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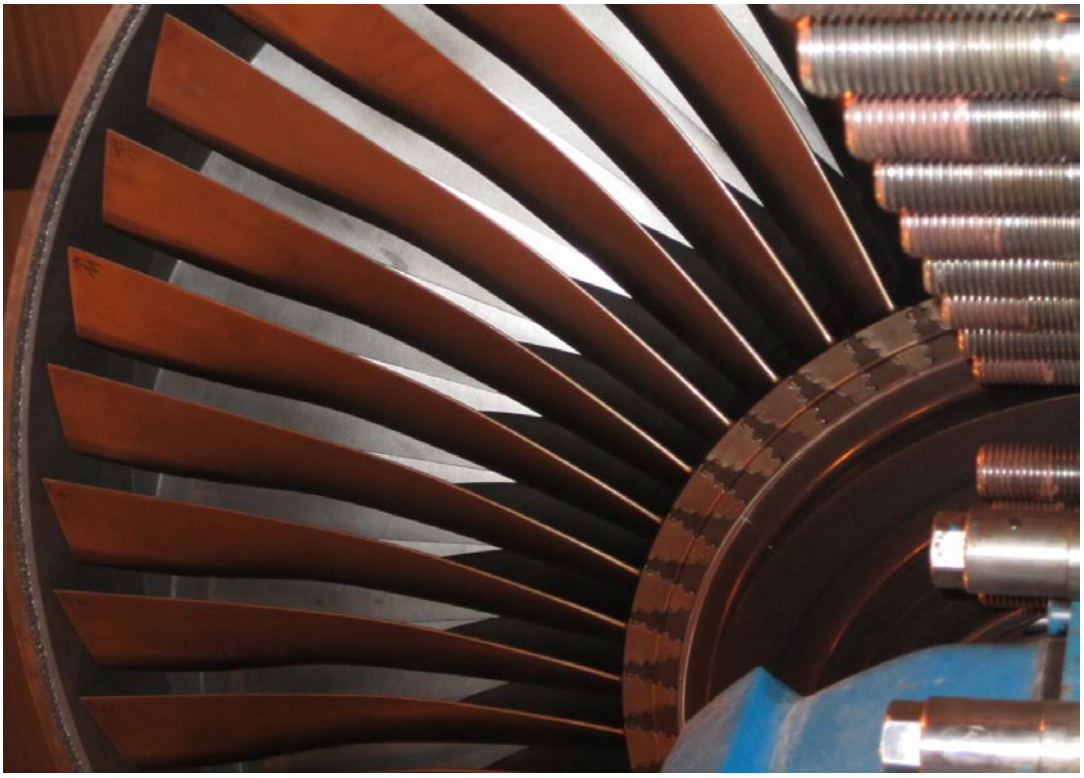
Insurance Coverage for Contracted Power Generation Agreements



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1.1 Foreword

Most domestic electricity markets have historically operated as state owned or regionally empowered monopolies combining the activities of power generation, transmission and distribution of electricity within one company. In more recent times, markets have liberalised trading structures such that these distinct functions are separated thus introducing an element of competition and enabling independent power producers to build power stations to produce electricity for profit as separate legal entities. The process was accelerated due to a number of contributing factors: increasing demand for electricity supply due to global population growth and industrial expansion; technological advancement giving competition between leading original equipment manufacturers to build larger, more efficient units whilst curbing emission release particularly within the gas / combustion turbine sector; availability and the cost of gas supply.

1.2 Basic Principles:

A Power Purchase Agreement (PPA) is a legal contract between an electricity generator (the seller[1]) and a power purchaser (the buyer[2]). Such agreements play a key role in the financing of independently owned (i.e. not owned by a utility) electricity generating assets. The seller under the terms of the PPA is typically an independent power producer (IPP) whereas Energy sales by regulated utilities are determined by local or state government such that a formal PPA is not applicable or required. The PPA is regarded as the most relevant document in the development of independent electricity assets and establishes the foundation and approach to be taken initially for project financing. The standard PPA model dictates that the electricity generator would secure the funding for the project, maintain and monitor the energy production and sell the electricity to the purchaser (often referred to as the 'host' utility) at a contractual price(s) for the term of the contract.

There are various forms of power purchase agreement and the structure and content are generally dictated according to the source of energy harnessed for example, combustion turbine, steam cycle, wind and/or solar. Many of the features of a PPA are common to other general contracts. The PPA is considered contractually binding on the date that it is signed, also known as the effective date. Once the project has been built, the effective date ensures that the purchaser will buy the electricity that will be generated and that the supplier will not sell its output to anyone else, except the purchaser unless contractually exempt. Before the seller can trade electricity to the buyer the project must be fully tested and commissioned to ensure that contractual quantity, quality and reliability benchmarks are met. The commercial operation date (CoD)[3] is defined as the date after which all testing and commissioning is completed and represents the date upon which the generator can start producing electricity for sale (i.e. when the project is 'substantially complete). The commercial operation date also specifies the period of operation, including the end date that is contractually agreed upon.

[1] In the paper the seller is variously referred to as the seller / generator / operator / insured depending upon context
[2] In the paper the buyer is variously referred to as the purchaser / off-taker / buyer / customer depending upon context
[3] Sometimes also referred to as Provisional Acceptance Certificate (PAC).

Normally termination of a PPA ends upon the expiry of the specified commercial operation period or as agreed under the terms of the contract. The most important references within the contract are the price of the electricity or the availability of capacity, the term of the contract (that can typically vary between five and twenty five years) and the delegation of responsibility for fuel costs and the procurement of supporting services, which is the major driver of fluctuations in expense amounts in the generation of power. Electricity rates are agreed upon as the basis for the PPA with prices being fixed, escalate over time or re-negotiated at regular intervals. A PPA will often specify how much electricity the generator is expected to produce each year. Normally payments are linked to availability targets with bonus payments established if the planned capacity is exceeded or contractual penalties levied if the intended availability is not met. (Note: as such, Operators do provide every encouragement to nominated Original Equipment Manufacturers to meet maintenance and inspection obligations within prescribed planned outage periods).

The governing terms of the PPA will usually provide an outline of responsibilities, liability and penalties should the established rates not be achieved or met. A PPA may be terminated if abnormal circumstances arise with the seller able to curtail energy supply where natural disasters and uncontrolled events occur i.e. 'force majeure[4]'. When the supply of electricity is suspended it is usually due to the fact that one of the contractual parties was at fault which can result in damages accruing to the benefit of the other party. From an operational standpoint, all sales of electricity are metered to provide both the buyer and the seller with the most accurate and reliable information about the amount of electricity generated and purchased.

In contrast to PPA arrangements, 'Merchant' operators are traditionally remunerated on the basis of actual Energy delivered, not on their availability to supply contracted power. Such providers do not operate under the terms of a formal PPA but offer the power generated at 'spot market' prices. Spot market prices are often determined by bidding arrangements organised to ensure the lowest cost of supply to a (regulated) utility, industry or other consumer. Merchant stations are also involved in forward trades akin to other commodity trading. In such cases, via a third party trading desk, the station will contract to supply energy at a fixed price at some future date. The forward trades can be a day, month, quarterly or for even longer periods ahead. The interesting element to this is when an event occurs following damage. The station may have made contractual commitments to provide energy at a future date at a contractually fixed price. Where the station knows that it will not be able to meet those commitments (as a result of a damage incident) they then have to set about trading out of those positions. This can be a precarious exercise as the current value of energy may be more or less than the forward contract rate. Typically a station will take advice from their traders to determine insofar as is possible what the likely future price of energy will be. This will assist the station in deciding to trade out today at a loss or see if

[4] *Force majeure* is a common clause in PPA contracts that essentially frees both parties from liability or obligation when an extraordinary event beyond the control of the parties, occurs. There is no definitive definition but typically an event such as war, strike, riot, crime, or an event described by the legal term "act of God" (such as earthquake, flood, hurricane, volcanic eruption, etc...), prevents one or both parties from fulfilling their obligations under the contract. In practice, most force majeure clauses do not excuse a party's non-performance entirely, but only suspend it for the duration of the force majeure event.

they can hold on for a while to see if the price of electricity improves prior to the committed sale date so as to reduce the impact of having to trade out at a loss.

Insurance policies will very often provide cover for this eventuality as an Extra Expense or an Additional increased Cost of Working. Where for example the Insured will sustain a loss in the price of the future commitment by selling today, the difference can then be picked up by policy wording. Very often the policy wording will have a monetary cap for his element and the cover may also be limited in time, say for a 6 month period following the damage event. Relevant in this context is where a station may decide to 'trade out' of their future position and take a revenue loss in the process due to the difference in the future sale price and the current price actually achieved. Merchant generation is often used to provide excess power supply at peak demand times, the cost of which can prove to be highly volatile. Relevant in this context, is the fact that generators can sometimes provide part of their revenue under PPA's whilst selling the remainder on a merchant basis.

2. History and Evolution

Until recently Power Purchase Agreements (PPA) have been fairly straightforward for energy producers (generators), besides the energy delivered (working price) a fee was paid for the availability of a power plant to provide energy (capacity charge). A typical power operator had units for base load operation running all year long, plants for mid-load (starting several times a month) and peak load plants starting only when required. Usually peak load operation generates high income per kWh but only for short periods of operation whereas base load operation generates low income per kWh during long operating periods.

Since the end of last century the set-up of many markets changed dramatically. Markets have been liberalised and deregulated. Electricity stock exchanges have been created. Several countries invented a market for emission certificates. Renewable Energies, especially wind energy and solar energy have been promoted and meanwhile significant capacities have been installed. Due to their natural fluctuations in availability these energies call for highly flexible replacement power thus changing drastically the operational mode of existing conventional power plants.

Buyers of electricity are changing their behaviour looking for more renewable energy supplies but on the other hand electricity consumption is still growing. Climate change also has an impact on the electricity prices as e.g. during dry seasons with lack of rain electricity generation from hydro power has to be replaced by conventional energies like coal or gas.

Summarizing above it has to be stated that many electricity markets today are in a state of considerable change and suffer new challenges. Energy producers are setting up new strategies for investments, modification of operational modes and are optimizing their income in sometimes unstable political surroundings. Unit sizes of new conventional power plants are often increasing and wind energy going offshore. Existing conventional power plants are now required to operate with much more flexibility and thus are deviating from original design features. The financial targets of power operators are modified and innovative power purchase agreements have to be expected.

For the underwriter future power purchase agreements will be more complex and provide claims and loss adjusting with complicated adjustment and settlement especially with the involvement of electricity and carbon emissions trading.

3. Financial Components, Risk and Characteristics

The assumption is made that we are considering very basic power purchase agreements between two parties rather than the complex commodity trades found in some markets. In addition, we are not considering the type of generation or those contracted parties as established by government agencies to support renewable and alternative energy sources.

As can be gleaned, the risks emanating from a PPA can be multi-fold. It can be physical risk related to the equipment or financial risks related to the production of power or still further to trading of power such as the availability of grid or end customers. It can also concern various parties to the agreement such as the project developer, the power purchaser, financiers, contractors, equipment suppliers and so on.

