# *WHAT WILL AN ENERGY CRISIS MEAN FOR YOU?*

## *Part 1: A Brief Overview – What We Should Know*

*By Graeme Jorgensen, Mal Keeley, Ron Fraley and Dr Charles Rhodes.*
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**I**t's time that we all became acutely aware of just how essential our *'real'* essential services are to our lives, and that, at the top of the tree must be the supply of electricity, because it is electricity that underpins almost every facet of our technology-driven and technology-enabled lives... including the full range of other vital essential services that cannot be delivered without it.

From our telecommunications systems, to our hospitals, our lighting, heating and cooling, our transport services and traffic management systems (whether road, rail, air or sea), municipal utilities such as water supply and sewerage recovery, treatment and disposal, manufacturing industries and commercial enterprises.

The bureaucracies and agencies of government, our services sector including food production and processing, homes and schools, local medical centres and pharmacies, the corner stores and cafes just down the street, and on and on... they're only there for us if the power is also on for them.

And don't forget the range of home-based medical devices which are essential to the health and wellbeing of many vulnerable people in our communities. And how will our "cashless" society manage without EFTPOS?

How many people have an expensive battery backup unit (often known as an uninterruptible power supply, or UPS), primarily as an alternative short-term power supply for their home office or critical medical equipment, which they could also use for their phones and other vital devices (for a short time, at least)?

We all know that we are in the throes of an enforced transition to renewable energy sources. It is claimed to be what we absolutely must do to save the World. It is literally in our faces, every day.

The claim is chanted ad nauseum, that all of our fossil fuel energy sources must be replaced – immediately, if not sooner – with *"clean"* and *"free"* energy from natural sources such as the sun and the wind, along with a few lakes for hydro power, if we have them. But, is this really the truth, and the answer for our future?

In a recent paper presented to the Ontario Society of Professional Engineers (OSPE), a Canadian expert in the fields of climate science and nuclear power generation, Dr Charles Rhodes, warns that:

*"Present government-led climate change mitigation policies are not founded in physics and are ineffective. Instead, we mostly need sustainable nuclear power, synchronous power generation and capacity-based electricity billing.*

*"When these things are in place, the electricity grid system will be able to accommodate about **20 per cent** (%) of extra energy contribution from wind and solar generation.*

*"A larger fraction of wind and solar generation is only economically viable if the geography of a nation supports large amounts of hydraulic energy storage." [Dr. Charles Rhodes, 'Nuclear Mitigation of Climate Change', Xylene Power Ltd, Sept 2024].*

This is critically important advice, so let's start by examining some of the important knowledge... the information which will help us to understand what's right and wrong, and what's best for our future, and for our children's future.

We really must understand these critical factors, in order to keep our thinking in order – factual and rational – to enable us to make informed choices.

For a better understanding, it will be helpful if we consider some of the **key and irrefutable facts** about power generation and distribution, the climate and thermal radiance, and about nuclear energy, before we can then examine our options for the future in a reasonably informed manner.

In a series of discussion papers, we have endeavoured to explain (in very simple terms), the important aspects of our electricity system and the related issues which we all need to understand. These discussion papers include:

Part 1: What We Should Know (*this Overview*)

Part 2: Our Essential Electricity System

Part 3: Our Existential Climate Crisis

Part 4: The Vital Role of Nuclear Energy

Information that really matters to all of us is explained in each of our separate papers, and a brief summary follows...

## *The Key Points – What We Really Need To Know*

Our discussion papers explain the explicit realities, including that:

1. In the first instance, ***synchronous generators*** **are absolutely critical** to a fully-functioning base load power system. They, alone, establish and sustain the frequency of the grid. It is the massive ***inertia*** of these machines which stabilises the network in a normally operating system;

2. Conversely, *asynchronous* and intermittent renewable energy generators (and other electrical control devices), have little to no physical rotational inertia. Accordingly, **asynchronous generators cannot control frequency or any other forms of system instability** (voltage, current, load, reactive power and etc);

3. In the absence of a healthy base load AC power system, household asynchronous generators – solar PV panels or wind turbines – will not generate electrical energy (without also having an integral battery, and a network isolator);

4. Further, and if intermittent asynchronous generators are the largest component of a power system, then the system will be functionally unstable and uncontrollable.

