

Hi & Hello



Risk Management & Insurance Considerations for Solar Projects

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01. FOUNDATION

Explore risk management & various approaches

Various Risk Management Frameworks

Why Now?

Why So Many?

Because the world is complex, evolving, and plentiful

COSO, FAIR...and more

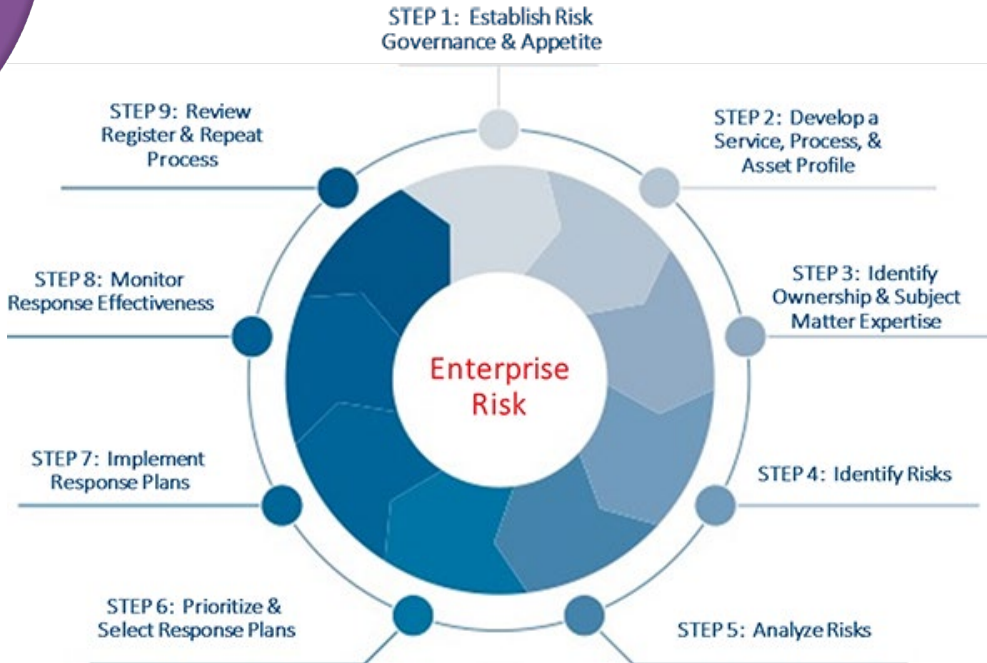


NIST, FORTE...and more

Various Frameworks

Why so many?

Because the world is complex, evolving, and plentiful



How to Pick?

Commonalities

- ❑ Risk Management Focus: All these frameworks focus on managing risks, though their specific applications vary (financial, operational, cybersecurity, etc.).
- ❑ Governance and Compliance Focus: Each framework emphasizes the importance of governance and compliance in their respective domains.
- ❑ Widespread Adoption: They are widely recognized and adopted in their respective areas of focus.

Differences

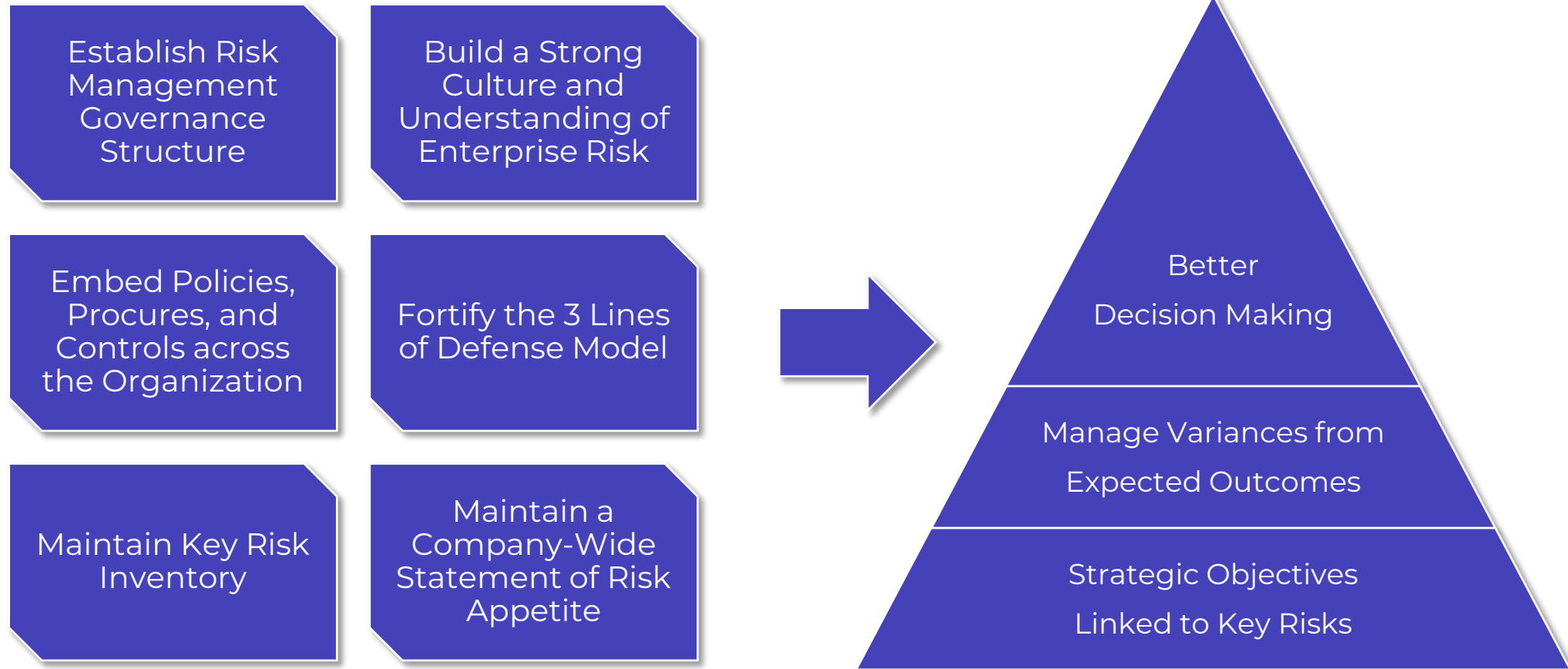
- ❑ Scope and Application: COSO and BASEL are more focused on financial and operational risk, with COSO being more comprehensive in internal control, while BASEL is specific to banking regulation. ISO provides a broad range of standards applicable in multiple domains, and NIST focuses specifically on technology and cybersecurity.
- ❑ Geographical Influence: COSO and NIST are more U.S.-centric, while ISO and BASEL have more global influence.
- ❑ Prescriptiveness: ISO standards are more prescriptive, providing specific requirements, whereas NIST offers more flexible guidelines. COSO falls in between, providing a structured framework without being overly prescriptive.