The policy coverages need to be designed keeping in view the different requirements of the aforementioned parties. For instance, while the developer would be primarily interested in insuring the equipment against unforeseen physical loss or damage, the financier would be concerned with the loan re-payment being secured and so might be more concerned on the financial part of the coverage being properly structured.

Modern electricity generators have a high initial capital cost and operating lives typically are in excess of 20 years. Due to this initial capital cost generators depend on capital markets for funding costs and investors who require generators have long term contracts in place which will compensate the generator with revenue to pay for variable, fixed costs and profit in exchange for the provision of electrical capacity and generation. Investors will also require insurance, including Delay in Start-Up/Business Interruption, be in place to protect the business gross profits in the event of loss.

The table below summarises a specimen profit and loss statement for a power generation facility operating under a power purchase agreement.

Type	**Description**	**February 2012**
		USD
Availability	Power Availability	99.38%
Income	Power Capacity	26,842
	Power Output	4,119
	Back Up Fuel Income/(Loss)	2,488
	Other Income	895
	Total Income	**34,344**
Fixed Cost	O&M Fees	590
	Labour Costs	1,900
	Maintenance	219
	Plant Insurance	420
	Administrative	300
	Safety/Training	73

	Total Fixed Costs	**3,502**
Variable Cost	Fuel	3,328
	Chemicals	885
	Back Up Fuel Expense	1,289
	Total Variable Costs	**5,502**
	Total Costs	**9,004**
Other Cost	Financing Cost	8,100
	Depreciation	4,482
	Spares Obsolescence	23
	Total Other Costs	**12,605**
Profit for Period		**12,735**

Fixed costs are period costs that do not vary directly with levels of operating activity and will include costs like staffing costs, depreciation, insurance, major maintenance expenditure, management agreements and debt interest payments. Profits will normally be earned to provide a return on capital to shareholders and principal for debt service payments.

Variable costs are costs that vary directly with levels of production activity, and typically include fuel, lubricants, chemicals, operating supplies, and some maintenance activities.

As power plants are many times constructed to cater for eventual generation to meet anticipated growth or retirement of existing plant, risks exist with the stability of electricity supply, and regional, state, or industrial users of electricity and generators will enter into power purchase agreements that cater to the nuances of the particular market in which the plant is located.

Many power purchase agreements are two-part agreements which compensate operators for two main activities, capacity and generation. This type of agreement is used in areas where power demand varies and operators therefore seek agreements which provides compensation for capacity whether it is called upon or not, and generation when required. The customer wants capacity that can be turned on and off when needed, but the generator requires a financial guarantee that the customer compensates the generator for its costs when the assets are not required. These types of agreements are used because with unpredictable demand and high capital costs of construction generators require the certainty of a fixed payment to compensate them for fixed costs despite the fact the facility may not be fully utilised. This is in contrast to a merchant plant / operator which earns no revenue when the facility is not dispatched. These agreements tend to include provisions for generators to earn a capacity fee equal to the facility's monthly fixed cost which will typically include a debt service component and a fixed operational and maintenance cost component. The second part provides a payment for generation called upon, which will typically include a fuel component, a variable operational and maintenance component. When aggregated, the

payments should provide compensation for fuel consumed, variable generation costs, maintenance expense, debt servicing, return on capital invested and profit.

Single part agreements providing a single payment for generation provided are used in areas with steady and predictable demand, or areas where the plant is expected to operate at base load. In these areas, power purchase agreements provide for an average payment for electricity delivered, the average cost representing the cost of fuel, variable operating costs and fixed costs.

As a general and simplistic rule, most agreements tend to be two parts which compensate the generator with a capacity and energy payment. As such, the commentary made in the remainder of this section relates to contracts structured in this manner and are the form of agreements that are most commonly in use.

The greatest risk to generators is a loss of capacity revenue as capacity payments are paid to generators to cover the generator's fixed costs, which given the capital investment required for construction are significant. Capacity payments compensate generators for their investment in generating assets which represents fixed costs such as interest payments, depreciation, insurance and most major maintenance expenditure.

Capacity payments are earned for being available to generate, with payments usually being received on a monthly basis. If plants are affected by breakdowns or loss, provisions of the power purchase agreement engage which constrain the payment. The means of adjustment vary according to the power purchase agreement but formulae usually operate on the basis of delivered capacity with payments being adjusted based on the reduction in availability from a pre-determined level of contracted availability. The contracted capacity is usually established at the time of handover, following a capacity test. The power purchase agreement will set out in detail the means by which capacity is tested, how the operator is compensated for capacity and the means by which the operator is penalised for its failure to deliver (or have available) the contracted capacity. The provisions of penalising an operator for a failure to deliver vary widely with some agreements providing for an immediate financial impact with others providing for financial impact when the level of availability for a particular period (i.e. month, season, and year) fails to reach a standard level, typically known as targeted availability. There are also agreements that provide for availability to be paid on the basis of rolling availability over a number of months and even years. It is important to carefully study the power purchase agreements in assessing the risk of pecuniary loss in the event of an interruption, in order to properly assess the risk exposure and the potential duration of the loss given the indemnity period involved.

In summary, the revenues earned by a generator for capacity are significant and critical to the financial viability of the operation. In the event of an insured incident such as machinery breakdown, the generator will likely lose its ability to cover its most significant on-going operating costs, these being the financial costs for interest payments and principal payments (debt servicing / fixed costs). There is also little scope to mitigate these costs through expense savings as the costs are by their nature fixed, and thus not avoidable.

On the other hand, energy revenue, whilst significant in value terms, usually results in very little gross profit once fuel costs are taken into account. Generators are typically dispatched[5] according to the customer's requirements with the generator earning revenue for each unit of electricity delivered. In relation to fuel expenditure, generators tend to be risk averse with respect to fuel energy markets and agreements are typically structured so fuel is either provided free of charge in exchange for a fee, or is paid for on the basis of pre-determined plant efficiencies, which are adjusted to consider current market prices.

As an additional feature, agreements usually establish plant efficiencies and heat rates for the consumption of fuel, which then is used to provide an incentive for the generator to produce efficiently. Generators are then penalised, or earn bonuses in the event plant efficiencies vary from contracted levels. These provisions provide risks to generators in the event of outages as certain machinery breakdowns lead to production inefficiencies that the generators have to bear.

Lastly, a component of the energy payment provides compensation to the generator for its non-fuel variable costs. These tend to be pass through costs (the generator earns no profit), and thus rarely present any financial risks.

In summary and in respect of energy payments, the income earned from a generator for generation is more than likely consumed with the variable cost of production and thus very little gross profit results from these activities. Profits may be earned from generation in certain agreements but we find these types of agreements to be the minority.

A careful reading of the payment provisions of the power purchase agreement should provide the underwriter with a reasonable basis to assess the financial risks of a generator in relation to a major loss or machinery breakdown. We do not consider that a financial review of the operations past historical results on their own will provide the underwriter with a sufficient basis to assess the risk accurately. As the provisions for payment and provisions for penalty vary from risk to risk only a review of the mechanism for non-delivery of capacity or energy will provide the required context to assess the risk appropriately.

Needless to say we have focused on the principal elements of a PPA and draw attention to the myriad of special provisions and statutory requirements which impose other risks on the generator.

[5] Dispatch is determined by the grid operator at owner's discretion.

4. Risk Assessment

Again, in considering Risk Assessment, we are considering a systematic approach to those related activities of a power purchase agreement between the owner(s) of the plant and a counter party (the purchaser of energy) within the context of a typical property insurance contract, be it construction or operation. We are not considering complex commodity trades that require significant financial risk management using sophisticated tools and hedges nor taking into account what could go wrong and the suitable measures to prevent loss or damage. These should be more clearly identified in a risk management program to include the controls required to eliminate, reduce or minimise the risks identified, for the moment we consider the basics of assessment.

From an insurer's perspective risk assessment should focus on the plant's ability to sell its electric output at design operating conditions for the duration of the policy period assuming in the first instance that the PPA takes into account the various technical limits of the plant consistent with design operating conditions[6]. These can include the minimum take, specified cycling band, limited number of cold/warm/hot starts, ramp rate, frequency and duration of shutdowns, scheduled maintenance, forced outage rate and the maximum number of hours of operation.

Plant risk assessment should commence with policy coverage be it construction or operation followed by analysis and assessment of the inherent risk(s) with the type and magnitude including probability and mitigation.

4.1 Risks that may impact the PPA during Construction and Operation

4.1.1 Erection

Typical risks during the construction period that may impact the integrity of the PPA may be considered as:

- Increases in construction costs
- Increases in financing costs
- Delay in completion of the power plant
- Delay in completion of associated facilities
- Failure of plant to meet performance specifications at completion tests
- Heat rates
- Government actions

[6] Design operating conditions specific for a power plant include ambient temperature, atmospheric pressure and power output frequency at which the plant will operate including installed capacity to be maintained in that ambient temperature, pressure and frequency. In the operating mode it may also specify installed base load capacity and installed peaking capacity.

In essence these will lead to a delay in the start-date and / or compliance with contractual obligations.

4.1.2 Operational

Risks during the operation period that may have an impact on the integrity of the PPA include: -

- Constraints on plant operation
- Increases in operating costs
- Non availability/non convertibility of foreign exchange
- Forced outage/de-rating or temporary shortfall in capacity
- Deterioration in heat rate below the rate(s) specified in the PPA
- Increased fuel costs and variable operation and maintenance costs
- Prolonged outage of the plant due to major damage to equipment
- Failure of purchaser to perform its obligations under the PPA
- Failure of the seller to meet its obligations under the PPA that is caused by the plant operator
- Environmental incidents caused by the seller/operator
- Control over the seller's rights to assignment of the PPA
- Termination of the PPA in case of an event of default
- Resolution of disputes

In essence these risk events may trigger non-compliance with contractual obligations triggering penalties and under the worst of circumstances, renegotiation of the contract.

4.1.3 Identification of Policy Risk

Needless to say not all of the above risks are a party to or impact policy coverage and in reference to Erection All Risks insurance and Property Damage with consequential Loss of Profit policies there are a number of common risk qualities that may be grouped and profiled as: -

- Geotechnical: ground conditions
- Location and (Catastrophic) Natural Perils
- Technology Infrastructure
  - Type of technology and age
  - Steam cycle / gas /hydro-electric etc. generating plant
  - Environmental constraint
- Configuration
  - CCGT, Open Cycle
  - Output constraint

- Fire Protection
- Management
  - PPA Generation Profile
  - Warranties
  - Incident Mitigation
- Operations and Maintenance
  - Operational Flexibility and Spare Capacity
  - Technical service contracts and OEM support
- Process Contracts
  - Suppliers
    - Fuels,
    - Electricity supply contracts (*plant start-up*)
    - Miscellaneous materials such as Limestone, Catalysts, etc…
  - Customers

4.2 Determining the value of risk

Needless to say although these risks exist they need to be qualified in respect of value and their influence on the PPA and policy coverage and in the first instance it is worthy of consideration how a power plant will look at risk. Most will categorise as: -

- Safety
  - General or Process
- Compliance
  - Legal and Environmental
- Plant Reliability
  - Availability, start, breakdown etc...
- Repair Cost
  - Technical Support, Prototypical, obsolescence,
- Market and Commercial
  - Value per MWh, market influence.
  - Suppliers
  - Customers

Methods for assessment of risk may differ between power plant owners and operators but all '*world class*' power plants will use risk assessment of some form to determine the quantitative and qualitative value of risk related to a situation and / or recognized and identified hazard whilst q*uantitative analysis* affords a value to risk by calculations of two components of risk, that is the magnitude of the potential loss and the probability that the loss will occur. This value allows the plant to make valued judgement on the management of risk be it in the simplest form the basis for maintenance and investment notwithstanding that the actual condition of the item, system or process should also be taken into consideration. Frequently complex risk management spread sheets are derived and these tailored into plant status and strategy of which one component is the insurance policy.

