

# Net Zero Carbon – “Your Country Needs You!” aka “The Constancy of Purpose”

written by Steve Mackowski | February 23, 2023

That’s right. Your country needs you! Because it is every one of you (us) that needs to contribute to the goal of Net Zero Carbon if there is to be any chance of reaching the goal. Note here that it doesn’t really matter if you believe (or I believe) that the goal is attainable. What does matter is that if the goal is to be reached then the discussion below is how it can be achieved.

Since this is [Article 6 in my series](#) and I am expecting it to be the last, I wanted to do something catchy, hence Uncle Sam. But what I really want to highlight is almost the name of the next James Bond or Mission Impossible film – “The Constancy of Purpose”. The most important aspect of the whole approach. I’ll get back to that.

So, your mission, should you choose to accept, is to be part of the solutions that need to be achieved for the goal of Net Zero Carbon to be attained. This message will not self-destruct after 30 seconds, so you don’t have to hurry. You can re-read before you commit. And when I say to be part of, I mean actively engaged. It’s your part of “The Constancy of Purpose”.

1. Nuclear power. Any new additional power requirements of any size are to be provided by nuclear power. Any replacement power following a fossil-fuelled power station shutting down must be provided by nuclear power. Why? As previously demonstrated there will simply be not enough

[Critical Minerals](#) developed to supply our power needs from the renewables sector. There will also not be enough [STEM graduates](#) to fulfill the resources required. So, you have to be actively engaged in the development or expansion of the nuclear power solution.

2. Solar power. You have to accept that large scale remotely located solar power is a waste of the limited resources highlighted. There is not enough lithium to make enough solar panels. The need to co-develop long transmission systems and battery back-ups is an inefficient use of resources. Rooftop solar is fine as it fits into existing infrastructure, but a solar farm in the center of Australia with 1,000 kms of new high voltage power lines. Methinks not. And using the power to produce hydrogen! Well, let's get it straight. No government subsidies are allowed anywhere in this discussion. If it isn't self-sufficient economically, it isn't a solution. It's part of the problem.
3. Wind power. Another huge waste of limited resources for the same reasons as above. Magnets are better utilized elsewhere. End of story.
4. Electric cars. The symbol of inner city wokeism. I'll only browse here. Just imagine the upgrade to your district's electricity network needed to charge even 20% of electric cars. Just imagine who is going to pay for the upgrade of the apartment block's electrical system to accommodate a significant increase in demand. Many thousands of dollars per apartment! Is it an efficient use of resources to span our countries with additional electricity transmission infrastructure? Resources are short remember! So, stick to your guns (oops, cars). OK. I'll let you have a hybrid!
5. Human Resources. Once we have the issues above well planned and in train, we can then define the [STEM needs](#) to achieve the goal. All levels of our education systems need

to change. And you have to be part of that. Whether as a parent or grandparent, or maybe just a concerned voter influencing our governments, we have to fix this. You have to encourage your children, you have to lobby the governments. The volume of STEM graduates needs to dramatically expand and be focussed. “The Constancy of Purpose” again.

Now sure, everyone has their part to play, but tokenism is not healthy. As [reported](#) in The Australian Newspaper, Sunday, February 12, 2023, by Robyn Ironside, is having the “greenest” airline really that important? When the solution requires orders of magnitude more production of “sustainable”, but still carbon dioxide emitting fuel at increased costs?

These “solutions” are wokeisms in play. Change the definition of sustainability and it becomes OK. Well, that is not acceptable. Net Zero Carbon is a real goal and is not to be fudged. I get pretty enraged when I read that EU power stations are burning purposely grown “wood waste” instead of coal and claiming zero carbon emissions. This is fixing the books, not fixing the problem.

## **“The Constancy of Purpose”**

“The Constancy of Purpose”. Who does this apply to? Well, if the world is going to achieve the Net Zero goal, well then, the world needs to have “The Constancy of Purpose”. LOL sorry, couldn’t help it. The developed world and the developing world are streets apart here. Only the developed world is chasing the goal. The developed world wants the developing world to also chase the Net Zero goal. But how can they? In a resource-constrained world, do you really think that the developed world will allow those limited resources to be deployed in developing

countries?

Maybe they should if the overall balance to Net Zero indicates that is the most resource-effective answer. Methinks not going to happen. Our political classes are too focused on their own political survival (and ideological orientation) to let valuable resources out of their grasp. That got me thinking about how to determine resource utilization effectiveness on a global scale. Another time, another series. But it will come to that distribution question. Why? Because there will come a time when the developing countries will see that they are being starved of resources by the developed world to attempt to meet their own Net Zero goals. And sorry developing world, you can't have any! Not a pleasant thought.