A desired framework

- ❑ Simple and repeatable – is the framework initiative?
- ❑ Flexible – can it handle various types of assets
- ❑ Modular and scalable – can the framework handle smaller scope and roll up to broader view

“Align the framework with strategy and culture”

Risk Management – Values & Objectives



Three Lines of Defense

Risk Ownership

First Line & Support

Process Owner

Participation

Risk Oversight

Second Line Support

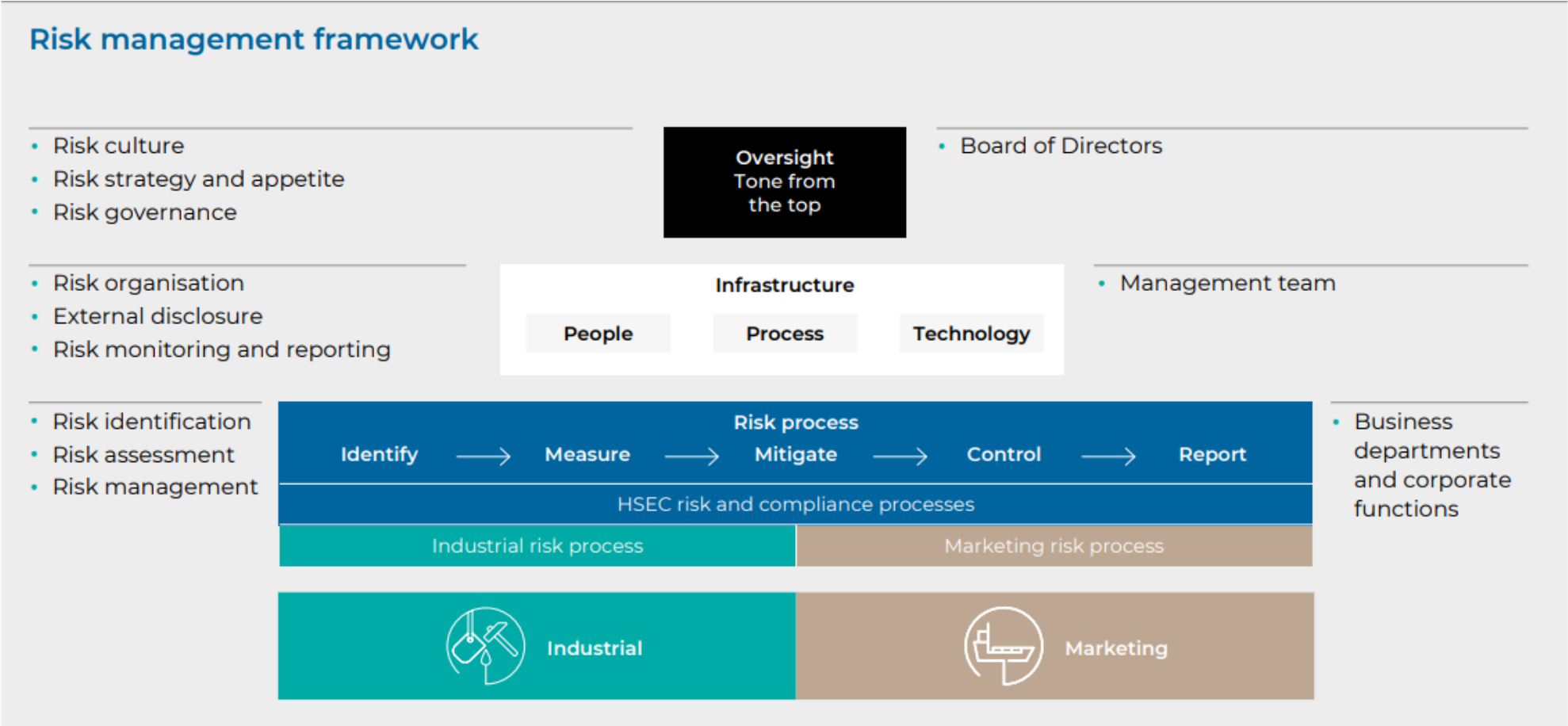
Business Process

Definition & Risk Ownership

Risk Assurance

Third Line Provides Counsel & Guidance

A sample *(from Glencore)*



Brief discussion on Compliance, Risk, and Audit

Compliance

What Could We Do?

Risk

What Should We Do?

Audit

What Did We Do?

Brief discussion on Metrics

Key Performance Indicators
(lagging indicator)

Are we achieving our desired level of performance?

Key Risk Indicators
(leading indicator)

How is our risk profile changing and is it within our desired tolerance levels?

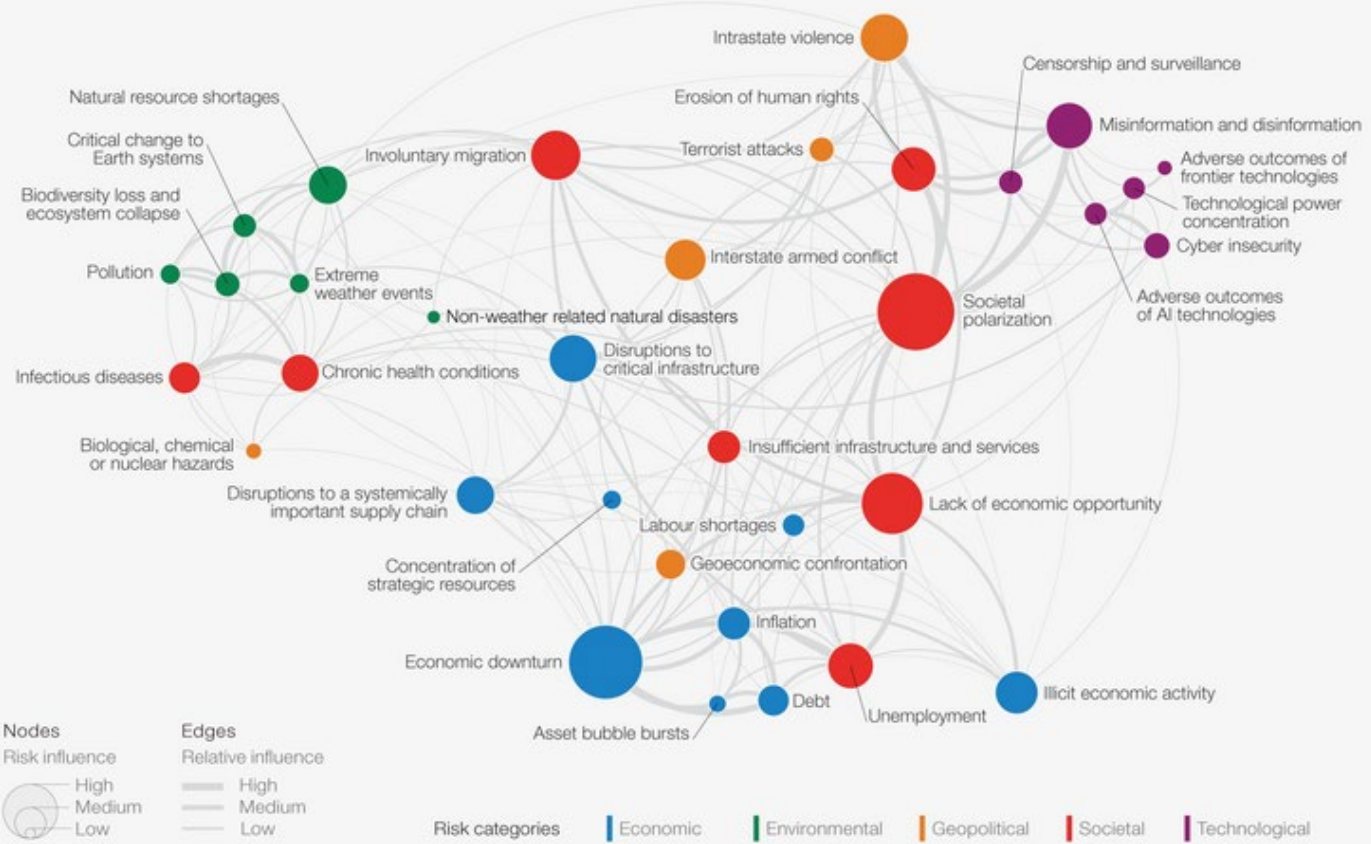
Key Control Indicators
(leading indicator)

Are our internal controls working? Are we “in control”?

