Iran Oil Endgame: USA Destroys THERMODYNAMIC Economy | Powell

The Iran War is not about what you see. But about what you can't consume. Join me for a talk with professor Warwick Powell on his newest book about the Thermodynamic economy. Warwick's book: https://www.amazon.co.jp/-/en/Dr-Warwick-Powell/dp/9699293209 Support us on substack: https://pascallottaz.substack.com Shop and Donations: https://neutralitystudies-shop.fourthwall.com

#Pascal

Welcome back, everybody, to Neutrality Studies. My name is Pascal Lottaz, and I am joined today again by my friend and colleague Dr. Warwick Powell. Warwick, welcome back. Great to be with you, Pascal. Warwick, you wrote a wonderful new book—let me try to show it here. It's called *Thermodynamics in a Time of Monsters: Rethinking Theory, China, and International Geopolitical Economy.* This is what we want to talk about. And actually, your approach has a lot to do with what's going on today with Iran. So, first of all, congratulations on your new book. And second, can you tell us a little bit about why this idea of thermoeconomics is so relevant right now for understanding the conflict that's unfolding in front of our eyes?

#Warwick Powell

Well, basically, the argument is that human societies and socio-economic systems are grounded in our ability, as human beings, to harness the thermodynamic potential of the world to overcome the entropy that is intrinsic to the dynamics of thermodynamics, and to continually engage in processes of energetic renewal. That's how we generate the surpluses we need to sustain the complex systems we've developed. So that's the underlying theoretical tone, I guess. The way it dovetails into the situation that's tragically unfolding in West Asia is that, in many ways, we can approach this conflict as an expression of the contradictions at the heart of different regimes of thermoeconomic accumulation.

So, for the better part of a hundred-odd years, and particularly since the 1960s, the global economic landscape, buttressed by American military power, has been tied very much to the ongoing development and availability of low–energetic-cost energy sources—particularly oil and gas from West Asia. The way in which the economic system, the economic metabolism, can power ahead is by accessing what I call high energetic return on energetic investment possibilities. And what West Asia—the Gulf states—offered was precisely that, at a global scale.

#Pascal

Sorry, what you mean is, you get a lot of energy for pretty cheap exploitation, right?

#Warwick Powell

Pretty cheap effort, right? So just think of it as effort—you put in a certain amount of effort to get access to a bunch of stored future possibility. One barrel of oil does the work of so many humans for five years, for example, measured in pure energetic terms. That's how powerful an energetic resource this particular part of the world has been, and why it's been so central to late-stage industrialization. And now we're witnessing the manifestations of all sorts of schisms emerging within the fundamental substrates of how, particularly, the leading economies have in many ways sat on their hands—not necessarily by choice. I'm talking especially about the United States, which has, in many ways, institutionally and politically, lost sight of the need for energetic renewal and become trapped in a process of entropy.

It's becoming less cohesive. It's fragmenting. And that's a symptom of a progressive—though at first hard to see—reduction in the overall energetic efficiency of the system at large. So as systems, in a sense, torture themselves to deal with the fact that they've got fewer energetic surpluses to do all the things civilizations try to do, they begin to lash out because there are distributive consequences. There's simply less surplus energy to go around, and different societies and institutions deal with these symptoms in different ways.

In the United States, some of the ways we've seen these problems manifest are in homelessness and similar issues, right? But these are worldwide problems. They have to do with the constraints, if you will, that nature continues to impose on us. We've had a great run for a couple of hundred years, but it's actually ending for a lot of places around the world. The foundations of that run are now becoming less energetically efficient to access.

#Pascal

This is a very interesting way of framing a couple of the problems we've been talking about on this channel for quite a while. I mean, the concept you're using here—thermoeconomics in a time of monsters—and we'll get to the "monsters" part in a second. But basically, what you're saying is that the United States is tumbling toward societal heat death through this entropy, because it's not growing—not as an economy, but as a productive, output-driven society. And that, in turn, affects how energy is being used.

And just one more point—I find this very fascinating. Of course, we have to somehow measure energy, and energy is a very abstract concept, even though we're used to it. You know, at the beginning of the Industrial Revolution, combustion engines started to be measured in horsepower—how much horsepower does this output give us? I think that's very important to this discussion about the energy density of certain materials. These hydrocarbons from West Asia changed the energy equilibrium. Can you talk about that a little bit—maybe again—about how you think this war and the cutting of trade relations impact the entire global system of distribution?