So, what chance Net Zero? [An article](#) from The Australian newspaper, also on Sunday, February 12, 2023, by well-acknowledged editor, Greg Sheridan, seems to present the argument that is most often proffered.

## Net Zero Carbon?

Again. Very negative. My views on Net Zero Carbon? The Critical Minerals developments needed can be addressed. Will take a major shift in Government approvals timing though. The choice of power technology to be nuclear focussed is again achievable but will take some guts from some governments. The Human Resources issue is again achievable, but it would mean the end of the woke revolution in our education system. Achievable yes, in practice – No!

Net Zero Carbon by 2050 on a global scale? No chance! The emissions from the developing world will continue to grow. They will not have access to the resources needed. Well, how about on a local scale, by Country say? In the US or Australia, or the

EU? “The Constancy of Purpose” test gives me no confidence. Twenty-five years of focussed efforts to achieve a goal that not even a majority of the population understands, acknowledges, or prioritizes? Methinks not.

We will just have to advance at a pace that results from ignoring the requirements that could move toward the answers. No wonder the Cheshire Cat has such a wide grin!

However, if you still want to do your bit in the Net Zero challenge, remember. “The Constancy of Purpose” may be coming to a theatre near you. So, thanks to movie-world for the license and to Forrest for the end quote: “Well, that’s all I have to say about that.”

---

# Decision Time: The Cheshire Cat Method or STEM for a Net Zero Carbon Future?

written by Steve Mackowski | February 23, 2023

This is now Article 5 of the **Net Zero Carbon** series. In Articles [1](#) through [4](#) ([“Net Zero Carbon and Other “Planning Dilemmas” starting with Rare Earths – Part 1”](#), [“Net Zero Carbon and other “planning dilemmas” – Part 2”](#), [“An ESG Armageddon, Net Zero Carbon and other “planning dilemmas” – Part 3”](#), and [“Is it an ESG Armageddon or are you The Survivor? – Part 4”](#)), we have progressed the first two planning dilemmas facing a 2050 target of Net Zero Carbon, those being: Physical Resources and ESG Concerns. We now have to deal with Technology, Power

Requirements, and Human Resources.

And, as I sit here thinking about the last three planning dilemmas to face and the order in which I will discuss them, I find my mind revolving in a circle. My thoughts keep jumping from one to the other to the other as the linkages become more clear. Perhaps that is it, they are linked. The resolution to the Human Resources planning dilemma depends unequivocally upon which Technology is utilized and which Power Requirement wins out. Follow the thinking. I'm starting with Human Resources.

As I discussed in the articles on [Physical Resources](#), there needs to be an across-the-board explosion of new Critical Minerals developments to meet the source materials needed to achieve any Net Zero Carbon timeline targets (irrespective of the technology and the timeline of 2050) through the renewables route. Never mind the creation of Western capacity to refine the metals, configure the alloys, produce the componentry and install them within manufactured products. Where are the Human Resources going to appear from? In Australia, I look at our Universities churning out non-STEM (Science, Technology, Engineering, Mathematics) graduates and question: Are these the non-STEM people needed to get through the Human Resources dilemma? I think not.

I look at our High Schools and find it impossible to picture these young environmentalists taking up STEM after graduation. I look at our Primary Schools and see what? Kids having days off to attend protest rallies to "Save the Planet". I see nothing to encourage me that our education systems are geared, gearing up to, or, preparing for the STEM Human Resources challenge that awaits us to achieve the Net Zero goals that everyone seems to desire. Scary huh! Seems to me that THEY will do it! Not me! THEY.

But do not despair. There are examples. The Chinese did it! It took a couple of generations. I'll come back later to that solution. The West achieved an unimaginable increase in its manufacturing efforts during WWII, so we've done it before. JFK also achieved a similar STEM focussed, an unimaginably large project, by putting a man on the moon. BTW would love to read a book on the planning dilemmas involved in developing such a space program. What a valuable reference. Would be a University classic must-read! That is if it was allowed on the syllabus. Can't offend the Flat Earthers!

So, Physical Resources coupled with ESG Concerns and Human Resources to achieve Net Zero Carbon by 2050? Not to that timeline with renewables only, methinks! Oh, the Chinese solution. Relocate your impoverished poor to government-built accommodation. Educate them to meet the industrial revolution you are creating. Promise lifetime jobs. Could this occur in the US? My answer later.

You are all aware of how China has successfully taken over the industrial world, so I will not re-iterate that history here. But what I will relate to you, is a program I was a minor part of in the mid-'80s. As a large-scale iron ore company, we, like all others, wanted to export more. China was the target, although then, just a minnow!