   A base load AC power system becomes progressively more unstable as the ratio of intermittent asynchronous generation to synchronous generation increases. In other words: **There cannot be a functioning base load system which is solely or mainly comprised of intermittent asynchronous power generation sources**;

5. Accordingly, **a secure base load grid should obtain no more than 20% of its energy from intermittent asynchronous energy generation**, *"noting that intermittent generation typically has a capacity factor of about 33%.*

   *"Hence, intermittent generation that on average supplies 20% of the system energy might meet as much as 60% of the system demand at a time when the wind is strong and the sun is shining.*

   *"However, and under those circumstances, the fraction of synchronous generation may not be sufficient to maintain grid stability;" [Dr. Charles Rhodes].*

   Despite the fact that it only has 75% of renewable energy capacity (according to its own records), the Government of South Australia recently boasted that almost 100% of the State's demand was met with renewables. But, there is one inconvenient and unstated truth:

   What was **not** noted was the important fact that the stability of their electrical system would only have been possible due to the State's grid connection to the much larger East Coast Grid (which comprises of several very large coal-fired, gas-fired and hydro synchronous generators);

6. Intermittent asynchronous power generation must not be connected to remote 'one-way' power distribution networks, as these networks are not set up for the 'reverse flow' of electrical energy (and the cost of adapting them with suitable protection, metering, control and switching equipment is huge);

7. In present circumstances, **there is no rational justification for the replacement of existing synchronous AC generators with intermittent asynchronous power generators** (at least until sufficient new base load synchronous generators are available to replace the existing generators, and to balance any proposed new renewable energy generators);

8. **The addition of intermittent asynchronous renewable energy generation to the electricity grid simply adds new and greater costs and risks to the electricity supply system – it will never be cheaper or more efficient.** Without capacity billing, asynchronous behind-the-meter generation (such as household systems), has the effect of transferring electricity system costs on to other electricity system customers;

9. The **only viable alternative to conventional fossil fuel base load AC power generation** is to install carefully selected nuclear power plants, noting that Small Modular Reactors (SMR's), which are a popular topic at this time, are not necessarily the best choice, nor are some of the other conventional nuclear plants.

   Governments need to consult widely, and with recognised independent experts in the field, especially because a major issue in reactor type selection concerns the future availability and cost of nuclear fuel;

10. *"Present government-led climate change mitigation policies are not founded in physics and are ineffective.* ***Instead, we mostly need sustainable nuclear power, synchronous generation and capacity-based electricity billing****.*

    *"When these things are in place, the electricity grid system will be able to accommodate* ***about 20%*** *energy contribution by wind and solar generation.*

    *"A larger fraction of wind and solar generation is only economically viable if the geography of a nation supports large amounts of hydraulic energy storage." [Dr. Charles Rhodes, 'Nuclear Mitigation of Climate Change', September 2024].*

    However, and when we consider a country like New Zealand, which has an extensive hydro power generation network and boasts of a rapidly expanding intermittent asynchronous renewables network, the country's energy grid must be daily bolstered by one large coal fired power plant.

    This dependable synchronous power plant is supplied with low-quality high-emissions coal imported from Indonesia, despite the fact that NZ itself has extensive reserves of high-quality low-emissions coal resources! To what extent does this factor reduce the claimed benefits derived from their unreliable intermittent asynchronous and costly renewables network investment?

11. **A grid system should include large base load generators which also have *Unit Islanding* capabilities**, in order to minimise the risk of *'black start'* situations. *"Following a total loss of the network (when it is completely de-energised, or "black"), "**only a large synchronous AC generator will be capable of undertaking the task**." [Dr. Charles Rhodes]*.

