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The September Sessions | Episode 1
Robert Friedland, Founder and Executive Chairman, Ivanhoe Mines

This week, we kick off our new series, The September Sessions, where we'll focus on the work required to make the energy transition a reality. Our first guest is Robert Friedland, Founder and Executive Co-Chairman of Ivanhoe Mines. SmarterMarkets™ host David Greely welcomes Robert back into the studio to discuss the realities of what it takes to produce the minerals and metals we need to change our energy systems.

Robert Friedland (00s):
As I've gotten older, I'm astonished at seeing the ability to revolutionize the way we source the raw material we need. I can see a better way to do it, and a lot of people that I know are working with us to do that. We can't solve all the world's problems, but we definitely won't get there doing it the way we did it in the old days. We need smarter markets, desperately. We need to price things differently. We need to allocate capital to the solution, not to the problem.

Announcer (30s):
Welcome to SmarterMarkets. A weekly podcast featuring the icons and entrepreneurs of technology, commodities and finance ranting on the inadequacies of our systems and riffing on ideas for how to solve them. Together, we examine the questions: are we facing a crisis of information or a crisis of trust, and will building Smarter Markets be the antidote?
This episode is brought to you in part by Abaxx Exchange, bringing you better benchmarks, better technology and better tools for risk management.

David Greely (01m 11s):
Welcome to Smarter Markets, the September sessions where we're focused on the work that is required to make the energy transition a reality. I'm Dave Greely, Chief Economist at Abaxx Technologies. Our guest today is Robert Friedland, Founder and Executive Co-chairman of Ivanhoe Mines. We'll be discussing the realities of what it takes to produce the minerals and metals that we need to change our energy systems. Hello, Robert. Welcome back to Smarter Markets.

Robert Friedland (01m 38s):
Thank you.

David Greely (01m 38s):
Thank you for sharing your time with us again. In previous episodes when you've been with us, we've talked extensively about the critical need to supply far more materials and metals for the energy transition than we currently are and today I'd like to talk with you about how we go about meeting that need. How do we put investment capital to work? How do we explore and develop the new minds and new infrastructure that we so clearly need and I believe this conversation is critically important because as you've said, most people's lives are divorced from the realities of the supply chain, from where things come from, from how the world works and so specifically, I'd like to discuss with you the realities of what it takes to produce the minerals and metals we need, what it takes to explore, discover, and develop world-class minds and I'd like you know, if you're willing to explore those realities from the lens of your own experience. Could you take us back to the beginning and share some of those experiences with us today? Maybe a good place to start is, you know, how did you get started in mining?

Robert Friedland (02m 46s):
There are 17 questions implicit in your opening question. You mentioned the words energy transition and you mentioned the words supply chain. You're talking about changing the way we generate energy on this planet and transmit it and utilize it as a species for human beings and of course, the way we've been doing that has a deleterious effect on the other countless species that inhabit this planet and so we've got a business with over a hundred PhD plasma engineers, plasma physicists. In fact, if we put them in a room and we ask them to define the word energy, they get into a violent debate, what that means and so just imagine how difficult it is to even define energy transition from what to what. We used to build a fire and a cave to keep us warm when we were cave people and we still have fireplaces in a lot of our homes, but they're being banned due to local air pollution regulations.

Robert Friedland (03m 52s):
Today's Wall Street Journal has a big article about how lethally dangerous to human and presumably animal health, urban air pollution is, it's worse than smoking. So the burning of hydrocarbon in relation to urban centers is just literally killing us. So as I've gotten older, we looking back at a very long learning process about what we're talking about here. This is such a enormously all encompassing topic that's a broader, wider, and deeper than the two word phrase, energy transition, let alone my own little experience and getting to where I'm in a position to talk to you about all this. But as I said last time, an excellent point of departure is a book by a brilliant mathematician named Brock Love Smith, who's written, what I'm told is Bill Gates's favorite book, how the World Really Works. It's really great primer about how we got this far as a species and where we think we want to go to feed seven, eight, 9 billion people to avoid fighting wars over things like water and food and energy security, especially in the context of war that we're seeing now more on a civilian population. So I was trained for what we're talking about from birth. This is a long story. Where do you want to begin, How far back do you want to go?

David Greely (05m 20s):
Maybe a year or two after birth but I am fascinated about why you were trained for it since birth.

Robert Friedland (05m 25s):
Yeah, I've always been a kid that was curious. I remember at a very young age, given that I was born in 1950 when I went to elementary school, my school teacher then forced us into a drill to get under our desks and cover our heads in the event of a nuclear attack. And I was the kid in school, you know, at seven or eight years of age and said, that's totally even of a nuclear war. We're all gonna be incinerated. My father built a bomb shelter out of the advice of the United States government in our home in Massachusetts, but it didn't come with a toilet and I pointed out that, you know, living in there with my mother and my brother and sister after a nuclear war would be a real nightmare, but we were actually concerned with nuclear conflict when I was 10, 11, 12 years old. So some kids are naturally rebellious and don't accept anything adults tell them and I've always been trying to figure out how the world works and how we can change it and looking for opportunity from the time I was a little kid and I think that's enough said for the moment. We should get to the present day and see how we're gonna unwind the current dilemma we find ourselves in.