*"Let's use Western knowledge to help them manufacture stuff out of our iron ore and we can buy that stuff back. Good for us, good for them. So let's start making cast iron grinding balls in China".*

Result: early failures! Head Office response: *"these guys will never succeed"*. At the same time, an engineering friend of mine was researching the production of military helicopters. The objective was to pour molten aluminum into a cast for the

helicopter frame in a single process with no joints (and no cracks on cooling). Why? Secrecy and flying radar blind. All that space race stuff. But never mind. Despite many attempts, they were not succeeding. I mentioned that the Chinese had been casting life-size bronze elephants with a 5 mm thin skin, meeting the same cooling parameters he was attempting to achieve with his helicopters for the last 1,500 years. The point? The point is that the Chinese knew how to cast. But they had yet to develop the industrialization skills needed to do it at scale. Boy, did they catch up in a hurry.

I have mentioned in articles and comments my exposure to the Chinese industrial technology degree process. This was China's answer to accelerating STEM graduate numbers. All employees in rare earth value-add factories are University students. They are learning the practical side of the technology while studying the science side. Their tutors/lecturers are their supervisors and managers. And here's the magic part. Each business has a University certified "Professor-ranked" scientist. He mentors, assesses, and grants qualifications to the employees when they reach the required level of competence. How's that for setting up your resources for the future. Again, however, I cannot quite see this occurring in the Western world.

So where I am going with this, is simple to say but comprises an immensely challenging set of tasks to do. Unless we totally overhaul our entire school system, educational processes, and universities, we will not be able to deliver enough STEM graduates to do all the things that are needed to create, design, install and operate those technologies that can take us through to Net Zero Carbon by 2050. A short-term answer to part of that issue is Cadetship and Mentoring whichever way we go. All of us old engineers are available (never quite retired) and I'll be willing to help young graduates develop the skills and experience as we transition to the new wave of STEM-focused



education.

There is obviously a significant gap opening up in our capabilities to achieve Net Zero. We have to become resources efficient in all aspects. So we must now look at the technologies we have focussed on to bring us here and perhaps think again.

Remember this is a journey where we think about a target and how to get there. I am working on thoughts about the balances required to achieve our 2050 goal.

Reference: Lewis Carroll. Alice's Adventures in Wonderland. The scene where Alice meets the Cheshire Cat sitting in the tree at the fork in the road. I'll paraphrase.

Alice: *which way should I go?*

Cheshire Cat: *depends on what you are looking for*

Alice: *I don't know what I'm looking for*

Cheshire Cat: *well, doesn't matter which way you go*

Well, it does matter if you go the wrong way and deliberately do not look back and review your decisions. I want to go back in time. Back in time to some fork-in-the-road moments and how those decisions changed mankind. I'll keep it short and simple. I'll abbreviate!

Firstly, man discovered fire. Probably in a painful way. But saw its value and started cooking meat. The brain grows and intelligence expands. Burning wood was a good decision. It gave mankind the intellectual boost to discover and utilize coal – steam engines and stuff. Industry. Commerce. The discovery of the concentrated energy of coal and its utilization was another good fork in the road call. STEM was in its heyday. The

Industrial Revolution allowed our intellect to discover oil and gas. Note here that each transition of one energy form to the next expands our intellect and allows the expansion of mankind's capability.

It is now that we get into trouble. The decision to go nuclear was the next key fork in the road moment. Some countries went right and others went left. Let's see where the left fork has taken us. With no nuclear, baseload power is significantly produced from fossil fuels. Sure hydro works, and of late solar and wind are getting a foothold. But go back to the Resources articles. There is not enough Critical Minerals development for this journey to succeed on a world basis. Tax incentives aren't the answer. Carbon credits aren't the answer. We need to go back to that key fork in the road and ask that question again. Should we go nuclear and replace fossil fuels? Knowing what we know now (but some refuse to accept) is that solar and wind cannot supply the majority of our base load needs. We are still in transition getting out of fossil fuels (where appropriate) and getting into nuclear. Sure renewables have a part to play but only in a niche way where their use is truly beneficial and economic (another article).

So, if we still want to get to Net Zero Carbon by 2050 we have some serious questions to answer. Some ideologies need to be challenged. And since the resources are limited and geographically dispersed across countries, ideologies, and cultures, my next article where I will provide the roadmap should be compelling reading. Left or right time with the Cheshire Cat!!

By the way, I am approaching the key (by market capitalization) Critical Minerals Australian-based people on the Australian Stock Exchange to present to us their ESG credentials. Critical Minerals covered include those mentioned in the 2022 [Critical](#)

[Minerals Strategy](#), March 2022 developed by the Australian Government.