Brief discussion on Metrics

	KPI	KRI	KCI
Business continuity	<ul style="list-style-type: none"> Recovery time objective Frequency of business continuity review 	<ul style="list-style-type: none"> Frequency & severity of storms Infrastructure disrepair or obsolescence 	<ul style="list-style-type: none"> Failure rate from business continuity exercise Incomplete / out of date business impact analysis
Data management	<ul style="list-style-type: none"> Data quality standards Identification & maintenance of critical data 	<ul style="list-style-type: none"> Volume of data under management Volume and complexity of data movement needs 	<ul style="list-style-type: none"> Failure rate from risk control self assessment control Incomplete / out of date critical business element inventories
Information security	<ul style="list-style-type: none"> Identity & access management standards Secure coding standards 	<ul style="list-style-type: none"> Increase in external attacks - volume, nature, complexity Increases internal threats - volume, nature, complexity 	<ul style="list-style-type: none"> Failure rate from risk control self assessment control Lack of adherence to standards
People	<ul style="list-style-type: none"> Code of conduct Performance management practice 	<ul style="list-style-type: none"> Elevated attrition rate Inability to hire - geographies, skillsets, etc. 	<ul style="list-style-type: none"> Non-compliance with corporate policies Project management practices not completed on time with quality
Third party	<ul style="list-style-type: none"> Third party management standards – sourcing, onboarding, management Vendor scorecards 	<ul style="list-style-type: none"> Financial health of third parties Concentration risk 	<ul style="list-style-type: none"> Failure rate from risk control self assessment control Poor supervision / oversight (e.g. contract execution)

FIGURE D Global risks landscape: an interconnections map



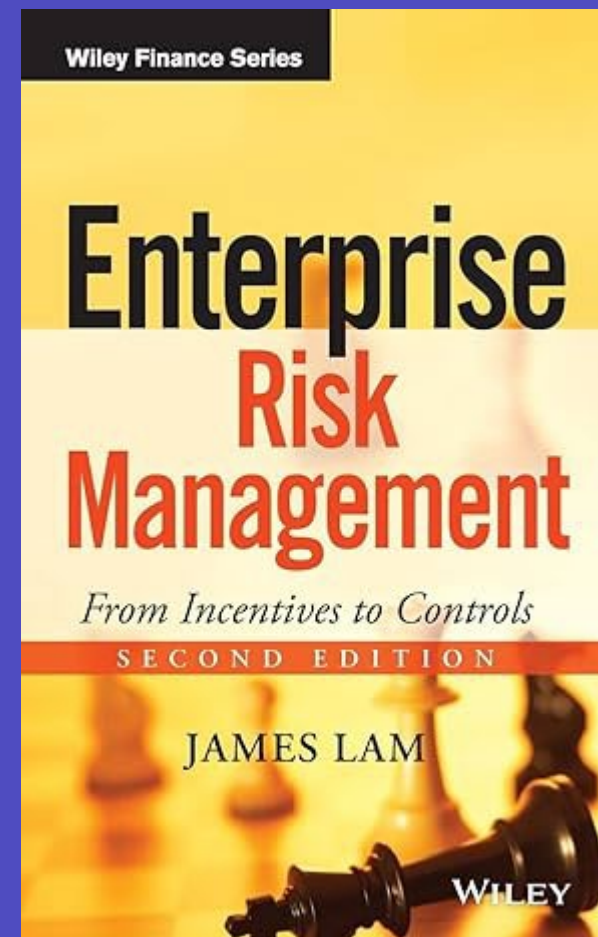
Source
World Economic Forum Global Risks
Perception Survey 2023-2024.

Strategic Risk

1. What are the key strategic risks facing my organization?
2. Is my industry currently being, or will be, disrupted? How?

A mock example (credit to James Lam)

Risk Type	Metric	Risk Tolerance (better – worse)	Q1 202X	Q2 202X	Q3 202X	Q4 202X
Strategic	ROE	12 – 10%	Green	Green	Green	Green
	ROA	1.5 -1.0%	Yellow	Yellow	Yellow	Yellow
	Unexpected Earnings Volatility	< 20%	Red	Red	Red	Red
Financial	% Loan Delinquency (30+ days)	0.5 – 1.0%	Green	Green	Green	Green
	Liquidity coverage ratio (90 days)	150 – 120%	Green	Green	Green	Green
	Material exceptions to financial risk policies/ limits	0	Green	Green	Green	Green
Operational	# of cyber incidents with business impact	0 – 2 - 5	Red	Red	Yellow	Green
	Operational losses as a % of Total Revenue	< 1%	Yellow	Yellow	Green	Green
	% of high risk operational control issues	< 10%	Red	Red	Yellow	Red
Compliance	# of high severity compliance issues	0	Green	Green	Green	Green
	% of compliance areas deemed effective	90% - 80%	Green	Green	Yellow	Red



TRY THIS

...Provide perspective and insights, not homework.

Don't stop at 'informative'

Reach for 'useful/actionable'...

Risks exist in the unknown. If we are in the dark, we are exposed.

Study risks make them less scary.

In Closing

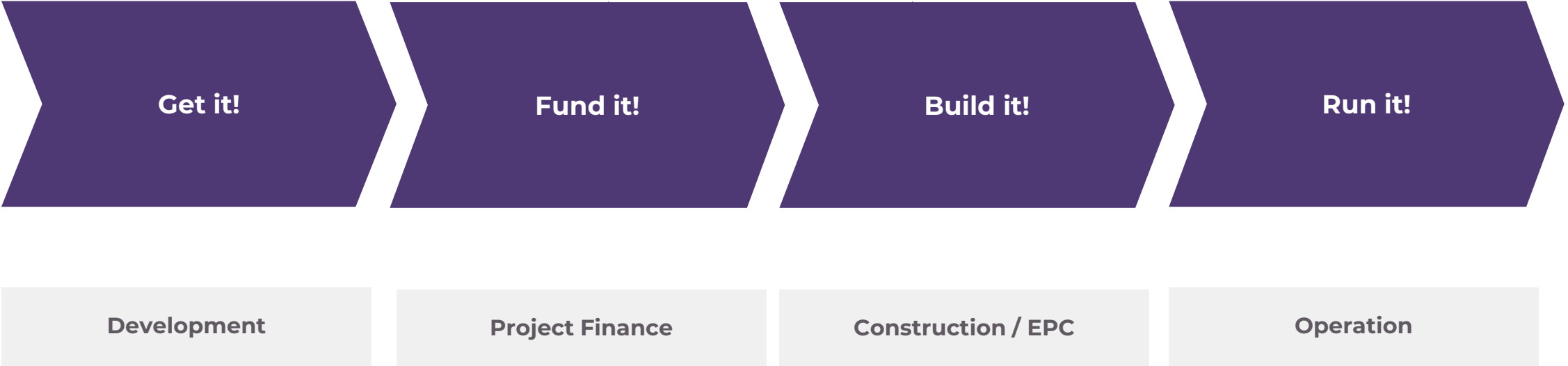
How can you help your organization understand the range of potential outcomes?

Parting Thoughts

02. ZOOM IN

Strategize Risk Management for Solar Project Life Cycle

What are the stages of a project lifecycle?



Get it!

Big picture

It is expected that there will be a lot of consolidation. Therefore, you might be acquiring projects that already have certain IX (Interconnection) agreements or PPA (Power Purchase Agreement) already attached.

These insurance provisions might have been written some time ago when the property markets were in a vastly different state than they are today, and than where we are likely headed.

So, don't just purchase projects without thoroughly reviewing the insurance provisions.