12. **We absolutely need to retain and maintain our existing large base load power plants** – and especially those that also have *'Unit Islanding'* and '*Black Start'* capabilities – until new and at least equivalent capability replacement generators have been commissioned;

13. Power dispatch protocols must urgently be revised in favour of synchronous base load generators, in order to **assure *Energy Security*** and to **avoid *Energy Poverty***, and to encourage investment in the provision of essential base load power generation and other network services;

14. *"The value of electricity is based on both 'reliable capacity' and 'energy'. Therefore, **'KW capacity' and peak demand pricing (in addition to KWh pricing), must form the basis of overall network pricing"** [Dr. Charles Rhodes]*;

15. **Nuclear energy is the only viable alternative base load fuel source** which will not add further $CO_2$ to our atmosphere;

16. Together with CANDU reactors, fast nuclear reactor (FNR) technology with supporting fuel reprocessing is **the only route to sustainable clean power for fossil fuel displacement**;

17. **It is essential that urgent progress is made to replace present fossil-fuel based synchronous generating capacity with suitable nuclear powered synchronous generation options**;

18. *"An issue that Australia must face is that it is very expensive to have large redundant fossil fuel generators which are only occasionally used when wind and solar energy fail. Once available hydro generation is fully utilised for energy storage, **there is no practical alternative to base load nuclear power generation**.*

    *"Nuclear, alone, is cheaper than wind + solar + energy storage + 100% fossil fuel backup. That fossil fuel backup must be composed of large synchronous generators to enable grid restarts, and to provide ongoing **grid transient suppression stability**.*

    ***"Distributed generation for renewable energy generators is a more expensive transmission and distribution network**, and the network costs of supporting bi-directional power flow, and matching synchronous capacitors and energy storage, are huge.*

    ***"Only a synchronous generator with a large rotating moment of inertia can easily suppress large power surges**. Providing comparable surge suppression capability via power inverters and electrical energy storage is extremely expensive, and is not presently found in most systems." [Dr. Charles Rhodes].*

19. With the benefit of a mathematical analysis based on the Australian context, Dr Rhodes summarised the likely result of connecting intermittent asynchronous generation to the existing grid. He explained that doing so:

    a) Saves nothing in synchronous generation capital costs;

    b) Causes additional capital costs for renewable generation and transmission equipment;

    c) Retains synchronous generation maintenance costs;

    d) Adds additional operating and maintenance costs associated with renewable generation;

    e) May reduce synchronous generation fuel costs by about one-third, provided that oil support is not required to maintain safe combustion conditions, and that steam turbines are designed for high efficiency at part load [which is uncommon with large base load power plants]; and

    f) Causes additional fuel costs for synchronous generation when the output of steam generating units is reduced from their normal operating load down to a lower average load. Steam generating units become progressively less efficient at low fractional loads, and oil support for combustion safety is critical.

    Dr Rhodes concludes that:

    *"As additional intermittent asynchronous renewable energy generation is added to the grid, it becomes necessary to control the load to take full advantage of the intermittently available clean power, **otherwise a lot of money is spent with little net $CO_2$ emissions reduction**.*

    ***"Almost all the synchronous generation costs are retained, and all the renewable generation costs are additional.***

    *"Moreover, the value per KWh of the intermittent renewable generation is much less than the value per KWh for the dependable synchronous generation.*

    ***"Parties who claim that renewable asynchronous generation is less expensive than synchronous generation simply do not know what they are talking about.***

*"Intermittent generation only makes financial sense for process loads that are not time sensitive, and that the electricity utility can control (such as for battery charging, electrolytic Hydrogen production and electrolytic metallic Sodium production)."* *[Dr. Charles Rhodes].*

20. **Biomass should be reserved solely for the production of aviation fuel as, at this time, there is no other viable non-fossil alternative**; and

21. Rapid adaptation is a strategy which we all must consider, and can act on, now. But **we will absolutely need a dependable synchronous base load electricity supply** to support any efforts to take a meaningful and proactive approach to developing a state of resilience.