The Critical Minerals referenced include Lithium, Rare Earths, Vanadium, and Cobalt.

Hopefully, the Australian companies will provide us with their ESG credentials and this can give them an additional means of communicating their ESG efforts. InvestorIntel publication can then supplement their normal communication processes. An example of which is Arafura Rare Earths Limited (ASX: ARU) [Greenhouse Gas Emissions Reduction Pathway](#) published recently to the Australian Stock Exchange.

In the next article, you, yes you, will have some Cheshire Cat opportunities.

---

# Is it an ESG Armageddon or are you The Survivor?

written by Steve Mackowski | February 23, 2023

**Net Zero Carbon – Article 4. A possible way towards meeting an ever-expanding ESG agenda.**

Wow. Article 4 is here already and this will finalise my thoughts on how ESG Concerns are going to have an influence on the Net Zero Carbon goals. And as a reminder, this is only two points off the list. Further articles will address the issues of Technology, Power Requirements, and Human Resources.

In my first article, I introduced a [planning dilemma](#) that I had

been tasked to look into. Mining in a First Nations National Park. Sounds daunting but there are planning/decision steps you can control and others you cannot. This ESG response that follows was part of my solution to that dilemma. It is also a major part of the ESG issues that will be faced as we attempt to advance on a Net Zero Carbon future. It is also my generic model for any resource business.

As we move into an age where accountability looms large, it would seem obvious that our systems, our processes, and our outputs need to be transparent, understandable, and very importantly defensible. You may think of your systems as your legal defence should things go astray or as your curriculum vitae (CV) to attract/impress your stakeholders.

### **Step 1. International certification of your management systems.**

The [International Standards Organisation](#) (ISO) is an independent, international organisation with a membership of 167 national Standards bodies. Through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that support innovation and provide solutions to global challenges.

OK. That's the official words but what is it to us? It's independent. It's internationally accepted. It's certification of your management systems through thorough independent, industry-experienced professionals who audit every relevant aspect of your business. So, your environmental management system can get the ticks (ISO 14000 series). As can your safety and health system (ISO 45000 series). This is where you can address the recent EID (Equality, Inclusion, Diversity) inclusions as a mental health related issue. You can also include your risk management systems (ISO 31000 series). And it will also be wise to include your quality systems (ISO 9000

series) as the internationalisation of the Net Zero Carbon solution progresses. That may seem like a lot of expense (it isn't if you do it properly). I prefer to define it as the cost of doing business. It's your instruction manual. It's the way we do business. It's also a line of defence should anyone challenge your credentials. I prefer to see it as a starting point to excellence. Remember the First Nations National Park.

## **Step 2. Becoming a Best-in-Class operation.**

Now you may think that ISO certification is a pretty good standard to reach. As it is. And it's cost effective if you think of it as a type of corporate insurance policy. I use it as the glue of the business. Operation to the Standards, verified by independent audit, is a foundation that maintains the status quo, while capturing any gains your business can attain through commencing the journey to best-in-class. The Standards don't really help here in the way of further improvement. The Standards encourage a continuous improvement ideal but of themselves do not provide the mechanism to get to a position of excellence. I will introduce a suite of tools which when used properly provide an excellent road map through regulatory compliance, ISO certification and onwards to best-in-class.

I would like to introduce [DNV](#). Det Norske Veritas. (The Norwegian Truth).

DNV are an independent expert in assurance and risk management. Driven by their purpose, to safeguard life, property and the environment, they empower their customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organisations, they use their knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations.

For us, though I would like to reference three of their system development products.

The International Safety Rating System (ISRS).

ISRS consists of 15 key processes, each embedded in a continual improvement loop. Each process contains sub-processes and questions. It is designed as a measuring tool but I have used it in reverse by utilising the questions within the sub-processes to design the steps and activities needed to build the management systems itself. So your progress through regulatory compliance, ISO certification and progress to best-in-class can be planned effectively and rolled out as part of your normal business planning process.

The following is an extract from the DNV website.

An ISRS assessment is a thorough evaluation of these questions and involves interviews with process owners where the questions are scored and commented. The scope of the assessment is entirely flexible determined by the size and complexity of the organisation and the management team's requirements. Detailed verification is conducted and organisations must be prepared to offer evidence to support their answers. The process scores determine an overall level of performance between one and ten. The results provide a detailed measure of performance and a gap analysis against the organisation's desired level of performance. This becomes the planning basis for improvement during the next period. ISRS seventh and eight editions are structured with 15 processes embedded in a continuous improvement loop:

1. Leadership
2. Planning and administration
3. Risk evaluation

4. Human resources
5. Compliance assurance
6. Project management
7. Training and competence
8. Communication and promotion
9. Risk control
10. Asset management
11. Contractor management and purchasing
12. Emergency preparedness
13. Learning from events
14. Risk monitoring
15. Results and review

During my early years of developing ESG systems, the ISRS protocol was extensively used around the world and is available today. To expand the ISRS concept, DNV further developed IERS (environmental) and IQRS (quality). I used these protocols to fully integrate ESG into the normal business planning process. And then the benefits can be clearly seen and achieved (My next series of articles: *Better business outcomes using ESG principles*).