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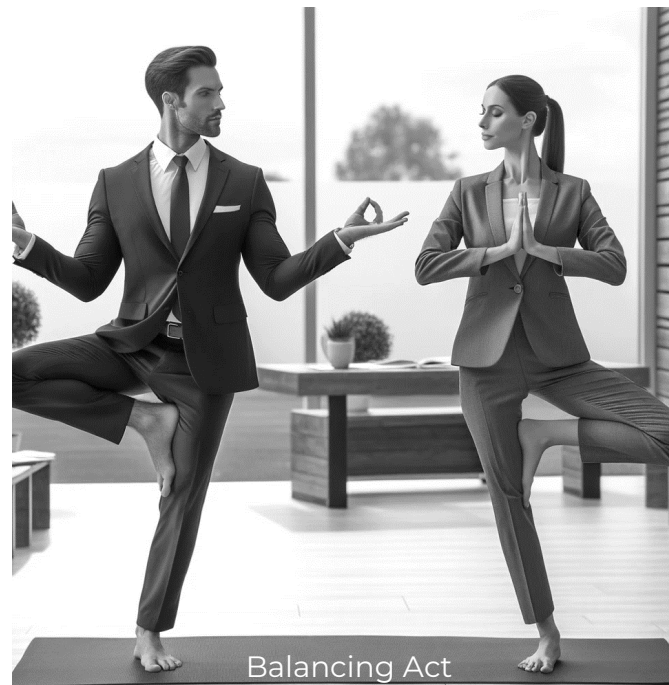
Merger & Acquisition



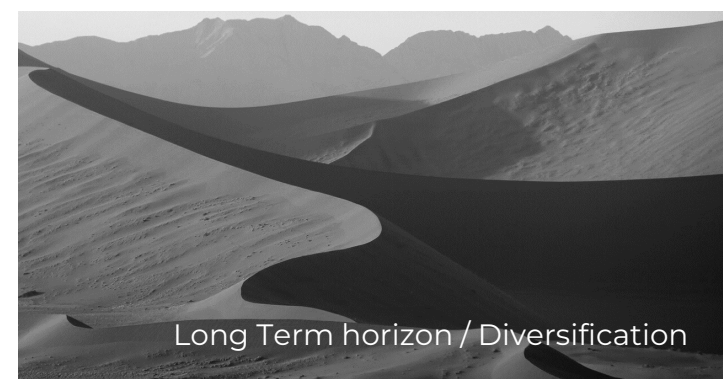
Land Lease



Due Diligence



Balancing Act

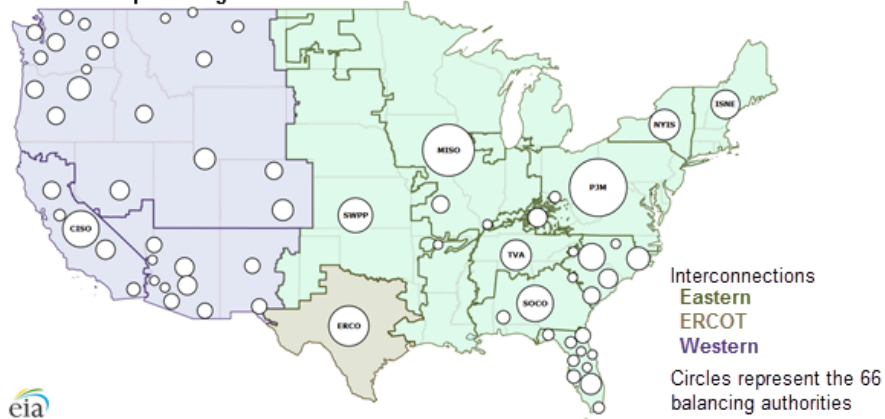


Long Term horizon / Diversification

Get it! Let's unpack

Acquisition

U.S. electric power regions



M&A deals

- + What are some of the contracts that are already in place? Interconnection agreement? Power Purchase Agreement?
- + Can they be renegotiated?
- + What are the big tickets that we have to walk away from if can't be changed? Look at those Insurance Exhibits. They could have been written many years ago that no longer viable.

Development deals

- + Where are we building this project?
- + What are some of the ways to be smart and intentional given ground lease agreements are long term (20 - 40 years)?
- + What are the concerns / objections from the landowners, city or county?

Fund it!

Big picture

The volume and speed are crucial in any deal.

This means you want a methodology that is repeatable, scalable, and appropriate. It's widely perceived that sorting out insurance provisions can be time-consuming. However, it doesn't have to be that way.

Establish a framework. Determine what is agreeable, what makes sense, and what is appropriate. Granted, every project involves different counterparties and unique risks, but for the most part, insurance provisions, in principle and structure, are largely the same.

Additionally, the amount of paperwork and the version controls of a single piece of contract can be overwhelming. Therefore, have a system and stay organized.

02. Zoom In Risk Management & Insurance Considerations for Solar Projects by T Lee, 2024

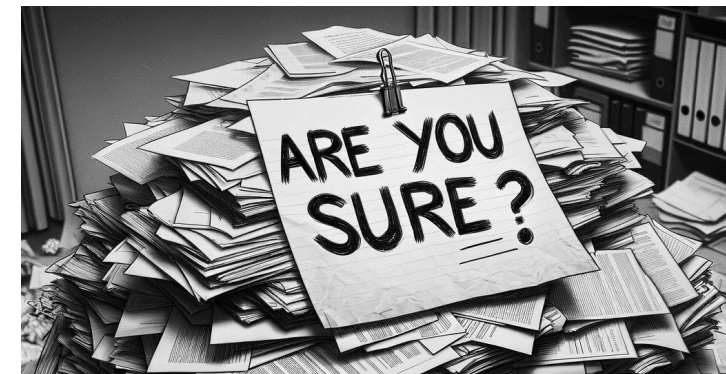
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Wishing you the best returns!

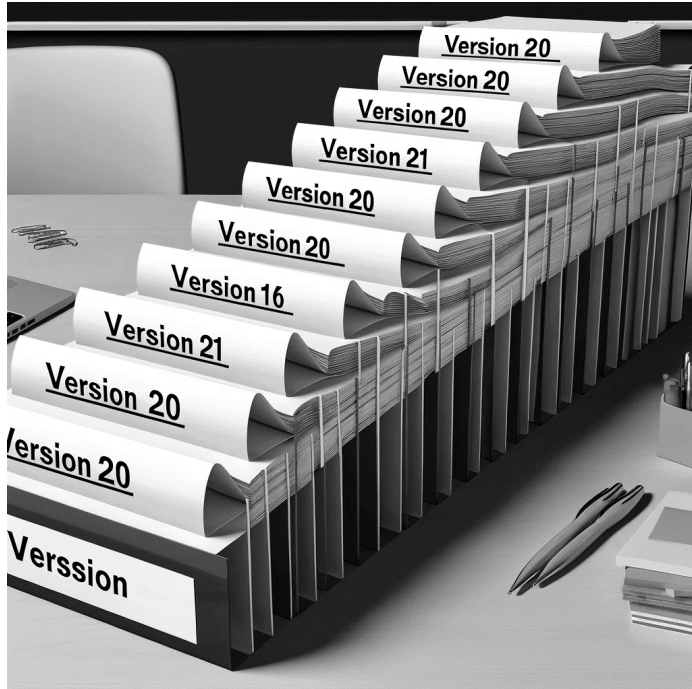
TAX DAY

NAME IS BOND



Fund it! Let's unpack

Finance



Project Finance

- + Who are the investors and what do they typically want? Knowing who we are transacting with can help speed things up from both sides
- + Insurance requirement discussion
- + Insurance placement
 - Property (construction phase and operational phase)
 - Surety bond arrangement
 - ITC insurance (various scopes of coverage)
- + Who is the insurance consultant and their track record?
- + How do I plan to communicate a vast amount of information succinctly, in real-time, and in an organized fashion?

Discussion: We are going to do a lot more deals. So what?

- + How do we do more deals more efficiently is the key question.
- + Does negotiation need to be one-deal at a time?

Build it!

Big picture

Milestones matter.

Therefore, establish a strong and solid relationship with the EPC (Engineering Procurement Construction) firm you choose.

The construction business is complex, with many moving parts. Appreciate that complexity. You would want a skilled mechanic who can.