#Warwick Powell

So I guess the way I try to think about the system at large is to view it as an integrated whole. And that integrated whole is anchored in our understanding of the natural, material world. The natural, material world—our planet—is an energetic world. There's a certain amount of energy available, and it transforms, takes new forms over time, and is continually in motion. If that's the sort of envelope—the energetic envelope—then what we seek to do as humans is harness the energies available to us, mobilize them, store them, and use them to produce things that societies find useful and necessary. So what I try to do is distinguish between two ways of conceptualizing this question of economic value, because these are economic systems.

And use-values are the ways I think we can approach this question of energy. Of course, we can measure energy in terms of joules, kilowatts, horsepower, and those sorts of things. But in a slightly more abstract sense, I try to think of energy really as value in motion. And value in motion transforms through productive engagements with it by humans. We do this in a few different important ways—and they're fundamental ways, ontologically necessary ways. They go to the fact that all human societies need food for people and fuel for machines, right? Now, we didn't need so much fuel for machines before we had lots of machines, but we certainly needed fuel for horses and oxen and those sorts of things, right? And we, as humans—as biological, material beings, bundles of energy—are vectors of energy.

We also transform energy through the ways we consume it—through nutrition—and then use that nutrition to exert ourselves in different ways, whether it's mental exertion, the work we do mentally or physically. Through that, we continue the cycle, if you will, of energetic transformation. Now, the more successful human societies have become at finding lower-cost ways of harnessing energy that can be stored, reused, and used down the track, the more high-density energy has enabled the flourishing of complex human civilizations. Right. But all of that superstructure is premised on the idea that we can continue to access high energy–return-on–energy-investment sources and have processes that are also energetically efficient.

Otherwise, the surplus energy and potential that we're trying to capture, harness, store, and keep available to us progressively diminishes. Now, for a long time, much of that loss of energetic efficiency isn't experienced or visible to us, right? Because these are usually slow-burn systems, if you will. The way we tend to deal with all of this is through the second component of the system, which is the pricing system—or what I call the system of exchange value. So we have use-values, the thermodynamic substrate of material existence on Earth, together with the fact that this circulation system requires ways of mobilizing these resources and of circulating and exchanging them among units within the economic system that are not internally self-sufficient.

We have divisions of labor, and so we have an exchange-value system that requires the injection of liquidity into the system—promises, right? The first and most generic form of liquidity is what we call money. And money is a claim on the future. Not only is it a unit of account, it's also a right to make a claim on a future use value—some other energetic form in the future. I can buy something, I can eat it, I can buy fuel and put it in a machine, I can buy machines. Or it enables you to make claims on other kinds of claims. I can either exchange it for some other currency, or I can exchange it for conditional claims—shares, options, bonds. These are all conditional exchange-value claims. None of these things actually drive the thermodynamic system in and of itself; they are mobilizers of the resources necessary.

#Pascal

Hey, very brief intermission because I was recently banned from YouTube, and although I'm back, this could happen again at any time. So please consider subscribing not only here but also to my mailing list on Substack. That's pascallottaz.substack.com—the link's in the description below. And now, back to the video. Yeah, this is where it's so important, this distinction you made between value in use and value in exchange. They're fundamentally different, but of course linked to each other.

#Warwick Powell

They're linked, but not in a determinative way at every moment. In fact, the systems we've created over time see these two worlds diverge regularly. We inject liquidity into the system to grease the wheels. That liquidity expands, but the substrate—the speed at which we can harness energy, transform it, and all those things—has a different rhythm. It has its own cadence and temporality. It's a lot slower. We can create claims against the future instantly, either by way of government financing, credit from commercial banks, or private agreements between parties—you know, IOUs.

Debt instruments, yeah—any kind of debt instrument, including banknotes. These are promissory notes of one sort or another, and we can create those instantly. The issue is whether the substrate—the material substrate—is able to redeem those claims when they come due. Now, when the material substrate can't do that, what does the system actually do? Well, fortunately, humans are relatively creative, right? So the first thing we do is refinance—we kick the can down the road. We create new instruments, like, "Oh, we'll just push that one further away." That's one thing.