5. Policy Implications and Alignment

5.1 Introduction

The terms of the insurance policy should be drafted to reflect the principal relevant features included within the Power Purchase Agreement. The principle of indemnity is more usually based on a fixed contract for an Operator's generated power or availability. An understanding and appreciation of the salient points of the PPA becomes essential including:

- The revenue profile,
- Identification of any availability or capacity payment or
- Bonus proportion of the revenue
- Other services offered such as black start, fast ramp rates or frequency control.

The following table provides an outline of the linkages between the phases of project and parties involved and the various forms of coverage associated with power generation plants during their life cycle including the DSU and BI components as dictated by the PPA.

Phase	Policy Form	Nature of Coverage	Insured Parties
Planning, Construction, Operations	Political Risks Insurance	Non-natural force majeure events such as Confiscation, Expropriation, Nationalisation, Deprivation, Selective Dis-crimination, Forced Divestiture, Forced Abandonment, Political Violence and War Risks	Project Developer, Financiers.
Construction	Erection All Risks	Loss, damage or destruction of property due to: - Natural Force majeure events such as Fire, Lightning, Explosion, Acts of God - Non-Force Majeure events such as breakdown of plant, collapse, erection faults and the like.	Project Developer, Contractors, Sub-Contractors, Suppliers, Financiers and other parties involved in project execution such as architects, consultants, engineers.
Construction	Advance Loss of Profits /Delay in Start-Up	Delay in commencement of supply of power resulting in loss of anticipated profit: - Natural Force majeure events such as Fire, Lightning, Explosion, Acts of God - Non-Force Majeure events such as breakdown of plant, collapse, erection faults and the like	Project Developer, Financiers (as loss payee).

Phase	Policy Form	Nature of Coverage	Insured Parties
Construction	Advance Loss of Profits – Contingent Delays /Contingent Business Interruption	Delay in commencement of supply of power due to: - Inability of a supplier to supply equipment on time - Inability of a supplier to supply fuel and the like - Inability of customer to take power on time arising from operation of: - Natural Force majeure events such as Fire, Lightning, Explosion, Acts of God - Non-Force Majeure events such as breakdown of plant, collapse, erection faults and the like	Project Developer, Financiers (as loss payee).
Operation	Property Damage Insurance Policy	Loss, damage or destruction of property due to: - Natural Force majeure events such as Fire, Lightning, Explosion, Acts of God - Non-Force Majeure events such as breakdown of plant	Owner / Project Developer, Financiers (as loss payee).
Operation	Business Interruption Policy	Loss of gross profit sustained due to Non-generation or reduced generation of power arising from: - Natural Force majeure events such as Fire, Lightning, Explosion, Acts of God - Non-Force Majeure events such as breakdown of plant	Owner / Project Developer, Financiers (as loss payee).
Operation	Contingent Business Interruption	Failure to evacuate / take power due to : - Natural Force majeure events such as Fire, Lightning, Explosion, Acts of God - Non-Force Majeure events such as breakdown of plant Happening at the premises of : - Supplier of fuel and/or other inputs - Customer/Utility Company's off-taking the power produced.	Owner / Project Developer, Financiers (as loss payee).

5.2 Policy Cover

5.2.1 Gross profit

A forced halt of production resulting from or caused by an insured event may entail severe financial consequences. For this reason, the need to take out a policy that covers for the loss of revenues (Loss of Profits/ Business Interruption/ Consequential Loss insurance) is very high.

In general, Loss of Profits insurance provides indemnity to the Insured for the reduction in Gross Profit incurred as a result of the interruption or interference with the Business. Gross Profit is defined as:

> *"Turnover (income received by the insured) less variable costs (e.g. the cost of raw materials, fuels, etc.) which are not normally incurred during an interruption or interference to the Insured operations"*

Or:

> *"Net profit plus fixed costs, including fuel 'take or pay' penalties and/or debt service provisions"*

Net profit equals the turnover generated less fixed and variable costs. To the extent that fixed operating costs will be added to this figure, in practice, both methods will lead to the same result.

The reduction in Gross Profit is usually calculated by applying a 'Rate of Gross Profit' to the reduction in turnover during the Indemnity Period. The reduction in Turnover is usually measured by comparing the actual turnover against the Standard Turnover, i.e. that amount that was earned over the same period during the preceding twelve months. However, insurance policies frequently contain a special clause, as indicated below:

> *"To determine a business operation's gross profit, business trends prior to and after the occurrence of the event shall be taken into account. The figure determined for gross profits shall reflect as closely as practicable the results that would have been realised during the relevant period of time after the occurrence of the damage, had the damage not occurred."*

The principle of such a clause is very clear: The Insured shall not sustain a loss of profits caused by or resulting from the occurrence of an insured event. On the other hand, indemnification paid for consequential loss must not result in an undue enrichment of the Insured. The need to recognise any intended staging of payments that could lead to disproportionate (as opposed to pro rata, 'straight line') recovery through the period of indemnity needs to be ascertained. Such scenarios could develop on the basis of operating regime for example, performance in intended peaking duty, two shifting or identified as standby facilities. In addition, other influences may mean that the sum insured is not applied in a linear fashion over time which may be the case in relation to certain renewable energy

sectors (hydro-electric, wind and solar power) or because of demand prompted by seasonal variations (climate demands for increased domestic or industrial air conditioning).

In addition, it becomes important to be mindful of the prospect of incurring costs on a basis that proves to be different to that upon which the liability accrues i.e. Long Term Service Agreement (LTSA) costs are established monthly but are billed only once per year. Depending on the policy form utilised, insurers may erroneously be expected to indemnify the Operator for costs incurred during the month in which the insured is invoiced rather than for the actual liability incurred during the period of the interruption. Any liquidated damage or other contractual penalties that accrue against 'rolling availability' exposures that may take the impact of a loss beyond the declared revenue period should be considered, particularly in the wording of the maximum indemnity period and in the application of a self-insured retention or deductible.

Cover may also exclude costs associated with replacement power (unless specific cover is assumed) and contractual obligations and bonus payments not declared and identified at the inception of the insurance cover. Any future scheduled outage period that may mitigate an insurance loss beyond the declared revenue period is to inure for the benefit of insurers. From a practical perspective, forced and/or unforced outage levels at an individual plant and unit level will be taken into consideration within the loss adjustment processes.

Some rolling availability contracts will provide for revenue accruing during the indemnity period but the receipts will not actually be paid by the customer until after the indemnity period has expired. For example, the revenue lost in the first month of an insured outage will accrue in that month but the invoice for it will not be issued and paid until much later. In such cases, Insurers would normally accept that the accrued revenue will be taken into account in the Business Interruption measure even though the invoice for the period will not be rendered and therefore paid until possibly after the Maximum Indemnity Period has expired. It becomes essential to ensure that such scenarios are reflected in the policy wording.

In practical circumstances, the matter of the Insured attempting to achieve a saving for example by bringing forward a future scheduled outage needs to be considered. If the scheduled outage is planned for a future date beyond, for example, the Maximum Indemnity Period and is brought into the interruption period, it is perhaps arguable that Insurers could encourage a reduction in overall potential claim amount relative to the uninsured period. Any additional costs incurred by the Insured through the undertaking of such actions may however, accrue for the Insurer's liability.

Practical illustrations of fluctuating risk exposure can be identified by the inherent risks associated with deregulation within the power sector which was typified by the Californian power market during the 1990's when it became the first US state to de-regulate its wholesale energy market. Regulated utilities were required to buy their electricity from newly developed independent power producers and were precluded from entering into long term contracts that would allow them to hedge their energy purchases and mitigate day to day swings propagated by demand spikes and routine supply interruptions.

Drought conditions impacted the supply of hydro-electric power reducing California's energy reserves such that independent power producers were able to manipulate demand factors and charge excessive electricity supply rates. Independent power producers were therefore selling generated power at peak demand times, the cost of which proved to be highly volatile and unpredictable. From an insurance perspective, in the event of an insured incident leading to a business interruption claim, basis of loss settlement conditions could lead to indemnity being granted well in excess of the sums insured that had originally been declared.

As such, prior to the beginning of each new insurance period, Insurers and Insured are always confronted with the challenge to establish an appropriate equation between the anticipated revenue profile, the sum insured and the intended basis of loss settlement. In an attempt to control such potential volatility, Insurers have moved to ensure that the insurance policy contains reference to a maximum amount per megawatt on a per diem (or on a regular interval basis) that can be claimed in the event of a loss. The issue presented in adopting such an approach is that the Insured is not fully indemnified for an increased risk exposure in the event that actual revenue exceeds the limit established through the imposition of such caps.

Insurers have traditionally addressed this situation by agreeing to a "preliminary sum insured", which attempts to anticipate the future development of business. From here, it is recommended that the policy demands that the Insured revisit and declare their sum insured on a regular basis (suggested no more than monthly) such that the Insured's expectations relative to indemnity can be realised. On the other hand, Insurers can continue to monitor risk exposure levels and particularly marked changes in the level of estimated maximum loss, relationship with the granting of underwriting capacity and line structure. The policy would contain a provision permitting the adjustment of premium on actual sums insured at expiry of the policy period.

Extreme care needs to be taken in all such instances. In certain situations (and particularly relative to Construction project risk including Delay in Start Up), there may be a requirement to meet 100% of the Energy Target Power Output on a specific date (the Scheduled Commencement Date) to satisfy the terms of the Construction Agreement. In such situations, even in the event of a partial interruption, the claim presented may significantly exceed and bear no relation to the actual loss of Power (MW) output.

5.2.2 Fixed and Variable costs

Gross profit consists of a business operation's net revenues and its fixed costs ("standing charges" such as leasing charges, wages/salaries etc.) i.e. all costs that will incur regardless of whether power is being generated or not. Such costs could include debt service provisions or indeed penalties that become payable under the terms of formal 'take or pay' provisions. Costs associated with fuel supply may be referenced as a 'fixed' cost under a 'take or pay' agreement. Such separate sums would need to be highlighted within the original sums insured within the business interruption section with appropriate note being taken of any

provisions within the PPA or Fuel Supply Agreement for 'Force Majeure' or other contractual relief.