David Greely (06m 39s):
Yeah and if you would maybe one stop on the day to the present. One thing I wanted to ask you about, just 'cause I think a lot of people, they're trying to understand what it takes to get these minds and infrastructure build and want to talk about what you're doing now but of course, your careers included many legendary discoveries including nickel deposits at Boise Bay in Canada, copper deposits at Oyu Tolgoi Mongolia and I was just curious, you know, what did these experiences throughout your career teach you about what it takes to produce successful minds that you'll be applying today?

Robert Friedland (07m 18s):
All exploration is basically generated by the same mindset. It doesn't matter if it's a scientist with some kind of intuitive breakthrough, Mr. Newton sitting in or a tree and seeing an apple fall and thinking about gravitational force, Galileo realizing that the sun doesn't actually revolve around the earth despite the confessions had to make to the Roman Catholic Pope. To the contrary, as a species, we always go out and find new things, but with 7 or 8 billion people in the world on our little planet, hurdling through space with an incredibly fragile environment, very thin atmosphere, very fragile oceans, very sensitive marine life, looking at everything from first principles, we really faced the largest endeavor in the history of our species, trying to figure out how 7 or 8 billion of us can coexist A without killing each other, and B without disturbing the natural order for all time.

Robert Friedland (08m 24s):
This is a really frightening responsibility on the current generations and I think that there's been so much green washing, so much misinformation, so much noise about how long it's going to take and the detailed effort we need to improve life for all of us rather than destroying each other. Just take for example, all the noise we're getting about incipient economic or potential kinetic war between Russia and China. I mean, if Russia and China go to war, we're gonna destroy human life as we know it on this planet. I mean, we're a toast when big elephants start fighting all the grass gets trampled, doesn't it and so if the military industrial complex is looking for the mother of all enemies, it's gonna be like a 300 year project if those two societies go to war and so what will our descendants think of us today when they look back at us from a hundred or 200 years from now, where we have the sum total of human knowledge available to everybody on the internet, and we're about to surrender our authority to machine learning or artificial intelligence?

Robert Friedland (09m 36s):
I mean warfare has totally changed in what's going on in Ukraine. We're finding that a drone warfare delivered by software can deliver a Dudley package to you anywhere, literally anywhere. Either you or I could be set a little, little drone and boom, we're gone individually addressed with a little camera that recognizes you cheap, easy, and lethal. Is that really what we want to do with the sum total of human knowledge and ingenuity? Do we really want to kill another civilian population and bomb them into the Stone Age so they freeze in the dark to gain a little territory or to allow an autocrat to stay in power a little bit longer. We're calling the glories of an empire 300 years ago and you know, when the holocaust happened, maybe a lot of people in the in the world didn't know about it. We didn't have the internet, did we?

Robert Friedland (10m 29s):
We didn't have WeChat and broadband. We didn't have instantaneous access to knowledge and we're acting like we haven't learned from that experience we're we have war now in Europe. To what end and why I said I I'm very much concerned that all the pressures on the supply chain could be directed towards the huge enterprise warfare as opposed to being directed towards the even more difficult undertaking of greeny world economy. The energy transition, adequate food and water, clean energy, clean air for human population, less pressure on marine life, plastic in the oceans, permanent chemicals in in your body, stress on your immune system from all the chemicals and garbage that we generate as industrial society. All of these issues are interlinked. You know, this war is particularly obscene because Ukraine was one of the greatest bread baskets of food on this planet in World War II.

Robert Friedland (11m 36s):
The Germans mined soil from Ukraine. That black earth from Crimea took it back to Germany to improve German agricultural potential. If that food can be grabbed by the incumbent largest exporter of wheat in the world, which is Russia, and that food is, say, directed to China, for example, then Nigeria will starve and Egypt will starve in Pakistan, for example. And so I don't recall seeing food used as a weapon. Do you, you know, and, and so this is all happening at the same time that we need copper and other metals to green the world economy. But instead, copper's going to go to he Mars and other sophisticated armaments. Copper's gonna go into 155 millimeter hs or shells in tanks. The Germans want to build an army. They haven't had an army worthy of the name since World War II. The Japanese want to build an army.

Robert Friedland (12m 30s):
They haven't had an army worthy of the name since World War II. The Japanese and the Koreans make each other nervous. So the Koreans also want build an army both north and south and I don't know, the US administration is talking about turning Taiwan into a giant porcupine. How much metal is that gonna take and the Chinese don't like us supporting Taiwan so much because we have had a one China policy for 30 or 40 years or more and so the Chinese are suddenly showing up in Taiwan saying, look how this feels. We're in an island near your shores because it's very hard to look at the whole situation through the eyes of the other guy isn't it. We're such different societies. If you look at the incipient civil war in the United States, two warring tribes, it reminds me of warfare in Northern Ireland.

Robert Friedland (13m 19s):
Two kinds of Christians going to each other's throats or the schism in Islam between Sunni and Shia. Two followers of the greatest, simplest, final truth as revealed by the prophet going after each other. Why are we killing each other when we have such a universal global problem to solve. I guess it's the only thing I can think of that makes me pray for aliens. If the aliens show up and start killing us all, maybe we'll all get together as a human species and try to figure out how to cooperate. Because this whole supply chain thing since we've started talking is, is giving every indicia being militarized and if we militarize the supply chain all of World War II, we're never gonna make progress on the greedy of the world economy. You recall the U-boats, the Germans invented these little needle submarines. There's one on the split, the Natural Museum of History in Chicago.