### **Step 3. Communicating with stakeholders**

Having developed your systems and implementing best-in-class processes, you want a return. This clearly comes by effective communications with your stakeholders. Everyone should know about your efforts and achievements. How else do you think you will be trusted/selected to do that First Nations National Park project? How else do you think the Critical Minerals developments necessary to attempt to reach Net Zero Carbon will continue to get effective and expeditious approvals from the regulatory bodies? How can you provide a response to the eco-challengers that are surely lurking ready to cancel you? And very importantly, how to convince prospective employees that you

are the industry that they wish to base their careers around?

Here are some promised references you may wish to peruse to help your thinking on the Net Zero Carbon quest. You may think I am biased towards the negative on this issue. Nothing could be further from the truth. I have sufficient solar power installed such that I require no annualised input from the grid; I am self sufficient in water supply; I am an active recycler and my property has been developed with full ESG aspirations in mind. The fact that I haven't provided more fact based pro-Net Zero articles is purely to do with, well, they are not available, compared to the numerous pro-nuclear and negatively focused anti Net Zero Carbon debate. I will keep you posted.

### **The Australian newspaper, January 11<sup>th</sup> 2023**

Ted O'Brian. Federal Government opposition energy spokesman.

[Nuclear Energy? Who better to ask than Japan, whose history is inextricably linked to it.](#)

Comment: Part of the Australian proposed debate on the future of nuclear power.

[The Rice Video – CO2 in perspective, Malcolm Roberts. The Galileo Movement.](#)

One Australian view of the issue of anthropological climate change.

Comment: A little old, but the numbers used are factual.

Till next article, stay safe.

---



# Net Zero Carbon and other “planning dilemmas” Part 2

written by Steve Mackowski | February 23, 2023

In [Part 1 of this series](#), I introduced the concept of going to the plan’s end result and working backwards through the planning process. I recommend this for some of the more difficult planning tasks, as it eases the mental burden. By that I mean, when faced with the challenge of planning for the world to meet a net zero carbon by 2050, the mental challenge is enormous. So, let’s break it down.

A world that is meeting a net zero carbon target by 2050 will have to have achieved many linked but somewhat individual tasks and schedules. There are simply too many individual tasks to list, so I’m going to try and sub-group so that we can at least get a conceptualized overview of the challenges ahead.

1. Physical Resources.
2. Technology.
3. ESG Concerns.
4. Power Requirements.
5. Human Resources.

I’ll try and cover each sub-group and provide linkages as we develop our thoughts. FYI. I have heeded my own advice here and started the process from the end and worked backwards. What you’ll see are my thoughts and impressions formulated over many years in Critical Materials, ESG management, and planning, coming together hopefully with each article to get us all on board and with a clearer, more transparent, an honest view of the Net Zero Carbon issue, a Net Zero future and its requirements.

OK. Let's start with Physical Resources. You will have all been made aware by various reports that the amount of Physical Resources required for electric cars, wind turbines, solar power farms etc. is enormous. If not gigantic. It is certainly numbers of orders of magnitude bigger than current production levels. It is staggering to try to imagine 10 times (for example) the production of lithium, copper, chromium, rare earths, etc not to mention the steel and aluminum required for associated infrastructure. But let's put the issue of scale aside for the moment. I want to first dispel the notion that recycling will be the answer. I am not going to say that recycling is not important and should not be avidly pursued, but what I am saying is that recycling is not the "big-ticket" answer to the Physical Resources requirements. I'll demonstrate with a mathematical exercise.

Let's look at the current level of batteries (as an example). We need an assumptions list. We need a current output level, let's use a starting point of 100 units. Each battery will last 10 years. The growth in the need for batteries is positive 10% per year. These absolute numbers are not really important in this discussion. It is the understanding of where they take us that's important. OK. Question one – how much recycling can you do in year 1? Answer – None. There are no batteries to be recycled. They last for ten years! So not until year 11 are batteries available for recycle and these are the now "dead" year 1 units. 100 of them only. Then 110 in year 12. 121 in year 13.

I know I have simplified the situation but as I will repeat throughout this series of articles, it's the overall impact that needs to be understood, not the detail as such. Look at the following table of units needed to meet demand, the resources needed versus the effectiveness of recycling capacity.