The second thing the system is actually doing all the time is withdrawing liquidity. So it's injecting liquidity and withdrawing liquidity at the same time. But the system must have net liquidity growth for GDP to actually expand—it can't expand otherwise. And you can't have profit without liquidity expansion either, because what is today's profit, Pascal, is actually yesterday's new liquidity injection. If there was no new liquidity, then the system simply repeats itself, and the balances of income and expenditure always balance out to zero. You only get financial profits if there's a net injection of liquidity into the system.

#Pascal

Yeah, I like that you put it this way, because there are a lot of commentators online who'll tell you the biggest sin of a government is taking on more and more debt. But you're actually making the opposite case—without adding debt, you wouldn't be able to... That's right.

#Warwick Powell

"Debt" is a value- and religiously-loaded word, actually. It comes from... well, in a fiat promissory-note banking system—a monetary production system—we'd be better off thinking about these things as liquidity management tools, right? The management of the volume and flow of promissory notes within the economic system. They're not debts; they're literally liquidity management tools. The issue with thinking about this isn't that we're going to run out of the possibility of having future liquidity—there's no chance of that. The problem is really the extent to which continued liquidity injections exacerbate that widening gap between the fundamental substrate and the claims being made on it.

That's the first thing. But there's actually another dimension to all of this too, because just thinking of it that way leads you to say, well, we need public debt equals private surpluses, right? So that's the sort of accounting approach. And that is an accounting truism. But the social, economic, and political truism is actually that the private surplus bit is unevenly distributed and circulated. Oh, yeah. And because these are claims on the future—in other words, the capacity to exercise power over resources—the fact that injecting liquidity into the system grows the pool of liquidity masks the reality that not all systems expand in the same way.

So if you keep injecting liquidity into a system where the main circulation mechanisms deliver more power and authority to a smaller and smaller group of institutions and people, then you actually create a different kind of society than one that doesn't do that. And you create one that lays the foundations for systemic entropy acceleration. The reason we have systemic entropy acceleration is, first, because there's a widening gap between what the material substrate can actually do and what the claims are. But second, there's an uneven claim on the future material substrate, which potentially leaves a growing proportion of people with inadequate access to the surplus energy they need to sustain their quality of life.

So simply injecting more liquidity into the system as a way of overcoming liquidity constraints—as companies save more money or what have you—can actually make things worse. In and of itself, it says, "Well, we can keep the monetary circulation going." And I say, well, you could, but unless you're fundamentally changing the circulation mechanisms and transforming the economic substrate—where you can attempt to improve your energy return on energy invested foundations—all you're doing is kicking the can of entropy down the road a little bit further.

#Pascal

This is quite fascinating, because I thought you would take the Marxist route and say, like, oh, this capital accumulation within a small group is going to lead to disproportionate power over the larger group. And then you can deploy this large group, exploit them, and whatnot—but it's going to run itself out. But you're taking it the other way. You're saying it's all about how energy is distributed in the system, and how that energy then produces more benefits and goods and so on for society to grow. And that one is going down. Therefore, you're increasing the entropy, which, of course, is a bad thing. You don't want to increase entropy—you want to keep it down, because entropy leads us to heat death over...

#Warwick Powell

It leads to social implosion, right? Now, you know, I'm pretty conceptually agnostic these days. I think anyone who reads the book can see that it's really a synthesis, if you will, of a diverse range of approaches to thinking about problems. And the synthesis itself, I hope, works. Well, it might not. But for my part, I think I'm reasonably satisfied that it works well enough today. Maybe in two years' time, I'll look back on it and think, well, you know, it probably needs a lot more work. But there is no sort of automatic mechanism by which a system will necessarily correct itself, right? So I reject a couple of things, if you will, as fundamental assumptions.

I reject the idea that there's a historical teleology—that history is going somewhere, that there's an endpoint, good or bad. That's the first thing. The second thing is that I also reject the idea that the system is somehow intrinsically equilibrium-seeking. In fact, my argument is that, just like in nature, we actually live in a world of flux—that there isn't really a telos that is equilibrium-seeking either. What we actually have is a continual tension, which is the motor between systemic, fundamental thermodynamic entropy and human attempts to govern that entropic potential through negentropy.