Robert Friedland (14m 22s):
Those submarines were designed to interrupt the supply chain between the United States and England. If there was a ship going to the United States, to England bringing food or coal or oil or nickel or copper or war materials, the job of the U-boats was to sink Those boats cut off the supply chain and had we not had a brilliant mathematician who broke the enigma code, the Nazi enigma code, the Germans could have won World War ii. It was hanging by a threat because the interruption of the supply chain was a brilliant German idea, prevent the British from getting help from the Americans because the Americans have limitless industrial capacity. Most of the Americans woke up, it was actually ultimately gonna be toast for the Nazis and the Japanese. Today we have a more sophisticated understanding of the supply chain, but the situation is getting truly Kafkaesque.

Robert Friedland (15m 20s):
Since we last spoke we had the US administration say, okay Mr. China, we're not gonna sell you any two or three nanometer silicon chips, no chips like Nvidia that can make you artificially intelligent. They're all for us and so President Xi Jinping makes a press release and says, okay, fine. We won't sell you the germanium and the gallium that you use to make those chips. So once this integrated world economy truly breaks down, everybody suffers because we, you know, it's really a profound truth that the American and Chinese economies are still very deeply intertwined in the supply chain very deeply and that's a good thing because if we rely on each other we might send students to each other or try to understand each other BUT if we ever suffer the inflationary impact of say, 30 years of completely totally unwinding our interdependencies, then we're gonna objectify the other people in America, objectify the Chinese and the Chinese are gonna objectify the Americans and then we're headed on the road to perdition.

David Greely (16m 34s):
Yeah, it makes me wonder, you know, when we encounter these problems of not having enough natural resources, having these problems that we need to work together on having new technologies that should be applicable and should be useful. On the one hand, there's optimism. On the other hand, the way you describe it, it reminds me of, you know, the history of the world is filled with people fighting over scarce natural resources and using new technologies for conflict rather than cooperation. Is that the path that we're on, that it's in some sense, you know, are, are we falling back on some element of human nature of, well, if there's not enough clean air, we're gonna have to fight over who gets it. If there's not enough metal, there's not enough mineral, we'll have to fight over who gets it rather than working together. Is working together too hard or is it too contrary to human nature or you know, do people not have that curiosity mindset that you brought up earlier to want to go out and find a different way to do things?

Robert Friedland (17m 38s):
At the outset, I've got to tell you, I'm a violent optimist. The situation is absolutely hopeless, but it's not serious. We have limitless capacities as a species for ingenuity. If we had a superconducting, super colliding supercomputer, we would be able to know all the great breakthroughs and technological inventions that are happening as we speak. Incredible scientific and technological breakthroughs and I would guess some of them are coming from Russia and some of them are coming from China and some of them are coming from Japan and some of them are coming from the United States or Europe or Africa. But the problem is we don't have anything other than CNN constantly negative news or fox the other tribe bashing each other here. Take a look at that joke of a presidential debate in the Republican party. Nobody's talking about anything that makes any sense to me.

Robert Friedland (18m 34s):
There are tremendous technological breakthroughs available to humanity to actually solve these basic problems. Now that information is available to everybody and with SpaceX launching Leo satellites where there's, you know, there's basically no lag. We can have 8 billion people on the internet sharing information instantaneously and it won't matter whether you're in Burkina Faso, California and I don't know, do we, do we as a species need an external enemy like Lunarians attacking with some death rate because there's a very real chance of already being monitored by drones. You know, there's a lot of unexplained aerial phenomenon that could be alien technology. Maybe they're watching us wondering whether to put us out of our misery due to our miserable behavior. I don't know. But I think we do have the technological means to feed and clothe eight or 9 billion people carrying capacity and not destroy nature, not destroy the fish in the sea, and the countless species that exist.

Robert Friedland (19m 44s):
I really truly believe that can be achieved and of course, we're a little worried about machine learning. These machines appear to learn and if we assign them all apart to drive the drones, yeah, that's scary. Elon has talked about it. But I do think that the opportunity is before us, the current generations to get our together and utilize the advantages that we know about. I know in my field there are fantastic technological breakthroughs on the horizon that will make it easier to find the raw materials we need. And if we, you know, there's no point in trying to stop burning coal and stop creating, releasing methane in the production of hydrocarbon, the world gets much warmer. The permit thrust in Russia is gonna thaw, then that's gonna release an unbelievable volume of methane into the atmosphere. Methane's, what 30 times worse than carbon dioxide.

Robert Friedland (20m 44s):
And so before that happens, because we're all gonna suffer equally when that happens. I mean I don't know about you, I don't know if it's just anecdotal or what, that Phoenix had 36 days above 110 degrees and massive forest fires in Siberia. Massive forest fires in Canada. I think that's a huge idea phenomenon. Huge idea is the overwhelming feeling. None of this has ever happened before you

know, the world's getting hotter. It's the world is getting hotter. To what degree it's anthropomorphic or maybe, you know, maybe sun spots or solar radiation has something to do with it. It doesn't matter. We can't take the risk of not reorganizing the entire supply chain. So let's define the problem. We've got eight or 9 billion people that are gonna inhabit this little ball of iron and silica hurdling through space. We're not gonna move everybody off this planet anytime soon.