It is common for operators to have a contractual 'take or pay' arrangement with their gas supplier. Often, a Machinery Breakdown event is not normally regarded as a Force Majeure event and therefore the Insured is required to continue paying for fuel gas even though they are off line due to a forced outage. The insurance policy would usually provide for such a contractual commitment. In certain instances, the gas supply contract may allow a 'carry forward' credit for gas purchased in excess of the contractual minimum such that the excess gas purchase credit can be moved from one contract year to the next.

At the time of a loss therefore, the Insured can effectively be in a more positive financial situation with their gas supplier such that Insurers could reap benefit to offset against the minimum 'take' provision. The practical implication here is that in the absence of any reference to this situation within the policy wording, the Insured could refute this suggestion on the basis that should they experience for example, an uninsured outage later in the contract year, they will have lost their gas supply in-credit status (by Insurers having used it to mitigate the insured loss) and have to meet the minimum 'take' requirement at their own expense.

Often to overcome these situations, the arrangements that are considered above normally have a 'reconciliation' period such that the final adjustment to the Business Interruption claim would accommodate any other planned or unplanned outages not indemnified by the insurers. From an insurance pricing perspective, the benefit of credits available can be considered in the rating of the Business Interruption risk. This can change from year to year as reconciliation periods are concluded and a new period (within which no credit had been accrued) begins.

Variable costs are subtracted in the calculation when arriving at Gross Profit, since such costs incur only when electricity is effectively being generated and thus could be saved during the time of business interruption. Where fuel cost is expressed as a straight pass through to the off-taker, such expense will effectively represent a 'variable' cost and therefore not be indemnified under the terms of the insurance policy. It may be possible, circumstances permitting, to save fixed costs during the period of business interruption as well (e.g. selling of gas capacities). These cost savings must be taken into account when calculating the claims amount; failing that, the Insured may unduly benefit from the occurrence of the insured event (rule against unjustified enrichment).

5.2.3 Increased Cost of Working

The costs of loss minimization constitute a key aspect of any Loss of Profit Insurance after the insured event has occurred. In this respect, various measures can be introduced (e.g. speeding up repair work/replacement) with the attempt to reduce the extent of loss incurred from the interruption of business (the amount of loss, period of time). The base cover is therefore intended to indemnify the Insured in respect of additional expenditure necessarily and reasonably incurred for the sole purpose of diminishing the reduction in Gross Profit (including for example Availability, Fuel and/or Rental Income Payments), which without

such expenditure would have taken place. It is a requirement of the policy that the indemnity afforded in respect of Increased Cost of Working does not exceed the loss resulting from the reduction in Gross Profit thereby avoided - often referred to as the 'Economic Test'.

From a power generation perspective, Increased Cost of Working could relate to the prospect of providing alternative generating capacity to satisfy contractual supply obligations under the terms of a power purchase agreement if this is considered cost effective and indeed available. In these situations however, the financial implications may mean that the use of alternative generating facilities may only be realised at higher cost. A further example could involve the prospect of accessing and obtaining alternative power generating units following an insured incident (often under the terms of a formal 'lease' agreement with the Original Equipment Manufacturer) in order to mitigate the impact of loss of Gross Profit.

The practical difficulty that can arise with Increased Cost of Working expenditure is when it is incurred within the stipulated policy time deductible. The approach taken can vary significantly, for example:

a) Any Increased Cost of Working incurred within the time deductible period is excluded despite potential benefits to Insurers after the time deductible has expired. The argument here is that there is no Business Interruption cover during the time deductible period and the Insured are duty-bound to mitigate their loss in any event

or,

b) The benefit derived by the Insured in reducing the impact of their deductible is compared with that achieved by Insurers and then the expenses associated with Increased Cost of Working pro-rated accordingly. For example, if an Insured achieves 'return to service' within 30 days of a 60 day time deductible then they have derived a 50% reduction in their uninsured loss. The expenses incurred for Increased Cost of Working are therefore shared on a 50/50 basis

or,

c) If the Increased Cost of Working expenditure did not produce any benefit to the Insured as they did not achieve 'return to service' within the time deductible, an agreement may be reached to meet the entire cost of Increased Cost of Working as a benefit to Insurers only.

Irrespective of the approach that should be taken, it becomes essential to ensure that intention is clearly expressed within the policy form.

It becomes important to draw a distinction between the provision of Expediting Expenses under the Property Damage section and Increased Cost of Working under the Business Interruption section. The typical Expediting Expense cover is for overtime working, night time working, weekend working and express transport/freight. Some Property Damage policies will exclude air freight (or limit it). Therefore, if a repair is accelerated by the Insured obtaining their repairing contractor to work 24 hours a day (within the Time Deductible) a debate may ensue as to whether the claim submitted is for Expediting Expense or Increased

Cost of Working. A clearer distinction of an Increased Cost of Working scenario would be where a repairing contractor is able to obtain a replacement unit by offering an incentive through a premium payment made to another customer for their unit which is ahead of the production queue.

In all practical circumstances, reference to Increased Cost of Working whether sub-limited or otherwise will not serve to increase Gross Profit beyond the sums insured provided for within the policy and as such should be excluded from relevant loss estimate calculations as a result.

5.2.4 Extra Expense

Extra expense (or Additional Increased Cost of Working as referred to in certain insurance markets) represents a typical extension to the Business Interruption policy supporting the insurance of power generation assets. Indemnity is provided for the additional expense incurred during the Indemnity Period in consequence of the Damage for the purposes of maintaining or resuming business operations. Where this additional cover is provided, the Extra Expense extension should relate to a specific and identifiable risk exposure that considers the profile of individual operators, their contractual obligations and their operating regimes. Within the power generation sector, Extra Expense could be defined as or involve the contractual delivery or acceptance of steam and/or gas to/from a neighbouring facility. However, it becomes usual to exclude costs associated with replacement power or at the very least offer limited and well defined coverage with a view to minimising insurers exposure to pricing volatility within the respective power market.

As this coverage feature is an ‘extension’ to policy provisions beyond the standard Business Interruption cover (unlike that provided for under Increased Cost of Working), the indemnity provided is not subject to the ‘Economic Test’. A policy sub-limit should be included in respect of the maximum indemnity to be provided under this section and this may be further sub-limited to a maximum collectable indemnity according to the predicted loss of megawatt hour usually applied on an average daily basis. Given the nature of the cover as defined, any limit provided would be in addition to the sum insured in respect of Gross Profit and therefore, should be included in the development of any relevant loss estimate calculations. It is also usual for an additional technical policy rate to be developed beyond that charged for the base Business Interruption cover dependent on the risk exposure involved and the sub-limit granted.

If the results of a risk profile analysis establish that a given customer will not sustain any reduction in revenue resulting from a shutdown (of his own facilities), the customer is recommended to take out an Extra Expense insurance rather than a Loss of Profits policy to cover his potential exposure. The Extra Expense insurance covers all the customer’s extra expenses spent on such technical or contractual arrangements which will take effect after the occurrence of an insured event.

For Regulated Utilities with a mandate to supply energy – e.g. to private households within a certain town/city/region – it would suffice to buy an extra expense insurance since such power utilities usually enter into electricity supply contracts with other power supply utilities

(or they have their own alternative means of generation on standby) to ensure (alternative) power supply to customers, should an event of damage or loss occur. The prices charged for such third-party electricity supply (or to generate using alternative means) will typically exceed the customer's costs of in-plant power generation. The resultant difference may be used as a basis for 'extra expense' insurance.

5.2.5 Cost of Replacement Power

The standard policy provisions can be more specifically extended beyond increased cost of working and extra expense provisions to include an indemnity for the cost of replacement power either as a result of obligations under the terms of the PPA or through selling power under contract on the trading markets. There becomes a need to precisely define the loss scenario and exposure that is intended to be covered. The accumulated total of the forward pricing curve multiplied by the available capacity shall represent the sum insured against which the technical policy rate shall be developed. It should be noted that where cover is so provided, this should be limited to the incremental cost and a definable additional expense for delivering power over and above the cost incurred for the Insured's own generation.

The policy should be subject to the declaration of anticipated daily indemnity figures in accordance with the forward pricing curves for the grid / power market to which the operator is exposed. In addition, it is recommended that a monetary cap be established within the terms of the policy limiting the basis of indemnity to a (daily/monthly) maximum price per megawatt hour. These figures should be reviewed monthly as suggested to ensure that the sums insured under the policy are adequate to reflect market exposures. Provision can be made for increased liability in excess of the forward pricing curves up to a nominal percentage of the daily indemnity level (say to a maximum of 15%) from the original declared values resulting in the charge of an additional premium upon adjustment on expiry. In this manner, a constant check is maintained on the level of sum insured thus diminishing the impact of volatility relative to premium calculation, estimated maximum loss scenarios and intended basis of loss settlement provisions. The cover should be provided at additional technical rates beyond the standard Business Interruption terms to reflect the increase in exposure and coverage demands.

In one instance, a power generator with a 'transmission and distribution' policy extension did submit a claim which included a substantial amount set aside for the cost of hiring several hundred generators whilst the overhead supply lines were reinstated following damage. This contingency plan enabled them to continue (to some extent) supplying energy to their customers. The policy terms did exclude replacement power and the Insurers accepted that the hire of generators was not intended to fall within the relevant exclusion. In this instance, the hire of the generators was as a result of the obligation on the part of the Insured to supply power and not to mitigate a reduction in revenue. Hence, this claim could be construed as an Additional Extra Expense/Additional Increased Cost of Working example given that it would not be subject to the economic test (and if it were it would likely fail the test). Clearly there becomes a need to continue to check the granting of policy terms, conditions and exclusions within the policy to ensure that they reflect both the insured's and insurers intent.

5.2.6 Contingent Business Interruption – Customers Extension

A Business Interruption policy can be and often is extended to provide indemnity to the insured for their reduction in gross profit arising as a result of interference to the Insured's business following physical damage to a Customer's property. In assessing the exposure presented by the Customers Extension the underwriter should be aware of and consider the individual customers with whom the Insured has a relationship noting the dependency to specific customers, the complexity and interdependencies of the customer's own businesses and the degree to which the Insurers can measure the adequacy or otherwise of the Customer's own risk management practices. The Insurer should also consider the historic frequency of interruptions (for which indemnity was received or otherwise), together with the severity of such interruptions and any risk mitigation features that may have been introduced. Such an assessment will ultimately determine an insurer's appetite towards the coverage provided under this section and the limitations that may need to be applied in determining the premium to be charged.

It is common also for a Contingent Business Interruption extension to be further limited in terms of scope of application, the perils to which it would respond and the ultimate level of indemnity provided. For example, reference is often made to the fact that the extension is offered in respect of "First Tier Customers" only. Whilst there may be more than one interpretation as to the definition of "First Tier Customer", it is widely accepted that this would be a customer with a direct contractual relationship with the Insured. Given this, the contingent cover would not extend to "downstream" customers who may have contractual relations with the Insured's customer but not with the Insured itself. This can be an extremely important distinction to make particularly where wide area damage from an event such as an earthquake, snow/ice storm, flood or hurricane can affect multiple (and un-quantified) end users of the electricity generated by the Insured although not directly supplied by him.