Successful societies find ways to do that through a high energy return on energy invested, and through the institutions by which they can circulate and distribute that energy in ways that actually mitigate other kinds of system entropies, such as inequality, and so on. The third thing I should add—and this is probably the third leg, or the third thread, of the conceptual architecture—is the role that information plays in all of this. So we've got use values, we've got exchange values. If you think about this in supply chain terms, which is one of my background areas, we're producing things, and that goes in one direction: we harness energy, we make stuff, we sell stuff, and so on. And moving the other way is the flow of payments.

Okay. So that's your circuit: use values in one direction, exchange values in the other. But what connects these two things is actually information. Without information, at each moment of exchange, the exchange can't function. You can't exchange a means of payment for a product if you don't know anything about the product or the supplier, and so on. So information is embedded in this system. But information itself isn't some neutral property of the system—it's deeply and fundamentally energetic. Information is a product created using energy, and because it's created using energy, it also carries within it the potential to be entropic.

Now, this runs counter to most mainstream views of information, which for the last 60 or 70 years have treated information as negentropic in nature. But my argument is that, in fact, there are plenty of examples of information being entropic—where the energetic costs of creating, capturing, storing, distributing, and using that information are greater than the energetic returns from that information being used. Put in plain terms, nonsense is a great example—information noise, misleading information, BS. These are all forms of entropic information that can have serious systemic consequences because they block the ways in which the system can act or understand its own constraints.

So if the political and institutional architecture leads to the production of certain kinds of information systems that create a frame of reference but deny others, then you run the risk of being ignorant of the limitations of your own operational system. And this is what I mean when I talk about the United States being in late-stage entropy. For a society—an economic and social system—that has been remarkably successful in harnessing these low–energy-return information systems to create this incredible information architecture that has delivered entertainment and all sorts of things for people, to now actually be at a stage where the information costs of its own systems are so high that it's starting to feed back on itself.

And I often have in my mind that Greek mythical creature, the Ouroboros—the snake eating itself. I think of things like data centers or AI in the United States as an informational Ouroboros, where it's consuming such a large amount of energy on the promise of being negentropic that, in fact, it's eating itself. And in the process, it's also claiming more surplus energy potential from the system that would otherwise have been available to other kinds of economic and social activities, further accelerating system entropy. So those are the sorts of things that I think, for my part, are important to be watching out for now in the mid-2020s.

#Pascal

I find this approach fascinating because I haven't heard it before—I haven't thought about it before. So what about this kind of information, or the use of productive capacities, especially energy, for things that are themselves inherently increasing net entropy? To me, the number one thing—or social phenomenon—that does this, and that I try to fight against, is war. War inherently increases entropy because you're destroying each other's productive capacities and using a lot of energy. Tons of energy. And we see that even just with the CO_2 the U.S. war machine produces—tremendous amounts. In that sense, if you look at international relations that way, you could say one entity tries to decrease its own entropy by increasing entropy somewhere else. And if you do that on a systemic level, then, well, you'll end up destroying the very foundations.

#Warwick Powell

Yep. Yeah, absolutely. So when we start to think of global systems and nation-states as being thermodynamic systems in and of themselves, then we can start to understand the sources of conflict—where the energetic efficiency, or declining efficiency, of a nation-state begins to spill over as it seeks to make claims on energetic potentials elsewhere: Venezuela, et cetera, et cetera. These are claims being made on what are, in effect, higher EROEI possibilities by the United States as it starts to confront its own limitations.

It's also had a tremendous run over the last 20 years with shale and things like that, which were incredibly low–low-resource-intensive activities to access—certainly not as low-resource-intensive as the oil back in the day, when you literally walked through the fields sloshing through oil as it bubbled up to the surface. But as these pressures build in the system, where the energetic return on energy invested progressively declines, the people who are at the coalface of these systems, so to speak, actually understand the challenges they face. And the system itself ultimately pushes actors to seek ways to replenish its energetic potential—and sometimes that's through war. At the same time, it also seeks to deny others access to energy as well.

#Pascal

But that's a purely exploitative view of why these societies do that. I think your point earlier was also that if systems reach a point where they can't produce—where the output decreases, not just the monetary output but the actual thermodynamic output, the potential of the future—then that becomes part of the spiral of decline, which, if I understood you correctly, is almost inevitable.