Year	Batteries Demand	Additional Capacity to supply	Recycle Available	Cumulative Additional Capacity	Utilize Recycle to get new Capacity
1	100	0	0	0	0
2	110	10	0	10	10
3	121	21	0	31	31
4	133	33	0	64	64
5	146	46	0	110	110
6	161	61	0	171	171
7	177	77	0	248	248
8	194	94	0	352	352
9	213	113	0	465	465
10	234	134	0	599	599
11	258	158	10	757	747

So, it's not until year 11 that recycled batteries have any effect. The battery demand and the resources required will have increased between 6 and 8 times by then. In fact, it won't be until at least year 15 that any noticeable effect of recycling will be noticed. So, recycling may be a small part of an eventual solution, but it is not the saviour. Only increased output is. And increases in mining, processing, refining and manufacturing of this scale is to say the least challenging. And to meet the time challenge of 2050?

Well, let's muddy the waters of our planning process a little more and introduce the complication of co-dependence. And by that I want you to think about the example of making electric cars. To make one car you need enough of the various components to do that. Obviously! But what happens if you do not have any of component X? (Think of the current microchips issue for

example). The whole schedule stalls until the production level of component X meets the needs for that volume of production. Now think back over the last ten years at the junior rare earths space. Why haven't they developed the capacity to meet the predicted needs? Well, the end user, the car companies in this example, didn't expand as fast as first thought (or is that hoped?) and the explorer couldn't get market contracts to justify getting the development capital. So, the co-dependence of the car company and the junior explorer, stalled the junior's development. In fact, it shut down many of the juniors. Those that managed to stay alive are now facing more years to get back up and the co-dependence will again surface as the slow ramp up of rare earths output will directly impact the growth of the output of electric cars! What is the impact of this co-dependence of mining development for the rare earths in the magnets needed for electric car output requirements in 2050? It will take some planning. Especially when you throw in the mix the co-dependence of all the other resources required, particularly those critical materials with a long timeline to development.

Another term I use is cross-dependence. Again, in the electric car example, the vertical supply chain for each element or assembly, or whatever, can be influenced by a separate although essential vertical supply chain. Let me explain. If you need as an example to create a vertical supply chain for each of three new components, say, the magnets (from rare earths), the batteries (from lithium) and microchips (from silica), will the planning process allow for the indefinite delay in one or more of the components? That is to say, can the rare earths development timeline needed for the magnets be affected by an extensive delay in the creation of a process, or development of the resource, for say, lithium? Or silica? Of course, it can. The justification for the planned development of one is impacted

by the achieved development timeline of the others. The car needs a number of successful developments in critical minerals in separate supply chains (and other components) to reach the final stage, producing the required number of vehicles by the timeline stated. And they have to have matching timelines otherwise the imbalance will cause a market condition where the component being developed the fastest may be stalled by the delay in the component being developed the slowest. Although co-dependence is taught in most Economics courses, as it is standard supply chain logic, cross-dependence has become much more odious today as the need for new components comes to light. And this is only the Physical Resources. Can you see this isn't a simple "Supply Chain" issue. Its not one component we are looking at here. It's many. It's a "Supply Array" issue!

Now we are getting started! Now consider the implications of the Republicans' defeat at the last USA elections. Did that have implications for the 2050 target? You betcha! As will the EU response to the looming energy crisis across Europe this winter. I'll call this dependence Geopolitical or GP-Dependence. So, we now have added another dimension to the planning process. The planning dilemma has to deal with a "Supply Matrix"! Wasn't in my Economics 101.

Now, that's just for electric cars! You now have to throw in co-dependence, cross-dependence and GP-dependence with all those other required developments that together meet the 2050 target, some of which it has been stated that the technology does not yet exist! And remember, all of these developments are competing for the same resources! The Critical Minerals at least. This "Planning Dilemma" is on a scale probably never seen in the Western World. Well, not since World War II.

I think that's enough on the Physical Resources issue. There have been many articles, reports etc on this topic from others,

but don't forget the reasoning behind the issues of recycling, co-dependence, cross-dependence and GP-dependence. It will come back later.

I'm looking forward to reviewing the Battle of the ESG Titans online debate as ESG is a passion of mine. Since the Battle was live at 3am Thursday morning 15<sup>th</sup> December in my part of Australia, I will change the order of the 5 sub-groups listed above for discussion. I'll discuss ESG concerns next (article 3), to incorporate thoughts from The Battle, and discuss Technology in article 4.

I'm thinking: have a great time over the holidays, stay safe and see you next time.