Often the Business Interruption policy is extended for Contingent Customers but in respect of the perils of Fire, Lightning, Explosion and Aircraft Impact (FLEXA Perils) only. This would therefore eliminate exposure arising from wide area damage causes (natural perils) such as those noted above. In addition, the policy would not respond to a Machinery Breakdown event at the Customer's premises either. This may be considered important in instances where a Customer has a particularly high dependency upon single equipment items the maintenance and operation of which will (likely) be unknown to the Insurers.

With respect to the maximum indemnity provided under a Customers extension, given the lack of control that the Insured (or its insurers) will have over the repair or reinstatement of damage at the customers' premises it is usual for modest sub-limits to be imposed to restrict an Insurer's ultimate liability. The sub-limits imposed are often different in respect of those customers who are specifically named within the policy and those that are not. In addition, the maximum indemnity period over which the Insured may recover a reduction in gross profit from Insurers will follow the maximum indemnity period specified for the Business Interruption section unless specific alternative provisions are made.

For policy liability to attach, it is intended that the Customer's property is of "like kind" and would not have been specifically excluded by the Insured's policy (under the "Property Excluded" provisions). In addition, the proximate cause of damage to the Customer's property must also be a peril not specifically excluded ("Perils Excluded").

For example, it is common under the terms of a Power Generation policy to exclude coverage to Transmission and Distribution lines (and their supporting structures) greater than a specific distance (metres) from the Insured's premises. Given this, any subsequent reduction in revenue suffered by the Insured in consequence of damage to a Customer's transmission network at a distance greater than the specified distance from the Insured's property would not be indemnified by the Insured's policy. Similarly, if the Insured's policy excludes the peril of Flood, then again, any business interruption suffered by the Insured and stemming from a flood at a customer's premises would not be indemnified under a Contingent Business Interruption extension.

It should be noted that whilst a policy is extended to indemnify the Insured for a BI loss arising as a result of damage at a customer's premises, the policy would not indemnify the Insured simultaneously in respect of its loss of gross profit arising directly, i.e. through damage arising at its own premises, and indirectly, i.e. through damage arising at a customer's premises – it is either one or the other but cannot be both. Finally, it is worth noting that in addition to the Excluded Property and Excluded Perils provisions within the policy, the Contingent Business Interruption extension should be subject to all other terms and conditions within the policy, including the application of a deductible.

In determining a rate for exposure the Insurer should, ideally, reflect a rate for exposure associated with the customers' businesses, considering both the ultimate potential exposure and the coverage restrictions offered. For example, if power is supplied directly to a small number of customers all of whom have a high exposure to windstorm damage (e.g. resort hotels on a Caribbean island), then the prudent insurer may seek to restrict the perils to which the Contingent cover may respond but rate accordingly for the high frequency of exposure and vulnerability of the businesses affected. Alternatively, a generator who supplies power directly to a major transmission system which is provided with a high degree of redundancy and flexibility in switchyard and substation facilities (noting that overhead lines would likely be excluded from coverage) will likely present a low degree of vulnerability and severity to an Insured.

5.2.7 Contingent Business Interruption – Suppliers Extension

A Suppliers Extension to the Business Interruption section of the policy would work in exactly the same way as a Customers extension but providing indemnity to the insured for a reduction in gross profit arising as a result of an interruption to/interference with the Insured's business as a result of physical damage at a Supplier's premises. Again, the same philosophy with respect to the provisions/limitations within the main policy will apply.

The Insured should ascertain the suppliers on whom the Insured's business is dependent, assessing the role the supplier plays and alternatives which may be available. Clearly, the role of suppliers in the continuation of the Insured's business is likely to be much more

diverse than the role of the customer given that the suppliers to whom the policy may ultimately respond can include the suppliers of spare parts, services, fuel and other feedstock.

For example, the Insured could have a contingent exposure to a service provider who has removed parts from the Insured's generating plant for refurbishment. If the service provider suffers a fire at their premises this could delay a return to service of the generating plant thus resulting in an interference with the Insured's business and subsequent claim under the Suppliers extension. Alternatively, a power station may be dependent on its supply of fuel from a nearby refinery (refinery off gas) or steel works (blast furnace gas). Should a fire occur at the Supplier's facility interrupting the supply of fuel, the Insured's business may be adversely affected even if an alternative (but more expensive) supply of fuel (pipeline natural gas or liquid fuels) is available. Again a claim under the Suppliers extension may result.

Again, given the potentially diverse nature of suppliers that could give rise to a claim under this extension underwriters will typically look to limit cover to "First Tier Named Suppliers" possibly in respect of damage arising from FLEXA perils only and with the imposition of modest sub-limits in respect of indemnity (smaller limits may be provided for "un-named" suppliers). The determination of an appropriate rate for the exposure and the coverage provided is extremely difficult in the case of the Suppliers extension (given the diversity) and hence the rates applied are often considered in relation to the overall Business Interruption rate charged for the Insured's primary business. However, in circumstances where a predominant exposure can be identified (e.g. supply of coal from a dedicated mine) then the rate for exposure should, perhaps, be more aligned to the mine operations and the principal exposures identified, e.g. damage to a single bucket excavator or a high flood exposure at the mine.

5.3 Deductible Application

Attention is first drawn to the indiscriminate use of the word deductible. The paper takes the position that deductible is either a time component of the indemnity period or a financial component of the sum insured for the DSU / BI and policy wording needs to clearly reflect the underwriter's intent in the policy declaration and definitions.

The application of the time deductible (usually expressed as a fixed number of days) may take a number of different forms but in all cases it becomes essential to ensure that the level of self-retention commences at the point that the business becomes affected e.g. following the expiry of the construction project insurance policy, the date established as the commercial operations date for DSU/ALOP. These dates are formally written into both the Construction Contract and the terms of the PPA. It becomes essential that such dates are aligned and referenced to the anticipated date of commencement of the business expressed within the insurance policy. For operational policies upon the occurrence of the damage, in its simplest form, the application of the time deductible can be expressed as a fixed number of days from the date of the occurrence of the incident. In this situation, the self-retained daily amount agreed does not consider and is totally independent from potential (seasonal) fluctuations in gross revenue over time.

What becomes essential in determining an appropriate time deductible for the risk is that it covers as intended, a firm designated (initial) period of the 'interruption' and is NOT influenced (or eroded) by the terms of any contract between the Insured and the 'off taker' under the terms of a PPA agreement which then becomes reinforced within the insurance policy.

In one headline example, an Insured suffered the failure of a General Circuit Breaker leading to a Business Interruption loss. Given the terms of the PPA and more specifically, the quarterly rolling availability payment requirement, the financial effects of the incident were felt over a period of three months given the terms of the contract. Unfortunately the policy stated that the Indemnity Period will be defined as 'the period during which the RESULTS of the Business are affected' as opposed to referencing specifically 'during the Period of the Interruption'.

As a result, despite the fact that the policy carried a 45 day each and every loss time deductible and that the 'Period of the Interruption' was only 19 days, insurers were exposed to a much greater unintended loss given the detrimental longer term financial impact on the results of the Business.

Alternative forms of application of the self-retention can involve establishing the deductible period such that it represents a specified number of days applied to the average daily value of the ultimate loss. In such situations, the pecuniary benefit to the insurer can only be realised once the financial impact is finalised following adjustment of the final claim. It should be recognised however, that such an approach can have detrimental consequences when partial production is resumed during the indemnity period such that the true intended daily value of the deductible can be diminished.

Average Daily Value calculations can be severely reduced in the event of temporary repairs being affected. In one example, the Insured were able to effect a temporary repair to their damaged alternator by re-manufacturing the damaged teeth in the core whilst a new alternator was manufactured. The replacement new alternator took more than 12 months to manufacture which meant that the temporary repair was in place for some considerable time.

The repair meant that the alternator would not be able to withstand large fluctuations in its operation and therefore a steady state was recommended. The Insured therefore was not able to provide lagging/leading power operations for the balancing market which meant that they had to eschew their BETTA[7] revenue. The BETTA revenue was not particularly

[7] **BETTA = British Electricity Trading and Transmission Arrangements** where trading arrangements are based on bilateral trading between generators, suppliers, traders and customers across a series of markets operating on a rolling half-hourly basis. Under these arrangements generators self-dispatch their plant rather than being centrally dispatched by the System Operator. There are three stages (24 hour delivery/Gate Closure 1 hour before delivery/half-hour delivery) to the wholesale market, plus a new settlement process. Participation in the bilateral markets (i.e. the Forward/Futures contract market and the Short-term bilateral markets) and the Balancing Mechanism (i.e. offer/bid submission) is optional. Participation in Settlements is mandatory. In addition, certain categories of generator are required to provide Physical Notifications. The Balancing and Settlement Code (BSC) provides the framework within which participants comply with the Balancing Mechanism and Settlement Process. The BSC is administered by a non-profit making entity called Elexon. Information on Elexon is available from its website: www.elexon.co.uk.

significant. The effect on an Average Daily Value calculation was that it would have become severely diluted by the continuing loss of very minimal BETTA revenue. The conclusion in this situation was that the Insured agreed that the original intent was for a Time Deductible to be applied and not the Average Daily Value. This enabled Insurers to apply a significant monetary time deductible as opposed to a rather less advantageous Average Daily Value equivalent.

Where the revenue profile has recorded staged disproportionate 'trigger' points, or 'rolling' averages that are availability driven i.e. income derived from electricity generation and supply reduces once availability falls below a certain point, the deductible applicable could be established and set as a percentage of the total revenue (expressed as a fixed financial level of self-retention) insured in line with such contracts.

5.4 Types of Deductible

To afford clarity in respect of an interruption where a partial recovery is made during the period of loss we may consider a combined cycle power station with a total station output of 750MW operating on a base load basis. The station is configured on a 2x1 multi-shaft arrangement consisting of two gas turbine generator sets rated at 250MW each and one 250MW steam turbine generator set. The station does not carry the benefit of blast / by-pass stacks in order to achieve steam bypass.

The station is paid under a Power Purchase Agreement where an amount is paid as an availability payment, being a fixed price per MWh of generation availability. In this case the fuel is provided by the off-taker on a pass-through basis. The revenue paid is GBP11.00 per MWh and the indemnity period selected by the Insured is 24 months, equating to a sum insured of:

24 (hours) x 365 (days) x 2 (years) x 750 (MW) x 11 (capacity payment per MWh in GBP) = GBP 144,540,000

During the period of insurance the Insured suffers a forced outage involving blade loss within the steam turbine and as no steam bypass is available, the plant is forced to completely shut down and ceases operation for three months whilst the steam turbine is being repaired. During the repair and replacement of blades it is discovered that the turbine shaft has also been damaged (hogged) and now runs out of true with a higher than acceptable vibration level. To reduce vibration to an acceptable level the Original Equipment Manufacturer and repairer of the turbine rebalances the shaft with balance weights and achieves an acceptable vibration level warranting that that the turbine is perfectly serviceable but with a down-rated capacity of 200MW.