#Warwick Powell

Well, it's a continual battle, in a sense, because these entropic trajectories are embedded within the system. What we're constantly trying to do is counter them through negentropic interventions. Now, conflict actually isn't a very good way to do that. For some of the reasons you've described, there's a way of dealing with entropy—it's just a question...

#Pascal

So in your sense, redistributive mechanisms—to make sure people have access and can use that for their own purposes, like a social redistribution system—would, in your view, be a net negative entropic intervention, right?

#Warwick Powell

Yeah, and you see this at a macro scale as well, at a global level, because the energy consumed in fighting wars to access available energy could actually be better used finding new solutions that everybody can use, right? So you've got to punch through energetic systems. As I said, we've had an incredible couple of hundred years, but we're also on the cusp of all sorts of additional, supplementary, and possibly additive systems now. People often talk about energy transitions—I'm not so convinced that we transition, per se, because what we've tended to do historically is keep adding things on top of other things. And we, meaning humans, often continue to exploit nature even more intensely as we add more alternative energy sources, right?

So we use more timber today than we've ever used before, even compared to the days when we were burning timber. What I think we tend to do—and there's an argument here, you know, from the degrowth folks and others—is that this isn't viable, right? But put that aside for the time being. If what humans historically do is continue on our path of complexity, discovering new energetic possibilities within nature, then we keep adding these things. Now, what we've got to understand about this energy equation is that we're not just looking at the energetic properties of production—the harnessing of that information—we also need to consider the energetic efficiency of its utility value as well. It needs to be easy to use; it needs to generate efficient uses.

But there's a third dimension, and this is where information actually becomes really important, because we also consume and waste a lot of energy through poor coordination. So, systemic flows—if the system can flow smoothly—it's actually achieving very high levels of energetic efficiency. Wherever there are blockages within the system—and I guess this thinking draws a lot from both very traditional Asian and Chinese cosmologies, if you will, but also from traditions in classical economics, whether it was some of the French physiocrats or Ricardo and Marx and others—they really tried to understand the system not as a price-based market-clearing optimization process, but as a system of transformation and flow. The question is, how do you sustain smooth flows in a world that's continually changing? So what we're trying to do is find more energetically efficient ways of capturing and harnessing energy, number one. Secondly, we need that energy to be as dense as it can possibly be, so that it has the potential for use in a managed temporal setting.

We then need ways of using all of that. There's no point in having incredibly efficient energy-capturing systems if the way we use them is actually pretty inefficient. So we need to keep working to upgrade our production coefficients—that's the input-output ratio, how much energy goes in to get how much energy returned on investment as a utility on the other side. We need to continually upgrade that, and we also need to keep improving the circulation system itself. The extent to which something can be harnessed, transformed, and circulated are all intertwined.

And if we are unsuccessful in these three core components—and by the way, we are always, in a sense, partly unsuccessful—and we're partly unsuccessful because we have epistemological limits on how much we can know about the world and how uncertain the world and the future are, right? So we make errors. We go down the wrong paths. We have sunk costs. Sometimes they're path-dependent, which creates all sorts of problems when we make mistakes at systemic levels. But the successful societies tend to be the ones that are, by and large, able to get their act together across all three of these domains.

#Pascal

Yeah, you've got to figure all three of them out. And I mean, it's quite interesting, because I would say the two largest sources of energy—and of ways of creating the system you talked about over the last hundred years—are definitely, on the one hand, hydrocarbons: oil, gas, and so on. They're easy to store, transfer, price, and whatnot. The other one is, of course, nuclear energy, which is another one of these ways. But unfortunately, the electricity that comes out on the other end is notoriously hard to store, and therefore inefficiency increases there. But if we take this theory of yours as a basis, where does that leave you with the analysis of how today's global society is working—or not working, actually? Yeah.

#Warwick Powell

I think there are going to be some things that quite clearly emerge, particularly in the aftermath of the conflict in West Asia. I think there's a high likelihood of physical and relative shortages compared to the state of the world before the conflict blew up. There will be less oil and less gas in absolute terms coming from that part of the world, partly because I think we have quite a lot of infrastructure and resource destruction still to come. I hope I'm wrong about that. But if I'm right, and there is going to be a lot more energy system destruction, then it will force a whole range of changes and have major implications.