22. **The cost of base load energy is embedded in every other product and service that we procure**. **We simply cannot afford the full cost of 'renewables'**.

    We need base load energy sources that can be amortised over 100 years, not 20 years. We cannot afford to multiply the electricity transmission and distribution systems several times to enable use of low capacity factor generation. Even centralised energy storage adds considerably to the overall electricity cost due to much greater electricity transmission requirements.

## *What Must Be Front-of-Mind*

Our conclusions can only be that **it is vital to maintain a strong base load power system – one that is essentially comprised of large synchronous AC generators** for both supply to and control of the grid, and which are capable of generating reliably and efficiently 24 hrs/day x 365 days/year, over many years.

Further, this foundation must be prioritised ('*preferenced'),* by Governments and the National Energy Market Operator (AEMO), to the appropriate exclusion of intermittent renewable energy sources.

**This is the only way to maintain *Energy Security*** and to allow for the properly managed introduction of intermittent asynchronous generators.

Importantly, **the addition of any new intermittent renewable generation must always be conditional on grid capacity** (maintaining the inherent strength and resilience of the grid network).

Remember, too, that **it is the large base load generators that provide the cheapest and most reliable base load power generation** – when they're not deliberately priced out of the market by unrealistic and unaffordable subsidies for renewables – and because they will do so over a lifetime which far exceeds that of intermittent renewable power generators.

***'Dependable Capacity'* pricing is required. The dependable capacity value of most wind and solar generation is zero**.

**It can only be considered foolish in the extreme to procure the removal of existing base load AC generators, and their replacement with intermittent asynchronous renewable energy generators.**

Any form of cost-benefit analysis between competing technologies must be soundly based on a full life-cycle analysis which includes any actual or anticipated government (taxpayer-funded) subsidies, and which also accounts for the benefit of reducing $CO_2$ emissions.

Note that, as intermittent renewable generation increases, the $CO_2$ emissions reduction per KWh generated decreases, due to the decreasing part-load efficiency of parallel-connected synchronous fossil fuel generation.

The costs must also properly **consider the frequent replacement of renewable energy sources**, as against the much longer operational lives of conventional and especially nuclear power plants (around 80 years).

But, looking at what deluded activists and politicians are driving for today, **we should certainly be prepared for blackouts and worse**, before realisation of the facts and of the consequences becomes a reality for all of us. And who pays the price of these delusions?

Even the recent Chief Scientist for Australia, *Dr Alan Finkel*, admitted that **there would be no benefit from the country's head-on drive to "Net Zero Carbon" by adopting renewable energy at any cost!** Why would this view be any different for other nations?

Worse still, we don't know what that cost is actually going to be, as governments avoid the question (for obvious reasons). **We only know that the cost of energy storage and network stabilisation to support renewables will be huge**. Is this the burden that we should leave for our children?

The Bottom line is that **the health, wellbeing and wealth of a nation's economy and its people are absolutely dependent on the provision of a plentiful, economical, affordable and reliable supply of synchronous base load electrical energy**.

Importantly, **this extends to the ability to assure our resilience and survival**, not just for enabling us to effectively mitigate the effects of climate change, but especially to secure our resilience in the event of trade sanctions or war. This is a fact that cannot be disputed, and there is no other ready-made alternative to the facts as we know them.

It is also clear that we desperately need to **secure our long-term survival by replacing present fossil-fuel power generation with nuclear power as the only viable clean energy source**, and that progress towards the total replacement of our use of fossil fuels must be our greatest focus.