The Insured elects to accept this position as a new rotor will not be available for 18 months and the Insurers agree that it is in order to proceed with this temporary repair due to the considerable business interruption cost saving.

After the period of 18 months, the new rotor is available and is fitted during a scheduled major outage and the station returns to normal service at the full station output level of 750MW after an insured interruption period of 21 months.

The overall loss, making the initial assumption that the station, for the purposes of illustration, has unity availability with a 100% load factor and operates 24 x 7 at these conditions and is calculated as: -

First three months of loss (full station loss of 750MW):

750 (MW) x 3 (months) x 30 (days) x 24 (hours) x 11 (capacity payment per MWh) = GBP 17,820,000

Next 18 months of loss (50MW reduction in output due to the steam turbine down rate):

50 (MW) x 18 (months) x 30 (days) x 24 (hours) x 11 (capacity payment in GBP per MWh) = GBP 7,128,000

Total loss during the 21 month outage = GBP 24,948,000

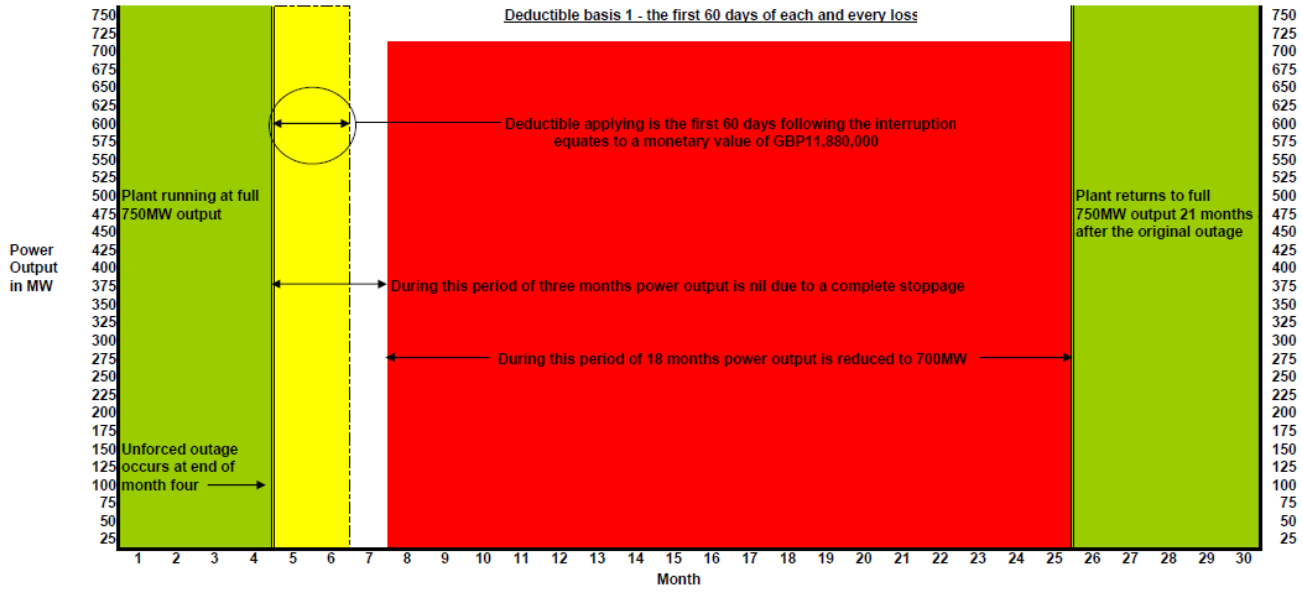
In order to demonstrate the difference in the monetary value of alternative methods of specifying deductible, the following options will be considered noting that it shall be the decision of the Underwriter to determine the basis of the wording to apply in order to reflect the differing methods of deductible application. This example merely serves to demonstrate the differences in the quantum of the deductible for such options: -

- The first 60 days of the loss.
- 60 days multiplied by the average daily value of the loss.
- A flat monetary deductible of GBP 5,000,000
- 60 days applied on a proportional basis relative to the amount that each component of the loss bears to the total loss amount.

5.4.1 The first 60 days of the loss.

Deductible applying = 750 (MW) x 2 (months) x 30 (days) x 24 (hours) x 11 (capacity payment in GBP per MWh) = GBP 11,880,000

as: -



5.4.2 60 days multiplied by the average daily value of the loss.

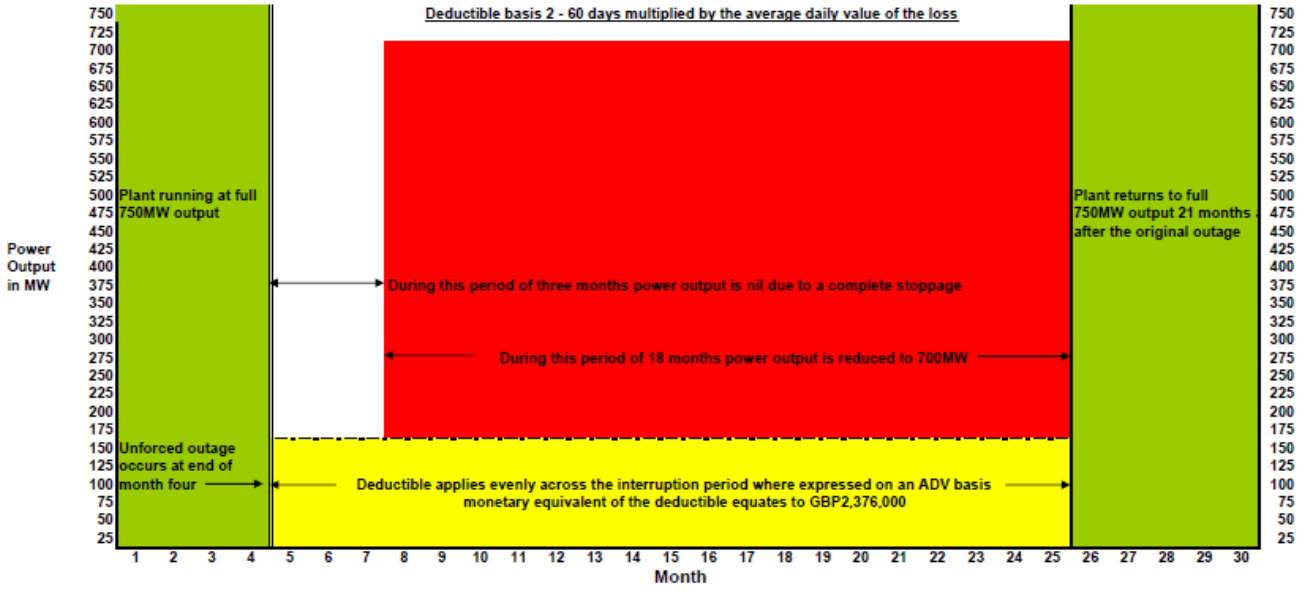
Deductible applying = average daily value of the loss x 60 days

In this case:

GBP 24,948,000 divided by 630 days (21 months) = GBP 39,600

Deductible = GBP 39,600 x 60 = GBP 2,376,000

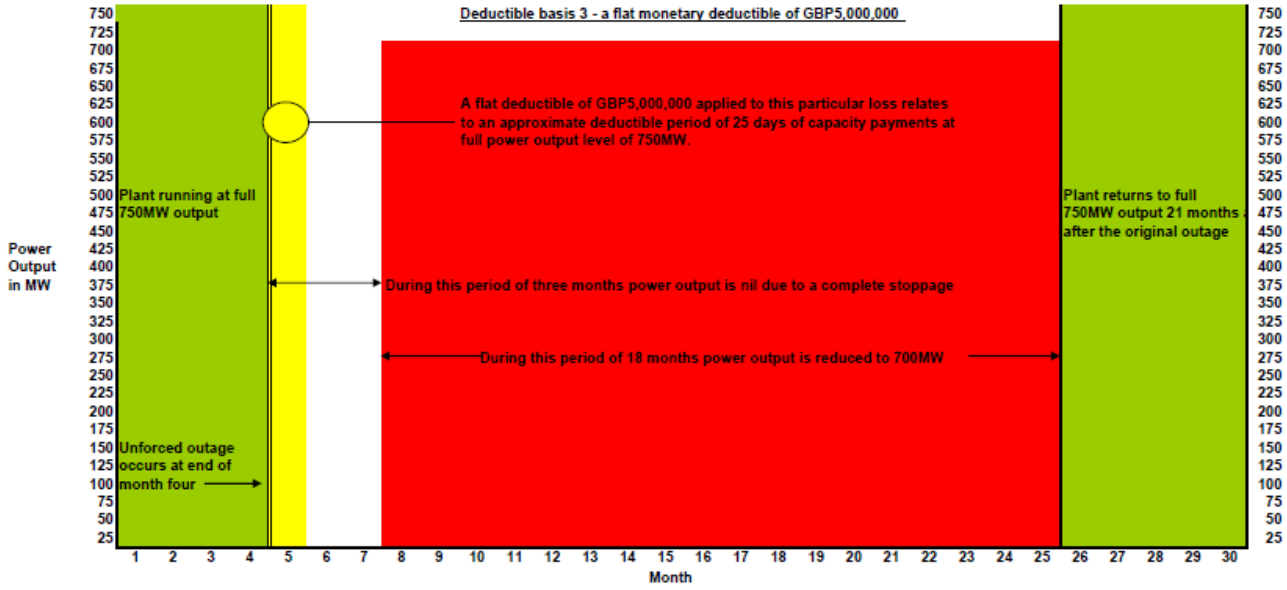
as: -



5.4.3 A flat monetary deductible of GBP 5,000,000

A flat deductible applies of GBP 5,000,000

as: -



5.4.4 60 days applied on a proportional basis.

In order to apply the deductible proportionally the differing levels of lost output must be considered as individual components within the overall loss, that is: -

The first component is the loss of full output for three months.

Proportion of the loss = monetary loss divided by total loss:-

GBP 17,820,000/GBP 24,948,000 = 71.42%

The second component is the partial loss of output for 18 months.

Proportion of the loss = monetary loss divided by total loss:-

GBP 7,128,000/GBP 24,948,000 = 28.58%

These percentages are applied to the number of days deductible; in turn the calculated number of days would then be applied to the average daily value of each component of the loss. In this way, the same theory may be applied to any number of scenarios involving two or more differing amounts of lost output.

For the example quoted:

First component

Proportion of loss (71.42%) multiplied by deductible in days (60) = 42.85 days of deductible applying to this component.

