

## ***“Nuclear Energy for Latvia” 18 May 2022***

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***“Why radiation is safe and everybody should embrace nuclear technology”***

### Slide 1

Fear of nuclear energy is the greatest cultural error made by humanity in the past 100 years, and with the onset of climate change this obstructs the only viable answer to climate change.

Let me explain.

Energy is essential for life on Earth.

That was true from the start 3,500 million years ago.

### Slide 2

By overcoming fear, humans came to dominate other forms of life.

They learnt to study energy and, by developing speech and writing, to share their findings and confidence with others – as we are doing here today.

With too little energy they died of cold and hunger.

Too much and they ran away frightened, like animals.

And so it was about 600,000 years ago. The Greens of those days were right – fire can be dangerous.

But they were wrong not to study fire and its technology.

Today’s Green Party is wrong, even on safety. Nuclear energy is much safer than fire and also the only viable large scale source for a changing climate.

### Slide 3

Energy is governed by two strict scientific laws, both very simple.

First, you cannot make energy. It has to come from somewhere – and go somewhere too.

We call sources of energy “fuel”. Primary sources are important.

Only from them can we make secondary sources like hydrogen, hot water, food and electricity.

So we need to find the primary fuels.

The second law says that, left alone, energy runs downhill. When we see a balanced rock, we ask “what greater force put that up there?” and “why has it not already rolled down?”

A cup of hot coffee goes cold.

But from two cups of half cold coffee, you cannot make one that is hot.

So we are looking for the hottest cups of coffee on Earth!

### Slide 4

That brings us back to safety and control.

Concentrations of energy can be released by mistake.

Many of those that are unsafe and difficult to control, have already dissipated and become unavailable.

Let us look at the whole Universe and see what possible sources are available on Earth in large quantity.

## Slide 5

The Universe is empty and huge – its scales span 41 powers of ten.

By eye we can see 26 powers of ten (range marked in blue) – but we cannot see the electronic atom 100,000 times smaller, or the atomic nucleus 100,000 times smaller again.

Where are the primary energy sources hiding?

**Click 1** As early life knew, its energy came from Sun, weakened by the huge distance and often hidden by weather. Humanity rejected this energy as intermittent and unreliable when the Industrial Revolution came.

**Click 2** Fossil fuel energy was also primed by the Sun, but in geological times. With 10,000 times greater energy density and available 24/7. it drove steam and other engines. But it was rejected in 2015 for its emissions.

**Click 3** Nuclear fission power from uranium and thorium was primed by stellar collapse before the Earth was formed. A million times greater energy density than fossil fuels, available 24/7 and no emissions.

## Slide 6

Nuclei are incredibly small.

Not like the Sun and the planets. So small that from the edge of an atom you would not be able to see its nucleus without a telescope with 1000X magnification.

What a masterstroke of design for safety and stability!

Hidden away with all that energy, not one nucleus in a million on Earth today has changed in 5,000 million years. It remained undiscovered until 1896.

## Slide 7

And nuclear fission is safer than fire because the nucleus is fortified by an electric barrier that prevents any two ever approaching one another.

This logarithmic diagram illustrates how it would take a temperature of 10 million degrees for two to touch.

One day the problem of commercial nuclear fusion may be solved, but not for Latvia or anywhere else in the immediate future.

## Slide 8

So we should compare the three candidates.

**In the first column**, the renewables refreshed daily by seasonal sunshine that powers the weather. Whether moving wind or falling water the energy density is low. That is why their farms or plants are so large – and invasive to nature. Worse, they are unreliable, randomly available only 25-35% of the time and vulnerable in extreme weather. They are accepted only because they are familiar – they can be seen or felt.

**In the second column**, the fossil fuels have higher energy and their plant is smaller. Available 24/7 but their emissions are not accepted and their safety is poor.

**In the third column**, the energy density of nuclear is vast and the footprint compact. The only problem is public image, based on fear and ignorance.

**The comparison** also shows the fuel needed for all purposes for one lifetime:  
10 million tonnes of water behind a 100metre high dam;  
a train load of 500 tonnes of coal;  
1 Kg of pure uranium fully fissioned.

## Slide 9

How about safety?

The people are gone from the Chernobyl Exclusion Zone and it is still radioactive.