Robert Friedland (21m 41s):
It appears to be getting warmer. Urban air pollution will kill you faster than smoking cigarettes. That's now known. Viruses move very fast through the environment and so, you know, we can see that all the humanities affected by one little virus. But what that did, there might be more in the pipeline, right and so we're all in this together and if you combine sort of World War II style trench warfare, opposing armies blasting each other and still killing a civilian population, consciously using drones to bomb innocent civilians, movie theaters, hospitals and schools. Haven't we evolved beyond that kind of obscenity in the year 2023 that's crazy. Can't everybody agree to condemn that kind of activity. So we must have other animosities or lack of understanding. Russian science was some of the greatest science ever achieved by our species. The Russians are fantastic scientists, you know, they competed with us and put them out on the moon.

Robert Friedland (22m 49s):
The Russians going up to the space station right now because that's the last vestige of international cooperation. We cooperate with Russia putting men out in the Space Station, China, thousands of years of inventing everything from pizza to spaghetti to fireworks, to government bureaucracy. It all came outta China. We need each other, man. We got to share our scientific talent. So, so if the Chinese steal our intellectual property, we could steal theirs. Maybe we should get together and just ban patents. They only have a life of 17 years anyway. Who invented the wheel, who invented fire you know, and once the nuclear bombs been invented, a lot of people can copy it, right. The North Koreans, the Pakistanis, and who's next. So we have this huge thing going on and as I've gotten older, I'm astonished at seeing the ability to revolutionize the way we, we source the raw material we need.

Robert Friedland (23m 52s):
I can see a better way to do it and a lot of people that I know are working with us to do that. We can't solve all the world's problems, but we definitely won't get there doing it the way we did it in the old days. We, we, if everybody in the world burns as much hydrocarbon as an American, I'm talking about everybody gets a Ford F150 pickup truck, all 8 billion of us and drives around to pick up a dozen eggs in that pickup truck. We're gonna smoke out everybody on this planet. We're a toast. We're gonna have to rearrange everything and so this, this idea of making smarter markets, I mean we invented financial markets several thousand years ago. We need smarter markets desperately. We need to price things differently. We need to allocate capital to the solution, not to the problem

David Greely (24m 41s):
I'd love to talk about some of these solutions that you're working on and some of the new ways that we can be applying technology to work the problem instead of engage in conflict with each other. I know you're hard at work applying your experience and these new technologies that a number of your current companies, I've seen news releases about multiple sites in the United States that you're working with through your company. US Electric Metals partnering with the Kingdom of Saudi Arabia to explore an area the size I believe of Switzerland and continue drilling at Kamoa Kula in the DRC through Ivanhoe minds. I was hoping you might be able to share, you know, kind of for those of us who don't have the super colliding supercomputer or you know, mainly can get our news through the traditional media sources. Can you walk us through some of you know, how technologies being applied there or how these problems are being approached in a way that might provide a template for how we can start to apply technologies to work some of these problems?

Robert Friedland (25m 43s):
We might as well start with electricity. That mysterious thing with Ben Franklin and a kite you know, waiting for some lightning to hit. We've only been using electricity two basic ways, direct, current and alternating current. Thomas Alva Edison thought the world was gonna run on direct current. He burned coal in a steam engine. The steam engine turned a generator, the generator made direct current. He put it into the world's first light bulb. It lit up and he said, holy, what am I gonna do. Now there was no place to sell light bulbs because there was no place to screw one in that first light bulb had a tungsten filament. So you needed a tungsten to make a light bulb and a partial vacuum. But the current came from burning coal, you know, generator silly, right and so he went to New York City and he strung him up Fifth Avenue in a DC line.

Robert Friedland (26m 36s):
When I was a kid, if you had put Christmas tree lights on a Christmas tree, if one bulb went out, the whole bulb went out because They were on DC direct current. So he strung a direct current lineup, Fifth Avenue. And that was called the New York Electric Light Illumination Company. He sold light, he didn't sell light bulbs, he sold light to the city of New York. Now heretofore we went out mining sperm whales to get the oil out of the top of their head to light Fifth Avenue and sperm whale oil was incredibly expensive. Like people went all the way to Antarctica. Remember Moby Dick, you know, to get that sperm whale oil to light the street in New York. And since New York was a big metropolis, you could pay for light because you don't have light in an urban environment. The bad guys come out and steal your handbag, right?

Robert Friedland (27m 22s):
You need light in the city at night and we keep our cities lit 24 hours a day. Now that company is called the General Electric Company today and then of course, Nicole Tesla pointed out that you really want to move electricity efficiently. You got to have alternating current. Now the good news is that there's been a better way to use electrical energy than either of those two old alternatives. But the bad news is that technology known as pulse power was exclusively reserved for the dark side, for strategic weaponry, for stuff that can annihilate us all. I think the American nuclear weapons inventory is big enough to kill everybody on the planet like a thousand times over and the Chinese want to mash that inventory and the Russians are openly threatening to use atomic weapons. I haven't heard that since I was a kid hiding under the desk.