---

## **Net Zero Carbon and Other “Planning Dilemmas” starting with Rare Earths**

written by Steve Mackowski | February 23, 2023

In the last 5 years since I last wrote for InvestorIntel, as they say, there's been a lot of water under the bridge. But 5 years ago, could you have predicted the actual water flow? Could you have had a target? Where is Macca's head space at? Well as usual I'll get there. So the last 5 years have been part of my “eco-retreat” project taking our property to almost pristine Australian forest, complete with all the native wildlife that goes with that. Achieved – yes! To plan – pretty much. Took longer but a few un-planned for health issues slowed me down,

but overall happy. So a good plan? Well yes, but why was that? I'll get back.

So the majority of Western nations are planning for some sort of climate change management by targeting "net zero carbon". Is that a plan? Is that an inspiration? Is that a target? Well, a personal anecdote may help to answer that. Twenty odd years ago I was asked if I could develop a plan to mine and process the resources of an island. "What is the time horizon", I asked. "That's part of your plan", was the response. OK! Background necessary to consider. The island is currently a National Park and has been granted First Nations custodianship. The resource is conventional and processing is not difficult. So what is the plan going to allow for? First point to learn here is do not start at the beginning and progress forwards, i.e. resource definition and all the normal stuff. That will consume a lot of time if you can't get a plan that has any chance of working. Start at the end and work backwards. What must have happened to allow such a controversial project to develop? Remember, this is First Nations and National Park. Was the request by the MD for a plan? A verification of his dreams? A realisation into practice through a lofty target? What is akin to "net zero" when there is no detail, no costs, no resources? In fact, it is worse than that since it has been stated that net zero will need "as yet unachieved technology" to get there.

Let's look at rare earths for a while. Circa one hundred years ago, some enterprising alchemist discovered the rare earths group (I am not going to write a history paper). He dabbled and found out that a mixed rare earth alloy could be used as a flint generator. Misch metal was born. Did he have a dream to produce magnets for electric cars? Not yet! A couple of decades later when catalytic converters were developed for motor vehicles, the use of lanthanum oxide powders was big news. Poor cerium prices went through the floor. Electric cars the dream yet? Not yet.

Not until the development of computer chips and the need for cerium polishing powders, did the rare earths scene buzz again. Electric car dreams? Not yet. Then came magnets in the 90's and the boom really starts. Boom goes neodymium-praseodymium (Nd-Pr) for magnets, boom goes Yttrium (Yt) for lighting, then boom goes Samarium (Sm), Gadolinium (Gd) and (Dysprosium) Dy for better magnets. Then boom for electric cars? Not yet? Why not after 100 years of technical development hasn't the dream/plan/target of electric cars (and net zero?) occurred? It needed the western world to commit to the target of net zero with the goal of saving the planet. So, could have the dream of electric cars been planned for 100 years ago and if so what would it have looked like? A series of as yet unknown new technologies with an unknown timescale and an unknown cost? Sound familiar with net zero planning?

Back on rare earths today. We are finally seeing traction on some of the junior explorers of the early 2000's. Take Arafura Rare Earths Limited (ASX: ARU) as an example. For many years the resource was known, the technology was defined, the way forward was clear, but what were the "planned" construction dates? Three – five years post Bankable Feasibility Study. That was over 10 years ago! What was wrong with the planning? Nothing! The caveats of financing and marketing achievement and timing were not met. Not met until this year when the motor companies finally saw their electric car future (a future they were perhaps forced to see) which led to financiers being amenable to the funds. I want you to see a process here, that is the planning process broken down into individual steps and timelines. Did the mining company meet its resource definition target? Yes. Did they reach their process definition target? Yes. Did they meet their BFS target? Yes. Did they meet their marketing and finance targets? Yes, but it took an extra 10 years. What do you see here? Some targets met as planned, other



targets met but later than originally planned. What is jumping out? Hopefully, you can see that Arafura met the plans that were under its direct control – the resource, the process, the engineering, the costing. The marketing and finance however were not under their control. They could perhaps influence the market and the financier, but they could not control. Hence the delay. So what's the lesson to be learned here? Yes you have to be good at the resource part, the chemistry and the engineering but you have to have the toughness, the hanging-in there, and the ability to stay alive until those uncontrollables that are part of your plan align and the main wheel starts to turn again. You can influence but you cannot control. What has this got to do with net zero planning? I will come to that in my next piece but I know you are waiting to find out about the plan to mine a resource on a First Nations National Park.

Imagine an island. A paradise. A National Park that has had its custodianship legislated to the First Nations people. It has a resource, a very valuable resource that you have been tasked to define a plan for its development. So what did I do. I started at the end. Asked the question: "What are the conditions that would need to be satisfied to achieve the goal". (Keep the net zero in the back of your mind. All will be revealed.)