Value of deductible for this component = 42.85 days multiplied by the average daily value of this loss component:-

42.85 days multiplied by GBP 17,820,000/90 days (3 months) = GBP 8,484,300

Second component

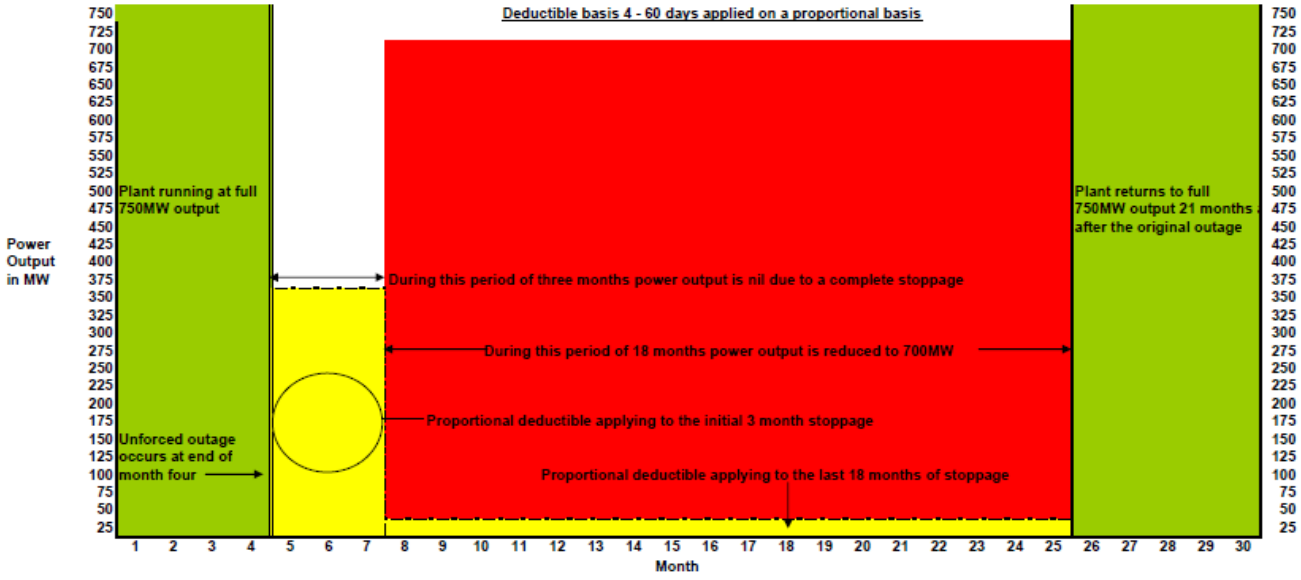
Proportion of loss (28.58%) multiplied by deductible in days (60) = 17.15 days of deductible applying to this component.

Value of deductible for this component = 17.15 days multiplied by the average daily value of this loss component:-

17.15 days multiplied by GBP 7,128,000/540 days (18 months) = GBP 226,380

Total deductible applying =

GBP 8,484,300 plus GBP 226,380 = GBP 8,710,680



In summary:

- The first 60 days of the loss.
  - Deductible represents a high proportion of the final loss amount.
- 60 days multiplied by the average daily value of the loss.
  - It can be seen that the average daily value of the loss presents an artificially low deductible due to the extended period of outage at a low level of lost output.
- A flat monetary deductible of GBP5,000,000
  - Deductible achieves the financial certainty of a fixed financial amount
- 60 days applied on a proportional basis relative to the amount that each component of the loss bears to the total loss amount.

- Arguably the most equitable solution for both Insured and Insurer for losses where a partial recovery in output occurs. Achieves loss sharing across different levels of lost output.

It is therefore recommended for underwriters to give consideration to the potential for full output losses where a partial recovery in output may be made during the interruption period. It is apparent that such a scenario may potentially apply to many risks; therefore the potential for a disproportionate deductible is likely should an unsuitable basis of deductible be selected.

5.5 Conclusion

The above demonstrates very clearly the requirements for developing a framework for the provision of intended policy cover for Loss of Profit insurance from a Power Generation perspective. As discussed, this requires knowledge of the details of the underlying electricity supply contract with regard to the calculation of the sum insured, and the costs and positions contained therein. Furthermore, it is vital to know whether or not a direct supply contract was entered into with end customers, and to be aware of the obligations arising out of such a contract.

6.0 Acknowledgements, Appendices and References

To reduce the size of our paper it was agreed that in preference to a wad of references we would provide URL's to both IMIA and World Wide Web documents.

6.1 Case Studies

6.1.1 Example of 24 months rolling availability PPA clause

Circumstances

A contracted power plant suffers a transformer outage which will result in the plant being shut down for 12-months whilst a replacement transformer is sourced.

The insurance policy provides for a 12 month maximum indemnity period and the insured makes claim for the business interruption sum insured on the basis it will be unable to produce for the entirety of the year.

Problem/Issue Identified

The power plant has a PPA which provides for capacity payments to be paid on the basis of a 24-month rolling availability. In other words the capacity actually provided for the past 24-months is averaged with the average availability provided being used as the basis for the current month's availability payment.

Over the indemnity period, the insured continues to earn 50% of its expected capacity payment, meaning the insured has only suffered an actual loss of capacity revenue of 50% over the period.

The loss of capacity revenue continues for the 2nd year, with the insured only earning on average 50% for the year.

Solution/Lessons Learned

The maximum indemnity period should mirror the length of the rolling availability period or wording should be used that stipulates that the loss will be assessed on the basis of the financial loss that flows from the loss of production during the period of indemnity.

6.1.2 Example of disconnect between deductible and underwriting intent

Circumstances

A contracted power plant suffers a mechanical breakdown which will result in the plant being shut down for a 30-day period.

The insurance policy provides for a 12 month maximum indemnity period with a 60-day deductible. The deductible wording defines the deductible as a time excess, with the wording stating that the insured will be its own insurer for losses occurring during the 60-day period.

Problem/Issue Identified

The power plant has a PPA which provides for capacity payments to be paid on the basis of a 24-month rolling availability. In other words the capacity actually provided for the past 24-months is averaged with the average availability provided being used as the basis for the current month's availability payment.

The 30-day outage results in the insured's availability payment being slightly reduced over the 24 months after the loss event.

The insured claims the financial impact of the loss for day 61 until the end of the maximum indemnity period, arguing that the deductible only excludes the losses during the first 60-days.

The underwriter says it was never his/her intent to insure losses with outage duration less than 60 days.

Solution/Lessons Learned

The financial impact of an outage event should be fully understood so that the deductible wording is aligned with the policy intent. If the application of the PPA means losses of a short duration lead to financial losses beyond the end of the interruption period, a bespoke wording should be used. Wording such as: "Underwriters will not be responsible for any financial losses which flow from a production interruption during the deductible period.

6.1.3 Example of deductible as either a waiting period or an ADV

Circumstances

A serious loss occurred in an alternator stator at a contracted power station. This produced a loss of energy output of 600MW. Temporary repairs were affected whilst a new stator was constructed. The total interruption period was 30 months. The Insured had the benefit of business interruption cover with a 36 months maximum indemnity period.

Problem/Issue Identified

The initial period of interruption whilst temporary repairs were affected was 4 months. During this first period of interruption the station lost contracted revenue for 600MW. There then followed a period of 24 months during which only a very minor loss of NETTA revenue was suffered as the unit returned to full but temporary service whilst a new stator was constructed.

The final two months of the interruption occurred when the new stator was delivered to site and the station necessarily reverted to a loss of 600MW of energy whilst the temporarily repaired unit was shut-down, removed and the newly constructed replacement was installed and commissioned.

It can be seen therefore that there were three distinct periods of interruption. The first was 4 months of zero generation whilst temporary repairs were affected, the second was 24

months of almost complete energy production with only a very minor loss of NETA revenue and the third was a final 2 months of zero generation whilst the new equipment was installed.

On an ADV basis the deductible amounted to approximately £2m whilst on waiting period basis the deductible amounted to £12.2m. The ADV was clearly heavily diluted due to the long period of interruption where only a very minor loss of NETA revenue was being sustained.

Solution/Lessons Learned

The difficulty arose in what appeared to be an ambiguity in the policy as it pertained to the application of the business interruption deductible – was it ADV or waiting period? A general condition of the policy referred to:-

> "*Where the Insured's Retained Liability is expressed as a period of time, the amount to be retained by the Insured shall be such proportion of the loss as the applicable Retained Liability (in days) bears to the applicable Indemnity Period (in days).*"

However, elsewhere in the policy the schedule referred to the application of a waiting period. Neither waiting period nor retained liability was defined in the policy.

In the particular circumstances of the loss the monetary discrepancy between the application of a waiting period deductible and an ADV deductible was substantial. The policy wording was unhelpful and obviously ambiguous. In the event, the Insured confirmed that during their discussions with the underwriter prior to placing the risk the intention was for a waiting period to apply. Without the cooperation of the Insured in the matter it was highly arguable that the correct deductible to be applied was the lesser ADV.

6.1.4 Example of rescheduling an outage during the indemnity period

Circumstances

A coal fired thermal power station consisting of two 500MW steam turbine generator sets suffered an unforced outage to one electrical generator due to a short to earth within one of the winding phases.

The plant operated on a base load basis through the winter months receiving revenue of GBP11 per MWh as a combined capacity and energy payment through a power purchase agreement. The generator required a rewind to the failed phase winding resulting in an outage period of six months between December and June and the policy carried a deductible of the first 60 days of each and every loss.

Problem/Issue Identified

The initial estimation of the loss, ignoring the PD value was calculated as:

182 day outage x 24 hours x 500MW x GBP11/MWh = GBP 24,024,000

Less the value of the deductible 60 days x 24 hours x 500MW x GBP11/MWh = GBP 7,920,000

Net loss = GBP 24,024,000 less GBP 7,920,000 = GBP 16,104,000

However, a major scheduled maintenance outage was due in August with duration of six weeks. It was agreed between the Insured and Insurers that it would be viable to reschedule this outage to take place during May in order to take advantage of the downtime available due to the forced outage.

Solution/Lessons Learned

However, such rescheduling came at a cost, which required evaluation by Insurers under the Increased Cost of Working Extension of the BI policy section. The extension was written as a standard economic form, and a test was applied to ensure that expenditure did not exceed the revenue saved thereby.

The additional cost amounted to GBP1m, compromising of the cost of mobilising OEM engineers at an earlier time than anticipated and to make the necessary parts required for the maintenance outage available in an expedited manner.

The revenue saved was 35 days x 24 hours x 500MW x GBP11/MWh = GBP 4,620,000

It can be seen that this position was advantageous to Insurers, therefore agreement was given to proceed and that Insurers would indemnify the Insured for the additional costs incurred. Thus through regular communication with the Insured and an understanding of the Insured's future outage position a mutually beneficial result was achieved.

The final settlement was made as follows:

Original claim amount GBP 24,024,000

Plus Increased Cost of Working GBP 1,000,000

Less revenue saved GBP 4,620,000

Less deductible GBP 7,920,000

Final amount paid = GBP 12,484,000, representing an overall saving of GBP 3,620,000

6.1.4 Example of non-linear BI intent verses application

Circumstances

Short circuit to failure experienced by main GSU transformer at a power plant.

PPA entailed agreed electricity rates over the life of agreement with variations applicable to availability during:

- Off-peak

- Peak
- Super-peak

Availability Targets varied from circa 90% for off-peak to circa 96% for peak and super-peak. Where targets are not achieved, the Generator was required to pay capacity refund payments to the Power Purchaser and these amounts are calculated for each half hour period and are subject to a total annual cap. Capacity refund payments are calculated on three month rolling basis as per the terms and conditions of PPA.