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Solar Power World

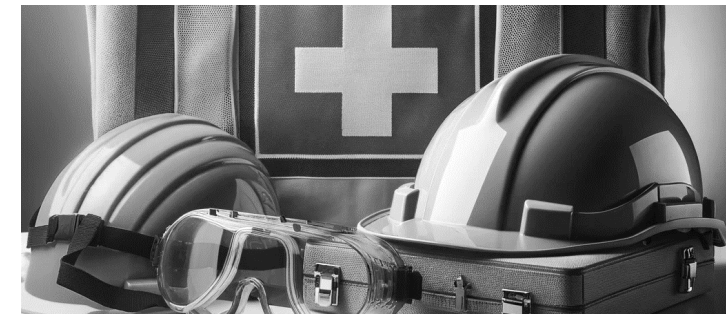
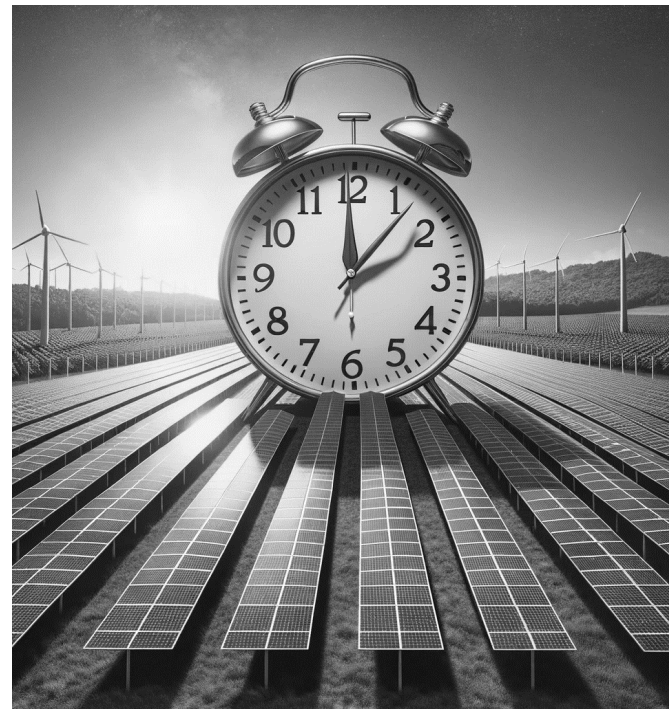
TOP SOLAR CONTRACTORS ▾ ARTICLES ▾ POLICY ▾ MARKETS ▾ PRODUCTS ▾ SUBSCRIBE RESOURCES ▾ LEADERSHIP ▾

Top Solar Contractors



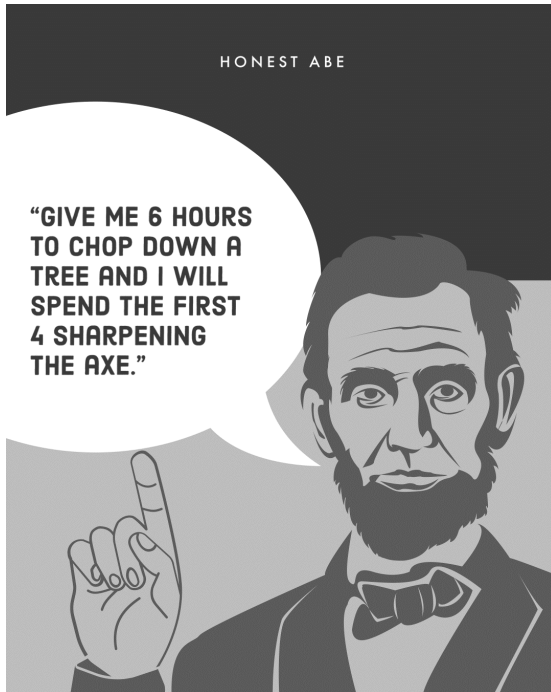
Solar Power World, the leading solar publication covering technology, development and installation, publishes the **Top Solar Contractors List** annually. The list includes hundreds of solar contractors and developers in the United States, listed and categorized by state/territory, service and market.

The list includes solar PV companies that provide the following services: sales, EPC contracting, development, construction/installation, electrical work and/or rooftop-specific installations. Companies can do work in any market segment, including utility, commercial, community and residential.



Build it! Let's unpack

Construction



EPC

- + Milestone matters. Do you have a strong relationship with the EPC firm? What is the EPC firm's track record?
- + Construction delays do happen. What kind of consistent & frequent communication do you have?
- + Weather events do occur. Do you know your gameplan – which party is responsible for placing insurance, paying for deductible, and managing claims?
- + Subcontractors matter. How do you prequalify your subcontractors?
- + Construction business is complex. Do you have a strong risk advisor team that can support you through various issues that might arise?

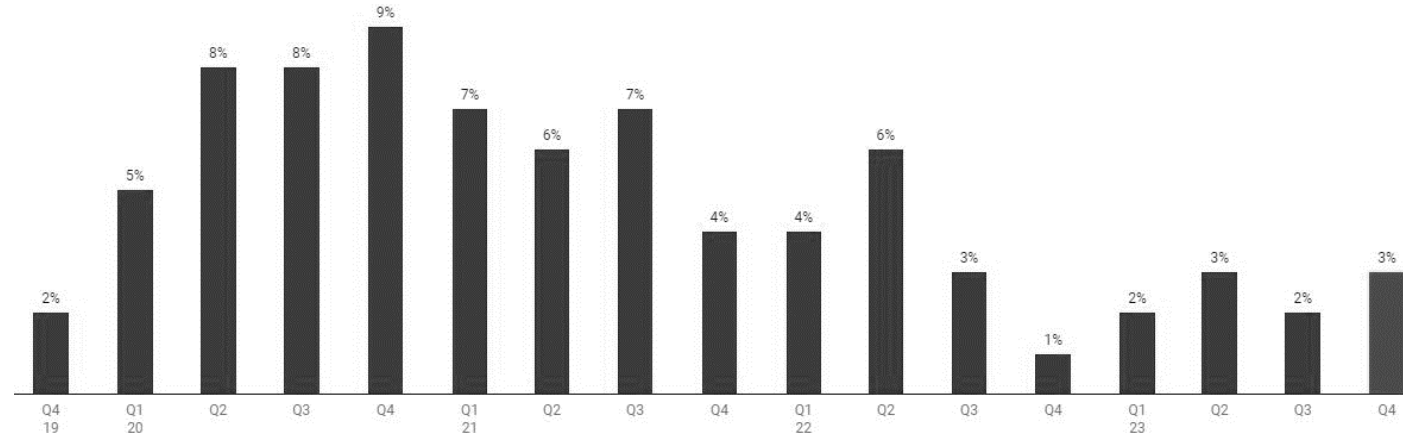
Discussion: We are going to do a lot more deals. So what?

Run it!

Big picture

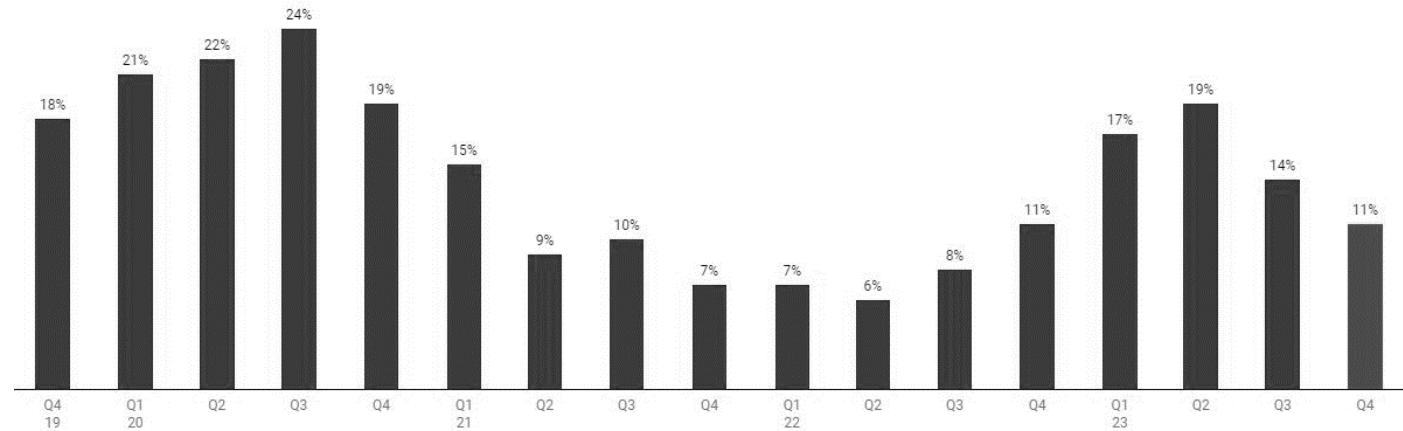
Everyone chases financial return. The question then is: over what timeframe? Is it for 1 year, 5 years, 10 years, or 20 years? The longer the time horizon, the more important it becomes to focus on the resilience of the asset. Resilience begins with the location. Other factors that also influence resilience include engineering, equipment selection, quality control, and ongoing monitoring.