It's quite clear that when there are significant shortages like this, an immediate symptom is pricing. And pricing then leads to the distributional issues we discussed earlier. There's no doubt that periods of supply-side shock around key resources, which then percolate across the economic system through all the complex networks and connections those resources are part of, ultimately lead to a dramatic reduction in the quality and affordability of life for a large proportion of people—relative to those who capture the short-term monetary profits that arise from this pricing situation.

That's number one. And that runs the risk of its own entropic potential. If enough people's lives are dislocated, if their lives are made miserable and nothing is done about it, then who knows what will happen. I'm often reminded, Pascal, of a movie I watched in the 1990s called *The Trigger Effect*. It was made in Hollywood but never became huge, possibly because the narrative or the main theme was a little dark. But it was basically a story following a series of characters whose lives became intertwined over the course of a few days after the city they lived in lost electricity.

And as events unfolded, you know, the drugstores would close, the security guards would now need to be armed, and so on—you could see social entropy manifesting itself. The second thing I think this is going to force many places around the world to do is look at their energy structure—the ways in which they've organized their historic affairs to deliver food for people and fuel for machines. And they will inevitably seek ways of accelerating a transition to systems that are less dependent on hydrocarbons that must be transported across long distances and through geographically controlled gates.

#Pascal

Yeah. Strait of Hormuz, Strait of Malacca. Yeah.

#Warwick Powell

And the rest, right? So when that happens, we're going to see, in fact, a new rush toward a diverse range of energy possibilities, all of which we already understand. We have, for instance, the electrification boom that's taken place in China over the last 15 years. The technologies that made that possible will actually come into greater demand globally. First thing. Second thing is that as gas prices continue to rise, I think we're going to see green hydrogen—and hydrogen in general—become a financially more affordable alternative and begin to play a more prominent role. Also, we obviously have developments in nuclear and the smaller nuclear modules. And in the longer term, we have the fusion technologies that I think are now, firstly, part of China's current five-year plan.

But we also know that China's made some significant advances in that space. Those advances are unlikely to really hit the ground until 2040, 2045, or 2050. But they will hit the ground as the current generation of renewable energy infrastructure begins to run its course. So that's that first level. I think the second thing that's likely to happen, Pascal, is we're going to see ongoing energy efficiency initiatives in the utilization of energy, right? So, more efficient factories, automation, dark factories, digitalization, and so on. But we're also—and this, I think, is probably the most interesting and potentially the most geopolitically interesting and under-theorized part as yet—looking at the role of nanoelectric systems to transform the ways in which data is collected at the edges and how data is processed at the edges.

So rather than having large-scale centralized data centers doing the heavy lifting on AI, there's every likelihood that, in the five- to ten-year window, we'll start to see a lot more of that computing pushed to the edges. We're also going to see a lot more data collection taking place at the edges, fueled by things like localized energy-capturing capabilities. Technologies like TENGs—T-E-N-G-s—which are micro technologies that enable the harnessing of natural movement, wind, and so on at a micro level, can then generate the energy to power the little sensors we're deploying in many places. So I suspect we're going to see transformations there.

We're also going to see transformations in other kinds of technologies that will impact how grids work, and how grids and grid-enabled AI systems operate as well. One of the things that will emerge as a result of the war in West Asia—and many people have talked about this—is the reduction in the supply of sulfur. Now, of course, for many people that's important for fertilizers and all those sorts of things. But it's also important because sulfur is necessary for the mining and separation of copper from ores, supporting about 20% or so of global copper supplies. So one of the things likely to emerge as a result of this—and it won't manifest for six to twelve months—is a tightening of copper supplies globally.

And as copper supplies tighten globally, systems that have depended on copper—such as electricity network upgrades and augmentations to support data centers—will start to come under pressure. The first thing that will happen is that prices will go up. Data centers will get priority, while secondary industries and households will again face the kinds of pressures I mentioned before. The electricity haves and have-nots will become an even greater social and political problem. And then we're going to see one last push, in a sense—that creates the space where alternatives to copper will find their opportunity to emerge.

So materials like graphene will begin to play an even greater role in the development of electronics because it's highly conductive. And again, China has mastered graphene production at scale. So those are the kinds of dynamics we're going to start to see. The extent to which a society can harness those—or will, in a sense, reject all of this because it's holding on, you know, that inertia is stopping it from embracing this process of energetic renewal—will be crucial. If a society struggles with energetic renewal in this era, it's going to experience increasing contradictions at a social level as competition for a diminishing amount of surplus energy begins to manifest.