Therefore the PPA represents a non-linear BI exposure given the variations of seasonal demand

Problem/Issue Identified

In respect of policy coverage both the Insured as the 'Generator' and 'Power Purchaser' are covered by a single policy with separate limits of indemnity applying to each albeit PPA applies to single location between said insureds.

The BI Deductible equates to "30 days times actual daily indemnifiable loss suffered by the insured" where the Daily Indemnifiable Loss: -

> "Actual Average Daily Indemnifiable Loss suffered by the Insured is calculated by taking the total loss suffered under Section 3 and dividing it by the total number of days during the Indemnity Period"

For example a Normal Loss Expectancy Incident ignoring PD deductible:

- 2nd week of the month
- 1st month of 90 day rolling average period
- 15 day reinstatement period
- Generator fails to meet capacity availability target
- BI subject to the above retention

Solution/Lessons Learned

Policy Cover Implications suggest significant disconnect between underwriting intent and application where the 15 day outage deemed to be trigger BI given that the Generator did not meet availability targets over three month rolling period. Therefore:

- 1st Month $ 1 m
- 2nd Month $ 1.5 m
- 3rd. Month $ 1 m
- TOTAL: $ 4.5 m

And

30 day average daily loss ~ $ 4.5 m / 90 days = $ 1.5 m

100% BI ~ $ 4.5 m - $ 1.5 m = $ 3 m (100%)

The net effect is that the 30 day time deductible becomes superfluous and in reality the BI exposure is heavily compressed due to the seasonal variations of the PPA.

6.1.5 Example of stacked PPA with wording omission

Circumstances of loss

The power company is a captive thermal power generating facility for a manufacturing facility having a capacity of 100 MW. Both companies are under the same group and their revenues are consolidated under the accounts of their holding company.

The captive use of the power company is limited to between 50 - 75 MW depending on season and demand. The balance is sold by the power company after internal sales to the manufacturing facility on a forward basis in the open market to various third party customers.

The power company has taken an Industrial All Risks Cover with a BI coverage of USD 25 m which represents both internal as well as external sales. The coverage for BI was a straight forward market wording covering insured gross profit on difference basis. Whereas part of the plant revenue was coming from internal sales to a sister company and remaining part from open market operations, the differentiation was not made in the policy. Also the drafting of the policy document did not take cognizance of the PPA's forming part of the forward trade being done by the power company.

During the currency of the policy there was a breakdown in one of the boilers resulting in partial shutdown of plant for a month. The power company declared a force majeure in respect of their forward contracts and informed its customers of their inability to supply. A MD/BI claim was proffered with the Insurer.

Problem/Issue Identified

During the adjustment of BI loss it was observed that as per terms of forward commitment, in case of under supply, there was a levy imposed on the power company, known as Unscheduled Interchange (UI) charges, being the contractual liability arising due to short supply of power after declaring readiness to make available a certain capacity.

Since the policy excluded fines and penalties, the loss adjuster disallowed this charge in his assessment of the loss.

Solution/Lessons Learned

Even though the charges were incurred as a direct consequence of the breakdown and the resulting interruption in insured business, the policy was not properly aligned to recognize this aspect and the power company could not be properly indemnified. The policy only paid for loss in generation of power as per policy terms and conditions.

Had the UI charges been included in BI Sum Insured as a separate item and coverage properly described, this situation would not have arisen.

6.1.6 Example of a seasonal PPA

Circumstances

A contracted power plant suffers a mechanical breakdown which will result in the plant being shut down for a 150-day period.
The insurance policy provides for a 12 month maximum indemnity period with a 60-day time excess deductible.

Problem/Issue Identified

The power plant has a PPA which provides for capacity to be provided, and capacity payments made, on a seasonal basis to accord with peak demand. The six months from September to February required generation at near full capacity, March to August saw a significant reduction in demand.

Capacity 'orders' for each season were agreed in advance and in a competitive market with an oversupply against demand.

The 150-day outage occurred on 1 July 2010, impacting production until the end of November 2010. However, orders for the period February to September 2011 were to be placed in October 2010. The order for the February to September 2011 period was not placed directly due to the mechanical breakdown and the resultant lack of trust.

On the basis that the insured 'booked', or partially-booked, the values of orders when received it wanted to claim for all of the lost order for February 2011 to September 2011, even though the period July to September 2011 fell outside the 12 month indemnity period.

Solution/Lessons Learned

There was an uncertainty as to how to apply the policy provisions to the complicated accounting structure of the insured. In this instance no cover arose because of the definition of "turnover" during the indemnity period, but it was not as clear as would have been expected.

6.1.7 Example of a Wind Farm PPA

Circumstances

A wind farm located on a beach around 70 meters from the ocean suffered from serious and heavy rain whilst at the same time a very high tide happened causing a flood claim.

Problem/Issue Identified

The client reported a claim to the insured, but as they were working under a concession cede by the Government they reported a claim to them too.

The insurance company paid the Material Damage but the discussion of the DSU started and the values involved were around US$ 5 M to 7M. However, in this particular case negotiation between the client and the Government commenced based on a PPA clause that allowed negotiation, in specific cases, of a revised delivery date in the event of a claim. A

new start date for the operational phase of the contract was defined and no DSU loss was incurred.

Solution/Lessons Learned

Attention is drawn to the need to analyse a PPA contract to investigate the actual mechanism of the clauses. For in some contracts DSU coverage under the PPA would not be appropriate if the owner / insured can move the final construction date or the day that they will deliver energy to the Grid.

6.1.8 Example of a power utility's loss covered by the extra expenses insurance:

- An electricity utility has taken out insurance to cover for the exceeding of the reserve network-capacity 600h-limit (RNC).
- Utilization of the reserve network capacity (RNC) is available at low cost up to duration of 600 hours.

Reserve network capacity defines a network's capacity to supply reserve power in the event of breakdown or revision of in-plant power generation facilities.

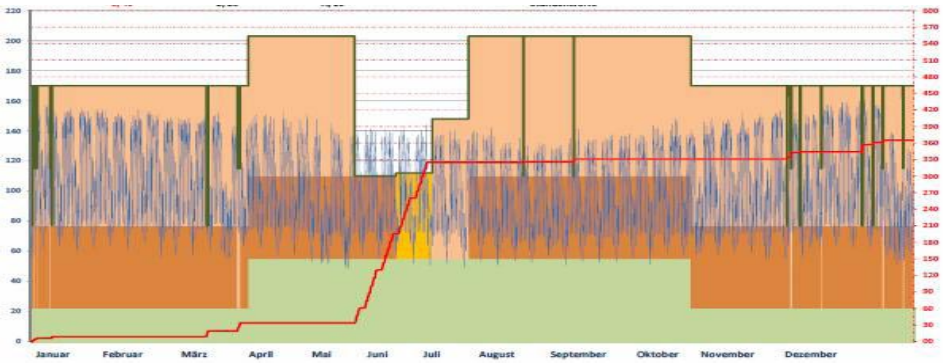
Real utilization of reserve network capacity depends on various aspects. Therefore, in-depth analysis of network utilization patterns is of utmost importance. The following aspects should be considered:

- Maximum network load to be expected in the relevant time segments (summer, transition times, winter)
- Overall in-plant generation
- Additional, declared supply of electricity (supply at any rate)
- Largest generation unit (determines the volume of reserve network-capacity supply)
- Planned plant inspections and shut downs (scheduled usage of reserve network capacity)
- Breakdowns (non-scheduled usage of the reserve network capacity; however, since empirical values have been gained from the past years, it is also possible to plan the supply of reserve network in case of breakdowns).

The model electricity utility has the basic line-up as shown below:

- In-plant generation: 150 MW; (various steam turbines)
- Maximum network load: 170 MW;
- Summer, supply at any rate: 65 MW;
- Winter, supply at any rate: 35 MW;
- Transition time, supply at any rate: 35 MW;
- Maximum reserve network capacity: 93 MW;

The above line-up shows a planned utilization of 380 reserve network-capacity hours and was calculated by way of an excel spread sheet including the relevant network, power generation and supply values. The diagram below reveals the calculation (in this case 362h).



For Insurers this means that there is a reserve capacity of 220 h left to cover unscheduled breakdowns. Not very much, one might think at first. However, we should bear in mind that a breakdown that will last on for two days will not give rise to a full 48h supply of reserve network capacity, but only a fraction thereof, i.e. only at those times when the network load has reached such a high level that (reduced) in plant generation and at-any-rate supply will not suffice to compensate for the network load.

As far as our model electricity utility is concerned, the utility suffered from comparatively harmless damage to and failure of the turbine section. To solve this problem the steam turbines had to be repeatedly shut down, one at a time, causing the electric utility to resort to reserve network capacity supply. Eventually, such failures of and damage to turbines are considered as what one might call the “teething troubles” of a steam turbine.

As one can learn from the above, the combination of and the interaction between at any-rate supply, reserve network-capacity supply and network load plays an important part.

Belated increase of the electricity at-any-rate supply is considered a key alternative to influence the temporary utilization of the reserve network capacity afterwards.

Regarding our claims case this means in principle:

In September, the electricity utility resorted to a reserve network-capacity supply of 580 h. Thanks to the belated increase of at-any-rate supply for the transition period from 35 MW to 65 MW, reserve network-capacity supply was reduced to 504 h. Increase of the at-any-rate supply will cause extra costs of 380,000.- Euros and thus will be deemed as loss-minimizing expenditure.

Advantage: As a matter of fact, exceeding of the 600h-limit was decisively counter-acted, thus avoiding reserve network-capacity costs of 3 million Euros.

Disadvantage: In case of a prolonged standstill of facilities caused by or arising from an event of damage or loss, the 600h-limit may be exceeded nevertheless, and in this case, loss-minimizations costs can no longer be set off.

6.2 Examples of Policy wordings

References - Policy Wording\IMIA-PPA_Policy_Wording_Example.docx

References - Policy Wording\IMIA Working Group Paper-PPA (2).docx

http://www.imia.com/workspace/WGP_75_Clark/?fl=Draft_Policy_India.doc&act=fd

6.3 Examples of PPA's

References - PPA's\IMIA-Power Purchase Agreements-Example 1.pdf

References - PPA's\IMIA-Power Purchase Agreements-Example 2.DOC

http://www.imia.com/workspace/WGP_75_Clark/?fl=Sale_of_Energy_in_Brazil___General_Overview.DOC&act=fd

6.4 Check List for Risk Assessment

References - Risk Management\IMIA Paper 74_12 chapter RM ANNEX.pdf

References - Risk Management\Risk Engineering for major construction projects 14 7 11.pdf

6.5 Acknowledgements

As chairman of the group I would like to extend thanks to all those members of the group who have contributed with particular gratitude to those that have afforded guidance and assistance including Mike Robertson, Flemming Jensen, Hugh Sparks, Nigel Chapmam and those not on the committee but who have contributed including Ian Smith, Kevin Lumiste, Kevin Seakins, Scott Milligan and Margaret Curzon. My thanks to you all.

Eldred R.W. Clark

Chairman IMIA WGP 74.12