Robert Friedland (28m 17s):
And so there's a better way to use electrical energy and our group has been working on it for 20 years with the assistance of the French government. We were licensed to use this same core technology for non-military applications and it turns out that if you use pulse electrical power, which is generated with very sophisticated super capacitors, more or less the opposite of a battery, the battery stores electrical energy and discharges it slowly. That's its job in your hand phone or a car. The capacitor stores electrical energy and releases it instantaneously like a switch and if you release energy in very short periods of time, you get enormous amounts of power with very small increments of energy. Now this gets a little mystical. People don't know the difference between energy and power. There are two entirely different things, huge amounts of power, very small amounts of energy.

Robert Friedland (29m 16s):
Any system that can do that is inherently very greed very greed. So technology exists to revolutionize virtually everything in the supply chain. With pulse electrical power, we can shut off a lot of the world's coal burning power plants because we wouldn't need the electrical energy anymore with a, with a system that's, you know, a motor magnitude more efficient. So the pulse electrical power is used in electromagnetic pulse weaponry, really nasty stuff. And it's used to detonate atomic weaponry. But it should be used for common purposes like making magnetic fields to get rid of use of pesticides or a better way to crush or grind rock to liberate the metals we need so that we can make things more cheaply out of metal or use it for manufacturing so that we can make stuff like anything you buy like a phone or a car with less energy.

Robert Friedland (30m 12s):
And we have the capability to do this. The technology has been around for a long time, but it's been used only on the dark side for weaponry. A lot of the best technology in the world ends up sort of ring-fenced by national security considerations only to kill the other guy. So we're a proponent of pulse electrical power because we need a ridiculous amount of metal if we're gonna stop burning coal and we're gonna stop burning oil and what's the point of trying to dig up all that metal if we're gonna generate so much global warming gas that we smoke up, smoke out our kids before we're gonna have the metal. So we're getting insufficient attention to how we can utilize new technologies to be part of the solution as opposed to being part of the problem. And unfortunately, all these technologies are dual use, right?

Robert Friedland (31m 03s):
Like fire is dual use. You can burn a city down or you can roast your marshmallows right and electricity is dual use. You can do all, you know, lifesaving operation on your heart or you can, you can power an electric chair. So a lot of these breakthrough technologies are available to us and must be commercialized quickly. And it goes back to my favorite book. You know how the world really works. We got to first you need to understand what the supply chain even is. Yes. Alice, you have to understand a ham sandwich definitely does not come from a refrigerator. And by the way, the refrigerator needs copper to make anything cold. Otherwise, there is no known common refrigeration technology that is not copper intensive. And refrigeration's a good thing. Air conditioning is a good thing. All these things are metal intensive. So there you go.

Robert Friedland (32m 00s):
Yeah. And I'm curious, you know, with this pulse technology, you know, when you look at, say for example in the mining sector, how it lets you mine relative to the technologies you used earlier in your career, do you see it as like a revolutionary change or an incremental improvement. How do you scale the impact it makes?

Robert Friedland (32m 20s):
No, no. You know, we need maximal total complete move to tube, cradle to grave sperm to germ disruption. We can't go out and go about this the way we've always done things. We can't get there from here with incremental improvement. We need fundamental, massive disruptive change improvements. So if you take a concrete column, you can put a hundred story building on top of it because concrete is very strong in compression. You can't squeeze concrete, but concrete is very weak in tensile force. You can just pull concrete apart. That's why we put rebar in concrete iron rebar, those little bumps on the rebar. So you can't just pull the concrete apart. If you build a concrete bridge and there's no rebar in it, I can assure you it'll just collapse. It'll get hot, it'll get cold, it'll just collapse. So what we've been doing as a species since we were a caveman, we wanted to make big rocks into little rocks.

Robert Friedland (33m 18s):
And by the way, that's what you need to do to get the metal out. You got to make a big rock and we got to grind it down the talal powder, get the metal off. We've been using compressive force to get the metal out big. And you know, we have these big washing machines that spin rocks around and we throw iron balls in there like a big washing machine and we grind the rock down and we use ridiculously large amounts of energy to do that. There's many nuclear power plants of energy dedicated just in Australia to crushing grind rock. It's like a fundamental, you know, human activity that you never think about. But that's what you do to make all the stuff you touch every day, like your computer, your phone, your car, your bicycle, your microwave oven, and your washing machine. We are crushing grind rocks.

Robert Friedland (34m 04s):
So we can crushing grind rock with a 90% reduction in energy with 90% reduction by using tensile force. We put the rock in a bath of water and we put gigawatt scaled electromagnetic shocks in the water. We create shock waves in the water and the water goes in a little vesicles in the rock that you have to see with an electron microscope and when the electromagnetic shock wave goes, it pulls the rock apart. It uses tensile force. If, if the rock could think, the rock would say, holy, I'm not rock anymore. I'm just sand just falls apart very short period of time. And when it falls apart, the metal falls apart. You want to get geeky on this. There's an acoustic impedance differential between the specific gravity of the little particle of gold or copper in the rock and the lower specific gravity of the rock around that little particle.