Condition 1. The First Nations custodians must be happy. Condition 2. The Governments and their bureaucracies must be happy. Condition 3. The multitude of ESG focused groups must be happy.

I'll stretch the word happy and settle for appeased. What would appease these groups? Well my first thoughts were around a serious military conflict justifying a Commonwealth takeover of all resources and territory, but I thought that was stretching the justification too far out of my tasked planning horizon. So a few examples. Doesn't matter how real you think they are, they

are just possibilities. The important bit comes after.

1. An animal of world significance is on the island and is looking at extinction unless some serious and expensive actions are taken. Or.
2. A similar situation with the whole ecosystem. Or.
3. First Nations heritage is under severe threat.

All issues require significant funding, but there is no money available. Only the development of the resource and the satisfactory rehabilitation will provide the funds to continue. Never mind the reality part, that's out of my control. But what is in my control is why should the government select my company to be trusted to do the development. These are the things that you can control. These are the things that you can do now and in the future that will develop your toughness and increase your chances – while hanging-in there, and staying alive until those uncontrollables that are part of your plan align and the wheel starts to turn again.

How much water did I plan for to go under my bridge, in my retreat rainfall, catchment and erosion plan? The 1 in 100 year rain event was my guide. But got 2 such events in 2 months. An event out of my control. I am still recovering/upgrading and yes, changing my plan. See you next time for more on the “Net Zero” planning process.

---

# US based rare earths processor, Energy Fuels announces a very robust third quarter

written by Tracy Weslosky | February 23, 2023

With COP26 just past its middle mark today, the stock rallies jettison around critical materials such as rare earths, cobalt, and lithium for electric battery materials, we at [InvestorIntel.com](https://InvestorIntel.com) are being deluged by interest from investors due to our editor in chief [Jack Lifton](#)'s reputation as a renowned authority. Add in uranium, which is finally getting some attention it deserves with greater education in place on the value of [nuclear energy](#) as a leading cleantech solution, Obama's speech at COP26 that astutely draws attention to the global pollutant leaders, China coming in at a strong #1, and yes, the USA – we are #2.

In this drive to clean up the planet, however, let us draw attention to a global leader as the world forges ahead to a [Net Zero economy](#) in the next 20-30 years – [Energy Fuels Inc.](#) (NYSE American: UUUU | TSX: EFR).

North America's only processor of rare earths, Energy Fuels provided a very robust [third quarter report](#) earlier last week. The company owns the White Mesa Mill in southeast Utah, which is also the US's only commercial licensed processor of radioactive materials.

Energy Fuels has a strong balance sheet and ended the quarter with US\$100.8 million in cash and marketable securities as well as \$29.3 million of inventory, which has a current estimated

value of \$46.9 million, made up of 691,000 pounds of uranium and 1,672,000 pounds of high-purity vanadium, both in the form of an immediately marketable product.

Mark Chalmers, Energy Fuels' President and CEO, said it best: "Energy Fuels continues to make rapid progress toward positioning our White Mesa Mill as America's "Critical Minerals Hub," by maintaining the Mill's key uranium and vanadium production capabilities while further diversifying our portfolio to include rare earth elements production – an exciting and strategically important move both domestically and for the Company. We also continue to watch the uranium markets closely in order to best evaluate our opportunities to capitalize on recent price increases and market improvements."

The company also has been focusing its asset base on the sale of non-core, conventional uranium projects located in the United States in late October. The sale included cash on closing, shares in the purchasing company, future potential processing revenue as well as future potential payments based on new production from these assets.

The strategic positioning of Energy Fuels should not be underestimated by anyone following this sector. The global drive to Net Zero requires a massive amount of "clean energy". This clean energy is destined for millions of new electric motors in wind turbines, electric vehicles and the never-ending consumption of small, strong permanent magnets in personal electronic devices. The demand so far outstrips the current supply that it is an almost inconceivable problem as the Western world seeks to eliminate the Chinese supply chain for critical materials.

Energy Fuels currently has the only facility in North America that is on track to start meeting this demand. They successfully

[delivered rare earth](#) carbonate to [Neo Performance Materials Inc.](#)'s (TSX: NEO) rare earths separation facility in Estonia. The company has a supply agreement for monazite sand from a United States supplier and is receiving multiple inbound expressions of interest for rare earths processing from potential suppliers around the globe.

The indisputable fact is that the clean energy economy will cost trillions of dollars and require resources that are not even in existence. We pledge as leaders in news and information on the critical materials sector to continue regular coverage of companies in the capital markets that are making a real difference.

Note from the Publisher: Tracy Weslosky is long Energy Fuels and Neo Performance Materials.