US casualty



Source: Marsh Specialty and Global Placement • Download SVG • Created with Datawrapper

US property



Source: Marsh Specialty and Global Placement • Download SVG • Created with Datawrapper

Run it! Let's unpack

Operation



Operating & Maintenance

- + Financial returns matter. How do care for your assets?
- + O&M services matters:
 - Are there Quality Controls before handing off from Construction to Operation?
 - What are the specific monitoring and reporting services provided? Site inspection and maintenance? Testing? NERC Compliance? What is the frequency? Daily / monthly / annually?
- + Weather events do occur. Do you know your game plan – which party is responsible for placing insurance, paying for deductibles, and managing claim?
- + Risk Control. Compared to other industry sectors, the clean energy sector is relatively young in its stage of maturity. Consequently, risk control could be overlooked and underinvested. However, this is precisely where potential vulnerabilities lie. If you want to save a significant amount of money, consider investing a small amount in risk control to prevent substantial losses from happening in the first place. This includes practices like defensive driving, safety training, emergency action plans, hazard prevention, equipment inspection, and maintenance.
- + Risk Retention & Transfer

Discussion: We are going to do a lot more deals. So what?

Let's talk Insurance



Insurance

Participants People & Roles



Insurance

Largest Insurance Companies

Source: Insurance Business Magazine, Jan 04, 2024

10 LARGEST INSURANCE COMPANIES IN THE WORLD			
Rank	Insurer	Country	Written premiums
1	<i>State Farm</i>	US	\$77.59 billion
2	<i>PICC</i>	China	\$73.09 billion
3	<i>Berkshire Hathaway</i>	US	\$71.84 billion
4	<i>Allianz</i>	Germany	\$71.34 billion
5	<i>Lloyd's of London</i>	UK	\$57.69 billion
6	<i>Liberty Mutual</i>	US	\$56.58 billion
7	<i>AXA</i>	France	\$53.67 billion
8	<i>Progressive</i>	US	\$52.34 billion
9	<i>Allstate</i>	US	\$50.31 billion
10	<i>Ping An</i>	China	\$44.37 billion

“... The largest property and casualty insurance companies in the world wrote a combined \$1.45 trillion in premiums in 2023...”

Insurance

Largest Reinsurance Companies

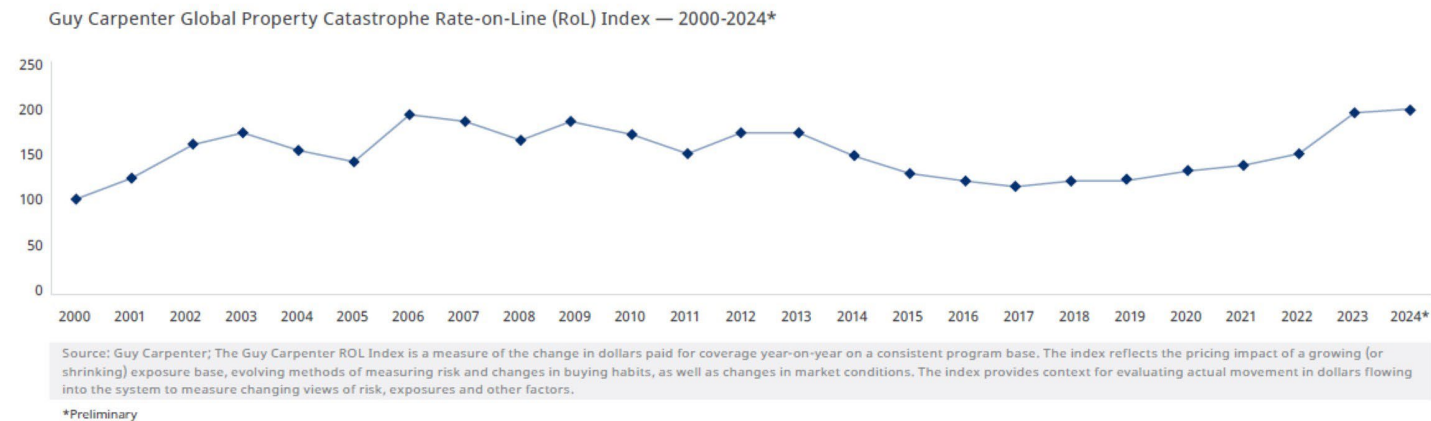
Source: Reinsurance News

Ranking ↕	Reinsurance Company Name ↕	Gross Life & Non-Life Reinsurance Premiums Written ↕	Net Life & Non-Life Reinsurance Premiums Written ↕	Gross Non-Life Only Reinsurance Premiums Written ↕	Net Non-Life Only Reinsurance Premiums Written ↕
1	Munich Reinsurance Company	\$51,331	\$48,550	\$36,729	\$35,290
2	Swiss Re Ltd.	\$39,749	\$37,302	\$23,763	\$22,826
3	Hannover Rück S.E. 4	\$35,528	\$29,672	\$25,884	\$21,637
4	Canada Life Re	\$23,414	\$23,414	N/A	N/A
5	Berkshire Hathaway Inc. 5	\$22,147	\$22,147	\$16,962	\$16,962
6	SCOR S.E.	\$21,068	\$17,055	\$10,695	\$8,782
7	Lloyd's 6, 7	\$18,533	\$14,162	\$18,533	\$14,162
8	China Reinsurance (Group) Corporation	\$16,865	\$15,395	\$7,688	\$7,207
9	Reinsurance Group of America Inc.	\$13,823	\$13,052	N/A	N/A
10	Everest Re Group Ltd.	\$9,316	\$8,983	\$9,316	\$8,983

02. Zoom In Risk Management & Insurance Considerations for Solar Projects by T Lee, 2024

Global Property CAT Rate on Line Index, 2000 - 2024

Source: Guy Carpenter



“... The Guy Carpenter RoL [Rate on Line] index is a measure of the change in dollars paid for coverage year on year on a consistent program base...”

Insurance

Largest Brokers

Source: Reinsurance News

2022 Ranking	Broker	2022 total revenues (US \$)	Prior year ranking (2021)
1	Marsh McLennan	20,700,000,000	1
2	Aon plc	12,500,000,000	2
3	WTW	8,900,000,000	3
4	Arthur J. Gallagher & Co.	8,400,000,000	4
5	Hub International Ltd.	3,770,000,000	5
6	Acisure LLC	3,680,000,000	7
7	Brown & Brown Inc.	3,600,000,000	6
8	Truist Insurance Holdings Inc.	3,380,000,000	9
9	Alliant Insurance Services Inc.	3,220,000,000	8
10	Lockton Inc.	3,100,000,000	10

Insurance

Largest Markets

Source: Swiss RE Institute

Rank	Country/market	Total premium volume (USD bn)		Total premium volume (USD bn)	Global market share	
		2022	2021	% change	2022	2021
1	US	2 960	2 725	8.6%	43.7%	40.3%
2	China	698	696	0.2%	10.3%	10.3%
3	UK	363	374	-2.8%	5.4%	5.5%
4	Japan	338	398	-15.1%	5.0%	5.9%
5	France	261	293	-10.7%	3.9%	4.3%
6	Germany	242	272	-11.3%	3.6%	4.0%
7	South Korea	183	193	-5.3%	2.7%	2.9%
8	Canada	171	166	2.8%	2.5%	2.5%
9	Italy	160	192	-16.5%	2.4%	2.8%
10	India	131	123	6.5%	1.9%	1.8%

Underwriters

Focus on partnering with a strong group of underwriters that understand the risks.

How to assess?

They tend to have a huge appetite for learning the technical aspects of insurance, industry and overall macro-environment issues related to the business. Underwriters need to be creative as risks do evolve, and part of knowing how to price risk is to adapt quickly and learn continuously. They need to think long term, not short term. They want to be known as the underwriters with expertise, and not underwriters who offer the cheapest price.