Robert Friedland (35m 06s):
So you're peeling that little particle of gold or copper away from the surrounding rock. You have to get rid of and liberating the metal. This is something human beings have been doing since ancient Babylonia and we've mined 700 million metric tons of copper since ancient Babylon, 700 million metric tons. That's what our species is mind. Just to give you an idea the American electrical grid has 150 million tons of copper in the grid. We need it there. The lights won't come on. If everybody wants to plug in a Tesla at 5:00 pm in the current the grid will just lay over and die. So there's 150 million metric tons of copper in that grid. Out of 700 million tons of copper in mine is a species now at the rate that we're utilizing copper in the world economy. We need to mine that same volume of copper as we mine in the last 10,000 years in the next 22 to 24 years to maintain 3% GDP growth without electrification of the world economy, just doing it the old way. But now we have to electrify the world economy, solar, wind, nuclear power, whatever your alternatives, geothermal energy, we need even more copper. But at the same time, we are utilizing those copper by copper on 155 millimeter Howards or shells coming out of cannons in Ukraine. You see war.

David Greely (36m 34s):
What I'm taking away so far in this conversation is we need to use the metals for our common problems, not for our weaponry and we have the technology, a lot of it developed in the military and applied in the military that we can produce the metals and minerals we need with remarkably less energy by applying some of these new technologies that are available now and when you brought up the story of Thomas Edison providing light instead of providing light bulbs, you know, it made me think as well that you've been extending your own efforts further downstream in the electric supply chain as well. I believe you've just, you had an announcement that you've gotten underwriters laboratory certification for vanadium redux batteries and I'm curious, like what's led you to move into the battery sector from traditionally the mining sector?

Robert Friedland (37m 25s):
You know, I've got a super green daughter. I mean, we're trying to be part of the solution, not part of the problem. So to all your listeners on this audience, I ask all of them, have you ever been guilty of walking in a room and turning on a light switch? Have you ever done that?

Robert Friedland (37m 41s):
The moment you did that, you know, somewhere a generator had a kick in and send you electrical energy. Have you ever been guilty of doing a Google search, you know, because if you did and you used up a huge amount of electrical energy in that Google search, you think it's free. But it was actually paid for by advertising revenue. So there's no electrical storage in the grid whatsoever in the United States to speak of and so the sun only shines about five hours a day in Arizona and the wind doesn't blow all the time. The Europeans had a bad winter last year when the wind stopped blowing and so wind and solar are a joke, literally a joke, unless you have storage of electrical energy in the grid. Now there's a lot of ways to store electrical energy. There are many approaches under development and consideration.

Robert Friedland (38m 33s):
The most primitive is you can pump water uphill. When you have excess energy, you can use the sun or the wind and use that to pump water uphill and bring it down when you need it. In the nighttime when either the wind's not blowing or the sun's not shining and some people want to compress air in a cavern or other people, there's all kinds of ideas. But without storage in the grid we're in trouble. So one approach is use the energy we do have more efficiently. The other is for alternative energy for many forms of we need to store that energy. So in a battery, you want high energy density in your car. We're trying to make the energy and the car battery more like gasoline. I don't have to explain to you that we have a gallon of gas between us. We throw a match.

Robert Friedland (39m 18s):
You see how much energy is in that gasoline is we're incinerated this very high energy density in diesel or gasoline. We want to make the batteries more like gasoline, more and more energy dense so that you, there's room for your kids in the backseat of the golf clubs and all the stuff you've got in your SUV. But as we do that, those batteries get more dangerous. As we're increasing surge energy density, they tend to catch on fire and you hate it when your electric car catches on fire because when you add water to that fire, which is dihydrogen monoxide, you're just adding more oxygen burns, even hotter. So lithium ion batteries are a terrible idea at grid scale. At grid scale, we're talking about batteries bigger than a Wal-Mart store. You're talking about, you know, the grid here. If you make those batteries outta lithium, which burns like hell, if you have a fire in that grid scale battery, you lose the grid.

Robert Friedland (40m 13s):
You know, that's a really bad idea and you all you have to do is Google all the terrible lithium ion batteries that have caught on fire and when, when cars are in a ship going across the ocean or Korea, many grid scale battery attempts with lithium. So what we've been working on is developing the world's best grid scale battery with materially have mine vanadium metal and these batteries are huge. They have low energy density. They're not like the energy density of your car. They're huge. They take a large area, you put them out in the desert where land is cheap, but they will not catch on fire. And those batteries will cycle on and off for 50 years without any degradation in their capability. And others are trying to make big batteries with iron or iron air batteries. There are a lot of competing battery technologies.

Robert Friedland (41m 05s):
I don't want to get lost in the weeds on what is the best way to store electrical energy even in the battery sphere. But we have now certified a technology that the Chinese already certified our customer was the China State electrical grid and the Chinese know what they're doing. The biggest batteries in China were built with this technology. In fact, President Xi inaugurated one of these batteries at a giant alternative energy site. And now we've brought these batteries to the United States certified for the great state of Arizona but in order to build these batteries, they're quite easy to build. They're very reliable. They'll not catch on fire. They will accept solar and wind and help us. We're have to, we still have to go mining, you know, we just have to mine something different set of mine. Lithium and nickel or cobalt for the battery.

