perspective, to book a hedging instrument like a (re)insurance contract (thereby benefitting from tax and accounting advantages) rather than booking a banking (investment) product, which has far less advantageous tax and accounting implications since a banking product is simply an investment and not a tax-efficient expense like a (re)insurance contract premium.

In terms of the accounting implications of trigger definition, the prime driver is the degree of risk transfer, i.e. the amount of risk accepted on the reinsurer's balance sheet and the class of such risk. For example, weather risks constitute a traditional risk class while financial risks, reputation and other off-balance sheet risks are difficult to embed into a (re)insurance contract and would require specific accounting considerations.

In some countries, there are regulations specifically designed to handle such transactions, which lie on the cusp between (re)insurance and banking. A (re)insurer must comply with the local regulations, in order to avoid selling a banking product camouflaged as a (re) insurance product.

VI. Examples of hedging strategies for the Renewable Energy industry

Business Case 1: Conventional Hydroelectric Power Station on a large European River

A hydroelectric power station on a river in Europe enters into a parametric (water-level) one-year reinsurance contract via the country's leading insurance company. This contract protects the electricity producer against adverse weather conditions (too little water over a period of 12 months), because in 2003 the producer experienced a very dry summer and little snow in the winter. The river is fed in the spring by melting water from the Alps, enabling the power station to produce electricity. To analyse this risk, time series on water levels were available for over a 100 years. Ultimately, the station wants to protect itself against a financial loss generated by a shortfall in electricity production. What would happen in the event of little snow in the Alps and dry summers?

- The solution to this case is a Structured Risk Transfer because it is a parametric trigger (but highly correlated) weather deal.
- One-year Stop Loss with a no-claims bonus (profit commission).
- Parametric weather risk (too little water at predefined measurement points in the river).
- Attaching point: for example 70% of a 10-year-annual average water level. So if the water flow, which is easily measured alongside the river, drops below a 10-year average by the end of each year, the reinsurer would pay.
- Capped (limited) cover to achieve favourable upside/downside profile.

This is an example of a simple parametric type of transaction. The deal is large enough to be shared between several (re)insurers. And the risk class is largely uncorrelated to any other (re)insurer's property or cat risks in the region, thereby enabling the (re)insurers to free up capital.

Business Case 2: Solar Power Station in a Southern European State

A solar power station in Europe is interested in buying a hedge against too little sun over the course of the year. However, in this project, the standard deviation over the year is actually very low: there is always sun in the region where the power station is located. There is so little variation over time that a hedge is deemed to be too expensive and to actually constitute a luxury for this type of company. The corporation, together with the ceding company, decide to retain the risk on their own balance sheet (self-insured retention principle). Therefore, correlation between the parametric trigger and the cedant's loss compensation must be at least 80%.

VII. What are the prospects for (re)insurers in the Renewable Energy industry?

It is widely expected that the renewable energy sector will grow over time since energy consumption is growing on a world-wide basis and, secondly, there is also a trend to substitute nuclear and fossil energy through alternative energy resources. Both trends bring additional risks about predictability of such resources alongside and the Renewable Energy Industry will increasingly have, therefore, a need to hedge such risks. In addition to banks that create capital market products, (re)insurers will also play a more active role here in establishing tailor-made risk transfer products for the renewable energy sector. (Re)insurers are key because they are experienced in analysing such risk classes when there is enough data available, before accepting them on their own balance sheet. Together with capital market instruments, (re)insurers can play a vital role in the future in terms of providing more advanced risk transfer products even when incomplete data is available only. However, this development is at its inception only and there will still be a lot of research needed to create such products.

Lastly, all market partners need to closely observe the development of this industry in order to be prepared to offer products and to take risks on their own book or convey such risks towards capital markets. Such a wider use of banking and (re)insurance technology will ultimately lead to a faster implementation and broader use of renewable energy technology and will pay initial costs back to society.

SPEAKERS' BIOGRAPHIES

Guest speakers

CARLOS F. AGUILAR

Senior Vice President, Project Execution and International Development

Carlos Aguilar was Senior Vice President of Project Execution and International Development for BrightSource Energy. His role focused on project execution and construction management, as well as expanding BrightSource's global presence and managing the company's relationships with major international partners.
Most recently, he served as Principal Vice President for Bechtel Power Corporation working on U.S. fossil power projects.
Dr. Aguilar holds a Ph.D. and M.Sc. in Technological Economics from Stirling University in Scotland, as well a B.Sc.E. in Mechanical Engineering and Materials Science from Duke University.

ALAN DUFFY

Insurance Manager, Masdar

In 2000 Alan Duffy graduated with an Honors Degree in Risk Management from Glasgow Caledonian University. In 2007 he spent two years at Dubai World's in-house broker working mainly on Nakheel projects such as The World, Palm Jumeirah, and Limitless projects like the Arabian Canal and Down Town Jebel Ali. In September 2009 Alan joined Mubadala, and is on long-term secondment to Masdar as Insurance Manager.