Risk Advisors

Seek insurance brokers who can also give advice on risks (and not just sell me insurance without giving me any valuable advice). Risk advisors should be viewed as your trusted advisors.

How to assess?

Please know this: Not everyone who knows how to spell insurance or sell insurance can be a risk advisor. Understand that people have different motives and those may be based on how they are incentivized. Watch how they communicate - are they here to sell or are they here to advise?

Strategic = Long Term

Good at many things including advisory, insurance placement, and claims advocacy.

Risk Managers

Seek someone that speaks English and simplifies complex matters for the decision makers.

How do you assess?

Technical competency

Non-technical competency (influence & persuasion)

Continuous learning

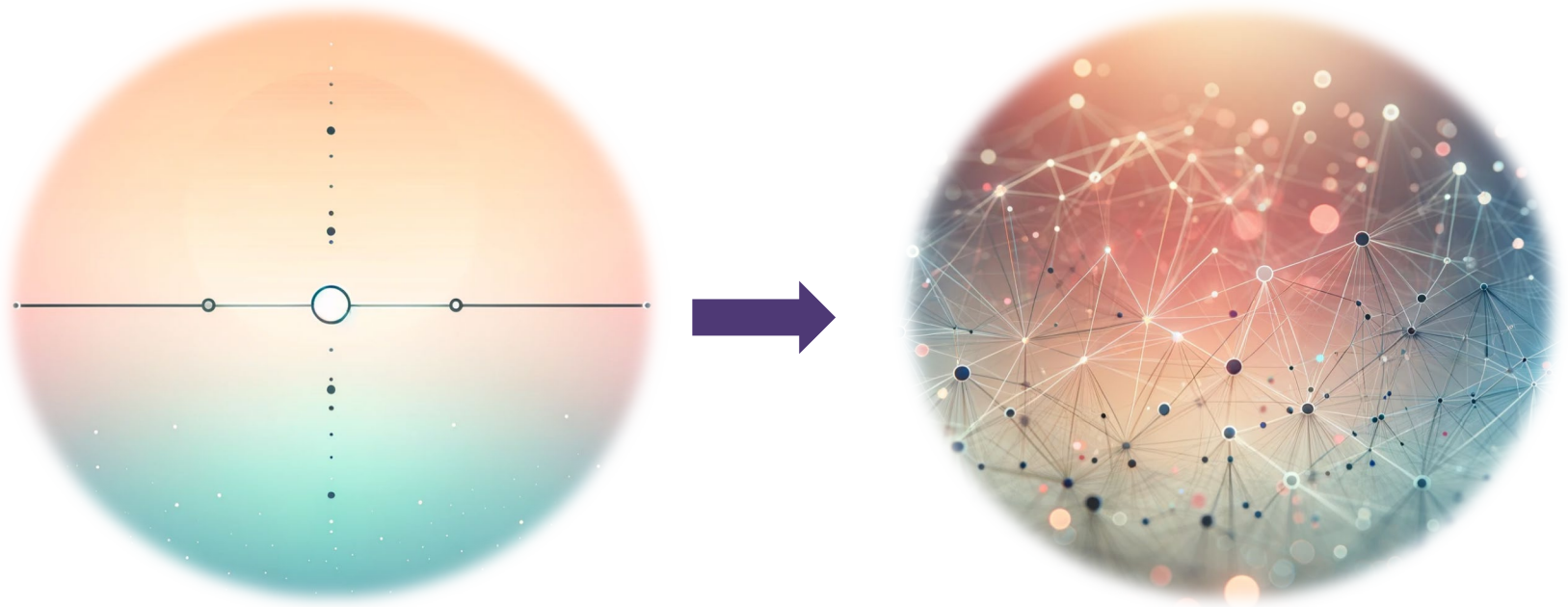
Show up as a partner, consistently

Accept this up front: people don't automatically understand what you do

Seek credit (who cares?) vs. Seek result (everybody cares)

Insurance

- + Insurance
- + Risk Financing Options
- + Contracts
- + Partnerships



**Add Value = Connect Dots
More than 1 Dot at a Time**

Property

Seek a spread of risks across geography.

If you have a concentration of risk in a particular area, consider requesting a cap on deductibles to help mitigate the impact from a single event on multiple projects.

The cost of insurance is directly correlated with the number of standalone programs you have in place. Consolidate standalone insurance programs into one or a few master programs.

Please do not trade dollars with the insurance company. Insurance should not be “maintenance” expense.

Casualty

You don't just transfer 100% of your risk without retaining some.

Emphasis on Risk Control

This includes practices like defensive driving, safety training, emergency action plans, hazard prevention, equipment inspection and maintenance.

Financial Lines (D&O, EPL, Fiduciary, E&O, KRE)

Take stock of areas of professional services provided

Be aware of important verdicts & jurisdiction

Be aware of M&As and significant contract requirements

Run-offs

Conversation about limit: Run benchmarks

Cyber

1st party coverage
(Data Breach Response, Business Interruption, Cyber Extortion, Data Loss or Corruption / System, Damage and Restoration, Social Engineering Fraud)

3rd party
(Network Security Liability, Privacy Liability, Regulatory and Legal Expenses)

Professional Services firms (Crisis Management and Public Relations, Legal Counsel, Cyber Assessment)

“Low hanging fruit”
(Software and hardware asset management, Configuration management, Vulnerability management / updates, Antimalware capability / Detection)

Underwriting Trends
Specific controls vs. Risk Culture

Surety

Optimize cost of capital throughout the entire life cycle

License & Permit Bonds

Payment & Performance Bonds

Interconnection Security

PPA Security

Decommission Bonds

“buzz word” = Surety Backed Letter of Credit

Tax

Investment Enabler

Before vs. After Inflation Reduction Act (IRA)

Base Tax Credit 6%

Wage & Apprenticeship +24%

Domestic Content + 10%

Energy Community +10%

Low Income Community +10% or +20%

ITC vs. PTC

Tax Risk Mitigation (Due diligence, Structure, Transaction Agreement, Tax Insurance limit & coverage)

Insurance

Risk Financing Options to gain control from underwriting, claim management, to investment decisions

	Captive	Mutual
Ownership	Single parent or a group of policyholders	A group of policyholders
Risk Retention vs. Risk Sharing	Captive insurance enables the parent company to retain a portion of its risk exposure, potentially reducing reliance on traditional insurance markets and allowing for more efficient risk financing.	Mutual insurance operates on the principle of risk pooling, where policyholders contribute premiums to a common fund used to pay claims and cover administrative expenses.
Financial Benefit / Returns	Captive insurance companies may generate underwriting profits	Mutual insurance companies may generate dividends

Insurance

Insurance / Relationship Management

Credibility + Reliability + Intimacy

Trustworthiness = _____

Self-Orientation

Credibility

“I can trust what she says about intellectual property; she is very credible on the subject.”

Reliability

“If he says he will deliver the product tomorrow, I trust him, because he is dependable.”

Intimacy

“I can trust her with that information; she has never violated my confidentiality before, and she would never embarrass me.”

Self-orientation

“I can't trust him on this deal — I don't think he cares enough about me, he's focused on what he gets out of it.”

TRY THIS

... By implementing *[Solution]*

we not only achieve *[Primary Benefit]*, but also unlock additional advantages

such as *[Benefit #2]* and *[Benefit #3]*, thereby *[Final Value Added]*...

The clean energy sector plays an increasingly critical role in the energy transition, offering insurance & risk management practitioner the opportunity to drive change and make a meaningful impact.

In Closing

Are you a change observer or a change agent?