Robert Friedland (41m 56s):
We have to mine vanadium. It's a different member of the periodic table. You know, and that's why we say, when you look at the periodic table, there are 10 or 10 or 12 medals I can tell you about that are gonna be huge winners and there are a bunch of others that are real dogs. Like, we're not gonna use them anymore. You know, so vanadium, redox flow batteries are part of the problem solved

and a very important part of the problem. We need storage in the grid. We also need an all new grid. I mean, that, that fire in Paradise, California, the power line of going to Paradise California was 106 years old. And very few people even thought, are there really power lines in America that are 106 years old? And the answer's absolutely yes. There's, there's sewers under the cities and stuff like, you know, the 747 aircraft is now 53 or 54 years old.

Robert Friedland (42m 52s):
The bullet train in Japan is over 50 years old. So we're older than we think right by now. We should have gotten our act together as a species. And so a lot of what we thought was great technology, like the bullet train of the 747 is really sort of antique technology now and so it's just remarkable how much energy got wasted, say, on the Gulf War shock and awe, you know, what did we really achieve there and how much, how many trillions of dollars did that one cost and wouldn't it have been better to invested all that money and a better way to generate and store electrical energy and so, you know, these drumbeats of war are, they're, they're drumming they're drumming louder every day, aren't they and so politicians want to sell you on the path to you know, Donald Trump is saying he wants to put a tariff on everything importing into the United States.

Robert Friedland (43m 44s):
Do you have any idea how much inflation that's gonna create, what a what an absolutely idiotic idea to be selling the American public. You know, putting a tariff on everything that goes to the United States means you'll freeze in the dark. So, you know, they, they've the Inflation Reduction Act, which I officially referred to as the Inflation Creation Act says that you can't bring Chinese solar panels in the United States without a massive tariff. Turns out the only American incumbent that's making inferior solar panels in the United States is reliant on a raw material. I won't name the metal here. They can only be found in China. It's like them saying you can't have our Bdellium or Germanian. We're completely dependent on international cooperation. If we don't have an integrated world economy and utilize all the advances of trade that we've developed over the last 10,000 years, we're screwed even before we begin. So the, the good news is that there's all kinds of great technologies that will enable.

Robert Friedland (44m 54s):
To find a better way to mine, a more responsible way to mine a mine. Where local communities participate in the wealth generation where women are in the mining industry, where communities buy into it, where we mine cleaner and greener with less lower warming gas in a more conscious way. We have to do that. We just absolutely have to do that. You know, there's an environmental organization called Earth First, and when you go to the Colorado School of Mines, which is a mining school, of course they have bumper stickers that say Earth first. We'll mine the other planets later, it's far less environmentally logical to mine. Other planets I mean, just think about how much hydrocarbon you need to fuel the rockets to even get to outer space and then you got to bring the stuff back down through the atmosphere without burning it up. Sorry.

Robert Friedland (45m 40s):
But we have to mine this planet and we don't want to mine the oceans. They're way too sensitive. It's a completely insane idea to go mining in the oceans. That's just crazy. That's madness. So we have to mine on land, we have to go to desert environments, we have to go deeper. We have to find a better way to mine. We have to mine the metals we need so that eight or 9 billion people have a better life and for their kids. And you can see that when people have a better life, they make less babies. And when people have a worse life, they make more babies. As an insurance policy, you can see the birth rate dropping in Japan and Korea and China. It's still very high in say, Nigeria or Pakistan or Egypt. So in order to slow birth rates down, naturally have to look after everybody, give everybody a good life.

Robert Friedland (46m 39s):
And that needs mining you know, mining to find the water, mining to develop the agriculture and in every field of endeavor we look at, we see breakthroughs, we see upside you got the XPRIZE, you know what a great thing the XPRIZE define the problem that we're trying to solve and reward people for coming up with a solution and so the most obvious definition is everybody on this planet needs. If anybody can argue with me, I'd be surprised. Everybody needs clean air. Everybody needs unpolluted water. Everybody needs natural healthy food without a lot of hormones and pesticides that throw off your immune system. And I mean everybody then all the stuff on top of that, like Porsches and Mercedes-Benz, that's a, you know, oh Lord, won't you buy me Mercedes-Benz? My friends all drive Porsches. I must make amends. That's a good one so right.

David Greely (47m 34s):
It is a good one.

Robert Friedland (47m 40s):
It's a good one. Everybody wants everything. If everybody has a car, there is 8 billion cars spewing out toxic poison. It isn't what's coming out of their tail put, it's how much energy we're expending to build those cars and keep them going and so this whole thing has to be thought through cradle to grave, sperm to germ moved to tomb. We need these kinds of dialogues. We need podcasts, we need smarter markets. I violently agree. We need smarter markets. We need to place a premium on anything that's part of the solution and a penalty on anything that's part of the problem.

David Greely (48m 16s):
Yeah and I wanted to ask you because you had brought up the US IRA, many governments seem to be taking a more active stance in trying to move towards energy transition in some way, whether it's the United States, China Kingdom of Saudi Arabia, you talk with all of them. I was curious, are there aspects you're seeing that you're like, yes, we need more of this happening from governments?