*It is critical that basic AC power concepts, climate concepts and nuclear power concepts all become core curriculum subjects in our schools.*

We are at a crossroads, a tipping point which has civilisation-wide impacts. It's your call, so please make it the right call, on behalf of all people in particular, and civilisation in general.

*Energy poverty cannot be allowed to eventuate or prevail for purely ideological purposes, in any World.*
*Energy Poverty isn't coming, it's already here! Do we really want Energy Insecurity as well?*

## *Access the Papers*

Please take the time to review our more detailed discussion papers, published as

Part 2: Our Critical Electricity System

Part 3: Our Existential Climate Crisis

Part 4: The Vital Role of Nuclear Energy

View published versions at
https://australianfutureenergyinitiative.substack.com/?r=4q14pd&utm_campaign=pub&utm_medium=web
Or visit the website australianelectricity.info (use the following address in your internet browser) https://www.xylenepower.com/Australian%20Electricity%20System.htm, to obtain this discussion paper.
To request a copy, send your details (full name, post code, and email address – with utmost privacy assured), to *realenergystory@yahoo.com* (copy and paste the address into your new email). And remember...

*Adaptation is a strategy which we all must consider, and can act on, now. But we will absolutely need a reliable electricity supply to support any efforts to take a meaningful and proactive approach.*

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## *The Authors*

***Graeme Jorgensen, Malcolm Keeley*** *and* ***Ron Fraley*** have been actively engaged in power plant commissioning and operations, technical documentation and training/educational roles (including the use of high-fidelity replica power plant simulators), over a period of many years – since the early years in the 70's when the control and management of power plants were largely human activities (both mental and manual). Apart from a range of power plant qualifications (including steam power plant), we have also held electrical, HV switchyard operations and authorised HV switching officer qualifications.

In the early period of our careers, the need to sustain reliable and dependable base load power supplies to growing communities and industries was a responsibility which soon became a badge of honour. We fervently hope this commitment will be maintained into the future, not just by operators and engineers, but most emphatically by corporations and governments.

Graeme, who's electricity industry career spans New Zealand and Australia, was also the founder and Managing Director of a power generation services company, Energen Pty Ltd, which delivered contract commissioning, operating and advanced training services to the sector (across Australia and SE Asia). Together with his close colleagues, Ron and Mal, a highly successful business was developed and operated across 23 years, until Graeme's recent retirement and closure of the business.

***Expert reviewer, advisor and contributor, Dr. Charles Rhodes*** P.Eng., B.Sc., M.A.Sc., Ph.D., is the Chief Engineer of Xylene Power Ltd. and FNR Power Ltd. (formerly known as Micro Fusion International Ltd.). Dr. Rhodes has more than 50 years of physics and engineering experience that includes the development, manufacture, installation, operation and maintenance of distributed energy control and mechanical equipment monitoring systems for major buildings, thermal energy storage systems, pipelines, high efficiency boilers and grid-connected behind-the-meter electricity generation systems.

Dr. Rhodes has been an intervenor and expert witness in Ontario Energy Board (OEB) electricity rate hearings. He has also been an expert witness in Alberta Energy Board (AEB) hearings relating to wind generation and buried sour gas pipelines. He has supported various parties in interventions relating to interprovincial and interstate pipelines.

Other work by Dr. Rhodes has been in the areas of engineering education, engineering management, corporate management, power line carrier, RF, VHF, and UHF communication systems, microcontrollers, microprocessor and microcontroller programming for real time control, electricity and heat metering, electricity rate and regulatory issues, wind generation, fluorescent lighting, solid state device fabrication and characterization, high vacuum systems, cryogenic physics, semi-stable plasmas, nuclear waste disposal, fast fission and fusion reactors, biofuels and the physics of climate change.

Much of his recent work has been related to liquid sodium cooled modular fast neutron reactors for mitigation of climate change, and further information can be explored at *xylenepower.com* (copy and paste the link https://xylenepower.com into an internet browser). Dr. Rhodes has broad experience that spans almost all aspects of energy.

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