#Pascal

That's a very interesting way of looking at it. Does that then lead you to the conclusion that much of the warfare we're seeing in West Asia is actually about reversing those trends, one way or another? Or is it more about the inability to understand the global economy—and the global political economy—in the way you're describing it? Is it an outcome, or is it more of a feature of the system?

#Warwick Powell

Look, I think it's partly a system feature, but it's a feature that's percolated—not in a determinative sense—in that the thermodynamic fundamentals within our material system continue to work away. But how humans respond to these pressures is actually the part we can do something about, right? And that requires a way of framing the issues at stake. My argument is that we need to frame the issues as surplus energetic questions, and they need to be understood not in zero-sum terms, because that leads to very suboptimal energetic pathways—which, of course, are destructive: energy, you know, death, destruction, and all of that. So that's an important, I guess, corollary.

I mean, I didn't write this book with these wars in mind, I must say, but clearly I think there's a need for societies around the world to reframe their shared concerns around global energy possibilities. That's one. Secondly, I think we need to have a more nuanced understanding of circulation systems. So, you know, as financial circulation gets clogged up because there are concerns—people are holding on, it's not flowing as smoothly—the temptation is just to, you know, squeeze more liquidity into the system. We call that fiscal policy, right, or quantitative easing, or what have you. That helps kick the can down the road a bit, but it can actually amplify the problems, because if you don't solve circulation and distribution problems at the root, you're actually just going to make them worse.

And the third thing that I think we need to be thinking more about, increasingly, is the ways in which—well, actually, how it is that information systems enable flows to happen smoothly, right? And if we can't come to grips with this on one planet, where we have many languages but nonetheless need interoperability, and ultimately arrive at information systems that are not threats to our collective existence but are actually the means by which we can better coordinate and collaborate, then we're going to fail ourselves. So we need to think a lot harder about information systems. We need to think a lot more clearly about information sovereignty plus information interoperability, because you need the sovereignty to mitigate risk, but you need the interoperability to ensure a collective negentropic effort. And these are the things that I think we need to be thinking a lot more about.

#Pascal

Yeah, and put them into concrete examples—like how, for instance, China is trying very hard to have this information or data sovereignty. On the other hand, you still need to exchange information with the Russians to get your hands on their hydrocarbons and so on, right? So there's a whole lot to solve also within BRICS and whatnot. Just one question, because I never thought of the global economy in your terms: how many people actually have this kind of thermodynamic understanding of the global economy? Is that a school of thought, or is it your project that you've been developing recently?

#Warwick Powell

Yeah. Look, as I said, this is a work of synthesis. There are real giants who've worked, going back to the 1970s, who really thought about the ecological and thermodynamic constraints and conditionality of economic systems. So I wouldn't say this is particularly original. What I would say—and I guess my attempt to make a contribution—is to create some synthesis between the ways in which we understand the thermodynamic substrate and the ways we can understand the information systems themselves, where I do argue, as I said, that information is not necessarily always negentropic.

And also how we need to embed the way we think about endogenous money—and this idea of money as a claim on the future in a unit of account—within a material system. Because otherwise we start getting too obsessed, in a sense, with monetary flows, monetary operations, and monetary effects such as balance sheet corrections, forgetting that the only reason these things actually happen is because of the disjuncture between these units of account, these claims on the future, and what the material substrate will ultimately be able to deliver. So we need to take an integrated, holistic view. That’s probably the main thing.

There's an Australian economist, Steve Keen, who many people will no doubt know, who has talked a lot about the need to bring energy back into the way we think about economics. And, you know, Steve's actually got a much nicer turn of phrase than I do. When I talk about food for people and fuel for machines, I think Steve says something along the lines of, "A body without food is a corpse, and a machine without fuel is a sculpture"—something like that. But he does have a beautiful turn of phrase that captures this idea that without energy, there is actually nothing. So, no, look, I think the work that I try to do certainly sits at the nexus of a series of traditions.