Robert Friedland (48m 42s):
Oh yes, definitely. There's intelligence everywhere. You know, I used to think, oh, Americans are really smarter, or Russians are really smarter. Germans are really smarter Chinese man. They're incredibly good, they're incredibly smart and based on my work in 65 countries I find that human intelligence is present everywhere in every country and people are really smart everywhere. People get this conversation, they understand it. Big Saudi Arabia, the Saudis have three major copper cable companies. One of them is Riyadh cable, another one is jet cable and they're using 300,000, 350,000 metric tons a year, copper to make copper cable and that cable goes into wire harnesses and cars. It's, it goes downstream in air conditioning, microwave ovens and washing machines and at Saudi policy now to try to develop some of that copper domestically rather than to import it because in the event of a disruption in the democratization of the world economy, they feel nervous.

Robert Friedland (49m 45s):
They'd rather mine it domestically. I mean, they have it, they never bothered to look for it domestically, but they haven't and if they can find their own 350,000 metric tons of copper, it releases 350,000 tons of copper for some other country that desperately needs it. It's a lot like squeezing and balloon on one end. It pops out on the other. If the Chinese have enough copper for what they want to do now, that's if they have more copper that liberates copper for America or Europe and the United States, we all want a green. Everybody wants to build electric cars by man. You know, an internal combustion engine used about 40 pounds of copper per car. If you bought a Ford Mustang. If you're buying a big heavy SS u v all electric, let alone an electric Hummer, you are using 200, 250 pounds of copper per car.

Robert Friedland (50m 56s):
You're the eight sixfold eightfold more copper per car. So you got a choice. You wanna burn gasoline, you wanna burn diesel, or do you wanna have an electric car just to make the car. You need about five or six times more copper. Now, if you wanna have that car windmill powered or solar powered, your energy, your, your copper metal intensity per unit of energy is 20 to 40 x 20 to 40 times more copper per unit of power produced compared to burning coal. So when you go to these sophisticated electric systems for everything, we just need oceans of copper. We need a better way to find it, better way to mine it and that's why, you know, Citibank and Goldman Sachs are saying, we need a higher price to incentivize people. They're relying on the pricing mechanism in the smarter market. Obviously we need a higher price, obviously we're gonna have a higher price.

Robert Friedland (41m 29s):
I had a debate with a, with a gentleman in China that ran a big organization, one of the biggest in the 1990s and the copper was £00.70 a pound and he said the highest price we'd ever go to was a dollar and I said, you're crazy, it's going to $3 a pound and he said, that's impossible. So I took him out the window and just had to look out the window at the city of Beijing. I said, look, everybody out there wants a microwave oven it and a washing machine and an electric toothbrush and a big screen TV got the point. You know, that, you know, we want everything right. We want everything. It's the pricing mechanism that limits it. What I want is everybody on this planet to be fed and clothed and educated without destroying the oceans in our environment.

Robert Friedland (52m 15s):
I think that's achievable and I think anything we do sliding into war is really, really, really bad for that effort. Now, the paradox is a lot of the technology we need to solve the problems came out of the military. The best technologies were reserved for the military. Like where does AI go first, right. I mean, like what sunk the Moskva pride of the Russian fleet. Some new toy sunk the Moskva, you know, you know the British are giving cruise missiles to Ukraine and you know, where's this gonna. Where's this going to stop. If we can't obey

the rules and we say, well the borders were different 300 years ago. We're coming in to kill your civilian population. We wanna restore the borders to 50 or a 100 years ago. How are we ever going to get our act together to eliminate global warming gas?

Robert Friedland (53m 08s):
And let's just take tanks. You know, the West is giving Ukraine the Abrams tank. Well, the Abrams tank has a jet engine in it, a turbine engine, a very sophisticated tank, a turbine engine. Well, that turbine engine generates a lot of heat. So with current technology can see the heat signature of that tank. So now we want to make that a battery powered tank. So you can't see the heat signature from a satellite to kill the tank. So now we want to electrify the entire United States military, the army, the Navy, and the Air Force. Well, that's going to drive up the price of electric cars opening sooner, you know, local dealer in 2025 and by the way, we need smarter markets because we're, still paying the same price for dirty copper and clean copper. You have a copper mine burning coal and a copper mine running on solar power.

Robert Friedland (54m 00s):
We're gonna build a green copper mine in Arizona. The copper mine that's clean should be rewarded for it to get a higher price for the copper. But we don't even have the right pricing mechanism in our markets. So our markets are sort of stone age. They're not that different than they were in ancient Babylonia. So we need disruptive change everywhere across the board. You know, we need more mining. We need, we need better pricing mechanisms. We need to mine the right stuff and stop mining the wrong stuff. We got to, we have to teach every single school kid what is the supply chain. We got to force every kid to read how the world really works by rock lab, smell a Canadian mathematician just to teach kids. Where does stuff come from you know, that'd be a great start. We need 500 more of these podcasts and we need Abaxx Technologies to succeed in making smarter markets. I'm an optimist. I'm hyper optimistic. Probably if I wasn't, I would be able to get out of bed in the morning.

David Greely (54m 05s):
And we need to have you back to help us understand how the world works. So thank you, Robert. Really appreciate you making the time.

Robert Friedland (55m 00s):
Thank you, mate.

David Greely (55m 18s):
Thanks again to Robert Friedland, Founder and Executive Co-Chairman of Ivanhoe Mines. We hope you enjoyed the episode. Join us next week with our guest, Dirk Forrister, President and CEO at the International Emissions Trading Association. We hope you'll join us.

Announcer (55m 37s):
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Announcer (56m 22s):
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