PAOLO FRANKL

Head of Renewable Energy Division, International Energy Agency

Paolo Frankl is the Head of the Renewable Energy Division (RED) at the International Energy Agency (IEA), which he joined in summer 2007.
In this role Dr. Frankl coordinates the Division's activities, encompassing the status and progress of renewable energy technologies; renewable energy policies and markets; and system-integration issues.
A physicist by training, he holds a Ph.D in energy and environmental technologies from the University of Rome.

JÉRÔME JACQUEMIN

Country Manager - France, GL Garrad Hassan

Jérôme Jacquemin qualified as a Mechanical Engineer in France in 1998, and completed the Eurec European MSc in Renewable Energy at École des Mines de Paris. He has been responsible for owners engineering work in GLGH's offshore department since 2005 covering aspects such as wind resource assessment, wind farm design, and O&M engineering work. Since June 2010, Jérôme Jacquemin is responsible for GLGH's French subsidiary and oversees all work conducted in France, North Africa and other French speaking countries.
He is an active member of the European Wind Energy Technology Platform – Offshore Working Group (2011–2013) and of the French Wind Energy Association (FEE) – Offshore Group.

CHRISTOS KOLLIATSAS

Renewables Team Leader, Mott MacDonald

Christos Kolliatsas is currently leading the offshore wind technical advisory in Mott MacDonald. He has undertaken a number of roles on behalf of owners and lenders for offshore wind projects in the United Kingdom, France, Netherlands, Belgium and Germany. In particular, he was involved with the work for four pre-construction non-recourse financed projects to date (Q7 - now Prinses Amaliawindpark, Thornton Bank and Bligh Bank) and is currently engaged with the financing of a further two offshore wind projects.

YANN MERCIER

Co-founder and Chairman of Méthanéo

Graduated from HEC Paris, Yann Mercier created and ran two companies in Spain. The first, founded in partnership with the French group SNPE (*Société Nationale des Poudres et Explosifs* – National Powder and Explosives Company), studied and analyzed the industrial risks of chemical and petrochemical units. The second company, founded in partnership with Proserpol, designed and constructed treatment stations for industrial waste. Then, he spent four years at Proserpol in the 2000s working in the same field as in Spain.
In 2006, following the appearance of buyback rates for electricity generated from biogas, he founded Methaneo in 2007 with his associate Sébastien Couzy.

MICHAEL TODMAN

Founder partner of TidalStream Limited

Michael Todman is a founder partner of TidalStream Limited. Previously he has been Chief Technical Officer at Pursuit Dynamics plc – a technology innovation company where he developed novel propulsion and processing systems, and prior to that he served as Chief Engineer at Rolls-Royce plc Industrial & Marine power, involved in both marine propulsion turbines and power generation systems from concept designs to in-service support.

SCOR speakers

VICTOR PEIGNET

Chief Executive Officer, SCOR Global P&C

Victor Peignet, Marine & Offshore Engineer graduated from the Ecole Nationale Supérieure des Techniques Avancées (ENSTA), joined SCOR's Facultative Department in 1984 from the offshore contracting industry. He has more than 15 years underwriting & managing experience in Energy & Marine insurance with SCOR. He was at the head of the Corporate Business Division of the Group (Business Solutions) since its formation in 2000, as Executive Vice President and as Managing Director from April 2004.
Since July 2005, he has been the Chief Executive Officer of SCOR Global P&C that is one of the two operational entities of the Group and that manages the Group non-life business worldwide. He is member of the Group COMEX.

EMMANUEL FIERENS

Chief Underwriting Officer & Head of Business Solutions, SCOR Global P&C

After 9 years in Industry, Emmanuel Fierens joined SCOR in 1991, as Industrial Fire Risks Underwriter in the Headquarters of SCOR in Paris.
In 2005, he became Chief Underwriting Officer (CUO) and Head of Business Solutions (SBS, the Large Corporate Risks' Underwriting Division of SCOR Global P&C).

HENRY GADEN

Head of offshore a Shipbuilding, SCOR Global P&C – Business Solutions

After graduating in Electrical engineering, he had a first experience with the GTM Entrepose Group as a Project Manager for offshore oil & gas projects and then expatriated for a decade in Abu Dhabi as local representative. Henry joined AGF (Allianz) in 1988 as a leader underwriter for large oil & gas and petrochemical international groups until 1994 when he started a new reinsurance experience with Sorema and nowadays with SCOR at the head of the Offshore and Shipbuilding department.

THOMAS RENGGLI

Head of Structured Risk Transfer, SCOR Global P&C

Thomas RENGGLI undertook academic studies in Bern and USA and passed degrees in Econometrics, Economics and Business Administration. He has almost 20 years of experience in non-standard risk transfer for insurance, reinsurance and capital markets. Before joining SCOR Global P&C in August 2008 he had management positions with ZFS, Swiss Re and PartnerRe.

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