But the wildlife there is thriving, better than before, as shown in many documentary videos.

Do they know something that we don't? They have not watched scary reports of deadly radiation.

So what do they know? Nothing!

Sherlock Holmes, the detective, might reply

“Quite so. But maybe something we think we know, is untrue.”

Perhaps nuclear radiation is harmless at low and moderate doses!

## Slide 10

For 120 years we have used nuclear radiation for our own health, following the work of Marie Curie.

Moderate doses of 10 milliGray for one CT scan.

High doses to cure cancer, 1000 to 2000 milliGray per day, every day for a month.

Fortunately, Marie Curie was not afraid and worked carefully.

**Click 1** With the benefit of 30 years' experience, safety limits were agreed internationally in 1934. Unfortunately, the public fear of nuclear was weaponised in the Cold War – and still is in the public mind.

In the 1950s bogus science was used to tighten the regulations by a factor 700.

Responsible safety should now be re-based on firm science, and this change should be made today.

These levels can be explained simply with a diagram.

## Slide 11

The area of each circle represents a monthly dose.

The red circle is a dose fatal to a tumour in radiotherapy.

The yellow circle, half the size, is usually recoverable, as for healthy tissue near a treated tumour.

The green circle is the level agreed in 1934, confirmed as a safe acute dose at Hiroshima and Nagasaki and by all available evidence.

This should be used today.

So, there should have been no evacuation at Fukushima, no costly reactor upgrades, no compensation payments, no plant closure with replacement by fossil fuels.

The area of the tiny black dot is current public regulation level, 700 times too small.

## Slide 12

And what about the effectiveness of renewables? For instance, UK offshore wind – with batteries?

In March 2022 in UK the total power available sometimes reached its design 10 GW.

But for one week 21/28 the output averaged only 1.5GW.

**Click** The missing energy corresponds to the blue square, equivalent to 1700 Beirut bombs.

Like the ammonium nitrate at Beirut, a battery is a chemical energy store.

Lithium batteries can explode and they do rather frequently.

Beware of batteries as a solution to the unreliability of solar and wind.

## Slide 13

A small nuclear power station can provide steady power to local industry and users.

This could supply electricity at peak times, but hydrogen, desalination etc at off-peak times, and heating at all times.

Such a supply would contribute to local social stability, security and confidence in society and business.

It would avoid extended infrastructure, such as large grids and renewables, that are vulnerable in a changing climate.

## Slide 14

It would avoid the use of large batteries, known to cause serious accidents.

Here is the largest in Australia on fire. It took 4 days to extinguish it.

Both halves of the largest in California also failed last year.

One in Liverpool UK blew up, and others in Beijing, Arizona and South Korea, likewise.

And nuclear? Only one incident with loss of life in 65 years – Chernobyl where less than 50 died.

## Slide 15

“And what about the waste?” people ask. This is a bogus question, although that does not prevent many people earning a living and winning fat contracts by answering it.

In brief, there is very little waste because nuclear needs very little fuel.

Like human waste it can be recycled – in the nuclear case because it is only 1% used.

It is solid, not released into the environment and easily stored. After 600 years it is simply harmless.

Unlike human waste, it does not spread disease and is not contagious.

Unlike human waste, about which every child learns from age 1 or 2 years, nobody learns about it.

Unlike human waste that kills more than a million children a year, the radioactive waste from a nuclear power station has never caused a fatal accident.

## Slide 16

Fear of nuclear energy is the greatest cultural error made by humanity in the past 100 years, and with the onset of climate change this obstructs the only viable answer to climate change.

Why did it happen? Jobs and lack of education, fear soaked in politics and served up by the media in their hunt for exciting entertainment.

The solution?

Everybody should understand the world they live in, and not leave it to “experts”.

(As dealing with their own waste!)

There is much more in these two books – but no heavy maths, I promise!

Lots of references to follow if you want to know more. Available from Amazon or me.

If you want to read something scientifically stronger

<https://www.researchgate.net/publication/339629356> Nature Energy and Society A scientific study of the options facing civilisation today

or the case to challenge the high priesthood of radiation protection

<https://www.researchgate.net/publication/311175620> Nuclear energy and society radiation and life - the evidence 1

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