As I mentioned, I also draw deeply from the traditions of classical economics, which try to think about our social, political, and economic systems and predicaments in holistic terms—terms that are more interested in dynamics and motion, anchored by the idea that we are in production systems at the end of the day. Without production, nothing else matters. So understanding the centrality of production is actually key. This contrasts with mainstream economics, which has become obsessed with allocation. For the past hundred years, mainstream economics has been concerned with the question of allocation.

You know, one of my microeconomics textbooks, when I was studying micro thirty-odd years ago, was *The Price System and Resource Allocation*—supply and demand and so on. If people read the book, they'll see that, in fact, this whole book is largely about how *not* to think about economic systems through the lens of supply and demand, but rather to think about them in terms of networks and flows. So, certainly, that’s part of a tradition. The other thing I’ll say, just very briefly, Pascal, and we touched on this before we came on air, is that this particular initiative is an experiment in and of itself. My last book, on information systems and supply chains, was published by a very well-known academic publishing house, and I was very grateful for that.

It was a great experience to work with people at that level. The downside, though, is twofold. One is that it takes a long time—academic publishing cycles, as I’m sure you know, can take years. Years. So it’s hard to get things out there, and I wanted to at least have these conversations. The second thing is that the model around academic publishing is now very institutionally oriented, which means the price of books is really, really high. In discussions with a number of publishers about this particular book, we were looking at possible price points between $150 and $400 per copy, which I think is insane.

It defeats the purpose of doing what we do. So I chose a particular self-publishing path, which is to do this using Kindle Direct Publishing on Amazon. It's not everyone's cup of tea. Some of the people who've bought the book have said, you know, “Can I buy it straight from you? Because I don't want to buy it from that particular platform.” But it is an experiment, because I think we need to be constantly exploring ways to circulate and share the fruits of our own productive efforts in ways that are accessible and affordable to people. And so, you know, hopefully this little experiment works.

#Pascal

Yes, we do. And just let me add one more minute, because I need to rant about this a little bit. You know, 400 years ago, publishers—especially academic publishers—had a very important role to play in the system, because reproducing information was very, very expensive. You needed a lot of people to typeset the material, make the ink, prepare the paper, and so on. The paper itself was expensive. So you needed a big collective effort, which you could only do with upfront investment. That meant whatever came out of it downstream had to be sold, and also distributed to universities. It was an information distribution system, and the price was high simply because we were inefficient at doing it.

Today, copying information is literally something you can do at the click of a button, right? Any kind of copy-paste. But what the model has transformed into is its opposite. While the old system had a price in order to distribute information, the new system actually gatekeeps. The new game in town for all the publishers—academic publishers, private publishers, trade presses, and so on—is to restrict access to information and then make you pay to go through the toll gate, right? And that's just... it's horrible, but that's what it has morphed into and what the game is actually about. So I'm glad to be going a different route, which we all have to figure out somehow.

#Warwick Powell

It's an experiment, like a lot of the things we've been working on, and I'll report on its success—or otherwise—in time, no doubt. I am working with a couple of other publishers on more mainstream activities, in part because some of my colleagues are at an earlier stage in their academic careers, and I think it would still be of value to them to work with the established publishing houses. But by the time you reach, you know, my vintage, that's less important. And look, I was lucky too, Pascal. I had a graphic design background from the days when I edited student newspapers at university. The reason I'm not a graphic designer is because I was actually not very good at it.

But I was nonetheless not frightened by the idea of having to lay out a publication and those sorts of things. So I was willing to dive back in and, well, again, let's see how it goes. Some people have sent me photos of books arriving actually before the authors' copies have been delivered. I don't have a hard copy myself, but other people around the world do. So, you know, hopefully it will provoke a vocabulary for talking about these things in an integrated way, where we're, I think, more sensitive to the fact that our world doesn't revolve around financial claims. Our world is ultimately grounded in the physics of our existence.

#Pascal

Yeah, it's called the real economy. We've got to think about the real economy. And Warwick Powell is doing a wonderful job exploring that in a very fascinating way, as you've just heard. Everybody, I encourage you to get yourself a copy of *Thermoeconomics in a Time of Crisis*. Monsters—we didn’t, sorry, we didn’t talk about Gramsci and the “time of monsters,” but I think we’re all aware of what kind of times we’re going through at the moment. Warwick Powell, thank you very much for your time today. It’s been a pleasure. Thank you for having me.