Parting thoughts

03. ZOOM OUT

Analyze Headwinds & Tailwinds

From United Nation

SUSTAINABLE DEVELOPMENT GOALS





Key highlights from COP 28



Signalling the ‘beginning of the end’ for the fossil fuel era

COP 28 closed with an agreement that signals the “beginning of the end” of the fossil fuel era by laying the ground for a swift, just and equitable transition, underpinned by deep emissions cuts and scaled-up finance. As COP 28 President Dr. Sultan Al Jaber said: “We have language on fossil fuel in the (COP) final agreement for the first time ever.” It clearly points to the direction of travel in the energy transition, and that the scale and pace of change can’t be stopped or reversed.

The call on nations to transition away from fossil fuels was part of a decision by nearly 200 Parties on the world’s first ‘global stocktake’ to ratchet up climate action before the end of the decade – with the overarching aim to keep the global temperature limit of 1.5°C within reach.

“Whilst we didn’t turn the page on the fossil fuel era in Dubai, this outcome is the beginning of the end,” said UN Climate Change Executive Secretary Simon Stiell. “Now all governments and businesses need to turn these pledges into real-economy outcomes, without delay.”

The ‘global stocktake’ is considered the central outcome of COP 28 – as it contains every element that was under negotiation and can now be used by countries to develop stronger climate action plans due by February 2025.

The stocktake recognizes the science that indicates global greenhouse gas emissions need to be cut 43% by 2030, compared to 2019 levels, to limit global warming to 1.5°C. But it notes Parties are off track when it comes to meeting their Paris Agreement goals.

The stocktake calls on Parties to take actions towards achieving, at a global scale, a tripling of renewable energy capacity and doubling energy efficiency improvements by 2030. The list also includes accelerating efforts towards the phase-down of unabated coal power, phasing out inefficient fossil fuel subsidies, and other measures that drive the transition away from fossil fuels in energy systems, in a just, orderly and equitable manner, with developed countries continuing to take the lead.

In the short-term, Parties are encouraged to come forward with ambitious, economy-wide emission reduction targets, covering all greenhouse gases, sectors and categories and aligned with the 1.5°C limit in their next round of climate action plans (known as [nationally determined contributions](#)) by early 2025.



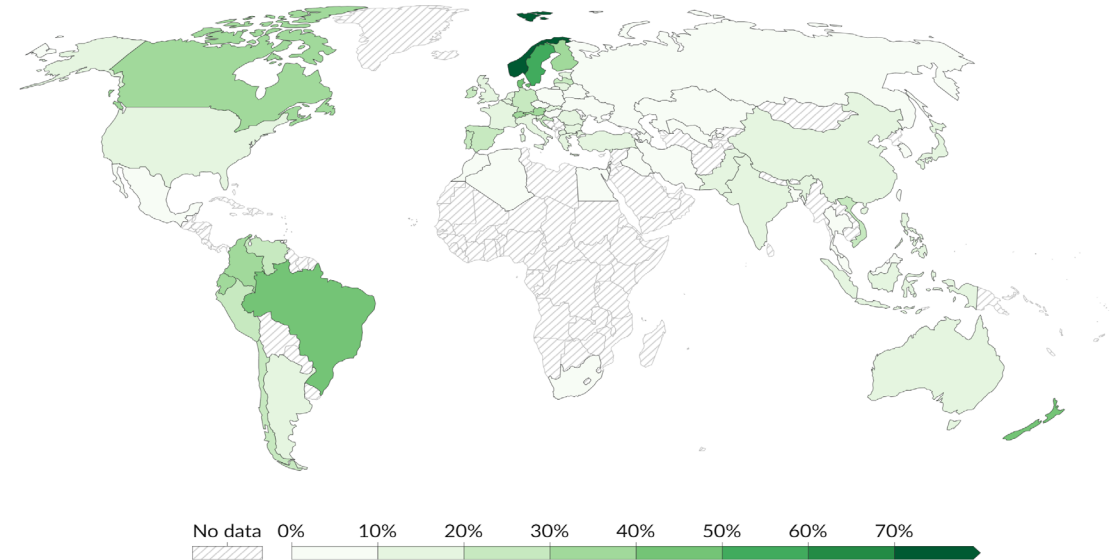
From Our World in Data

Share of primary energy consumption from renewable sources worldwide

Share of primary energy consumption from renewable sources, 2022

Our World in Data

Measured as a percentage of primary energy¹ using the substitution method². Renewables include hydropower, solar, wind, geothermal, bioenergy, wave, and tidal, but not traditional biofuels, which can be a key energy source, especially in lower-income settings.



Data source: Energy Institute - Statistical Review of World Energy (2023)

OurWorldInData.org/energy | CC BY

1. Primary energy: Primary energy is the energy available as resources – such as the fuels burnt in power plants – before it has been transformed. This relates to the coal before it has been burned, the uranium, or the barrels of oil. Primary energy includes energy that the end user needs, in the form of electricity, transport and heating, plus inefficiencies and energy that is lost when raw resources are transformed into a usable form. You can read more on the different ways of measuring energy in our article.

2. Substitution method: The 'substitution method' is used by researchers to correct primary energy consumption for efficiency losses experienced by fossil fuels. It tries to adjust non-fossil energy sources to the inputs that would be needed if it was generated from fossil fuels. It assumes that wind and solar electricity is as inefficient as coal or gas. To do this, energy generation from non-fossil sources are divided by a standard 'thermal efficiency factor' – typically around 0.4. Nuclear power is also adjusted despite it also experiencing thermal losses in a power plant. Since it's reported in terms of electricity output, we need to do this adjustment to calculate its equivalent input value. You can read more about this adjustment in our article.

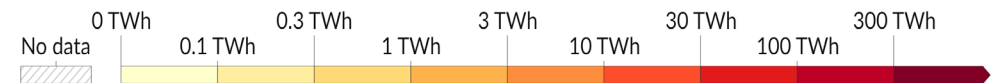
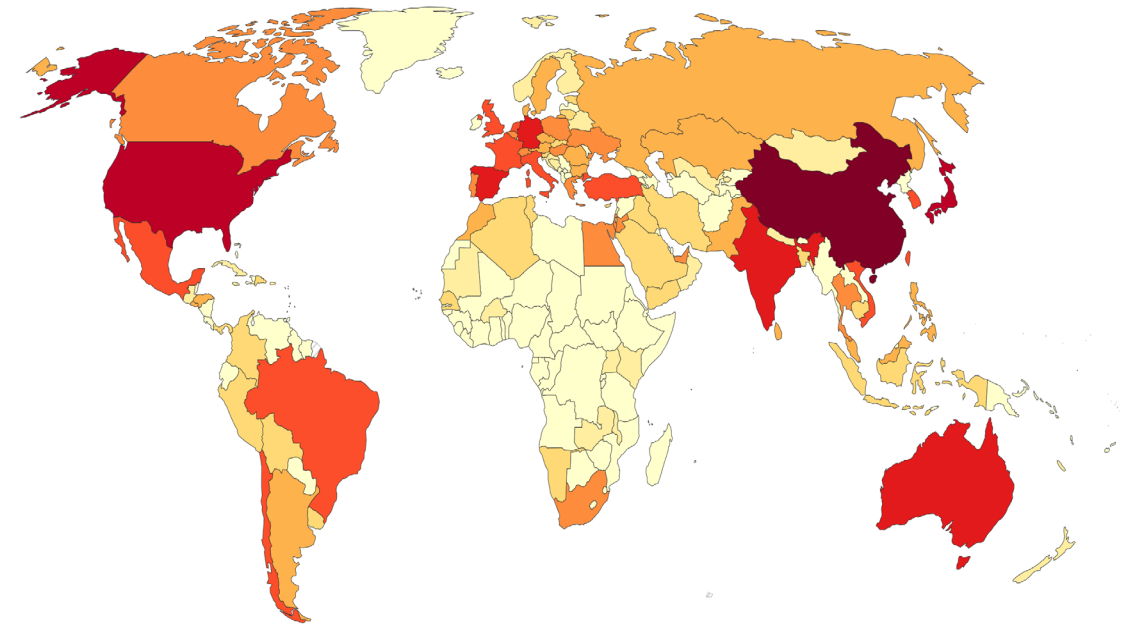
From Our World in Data

Solar power generation worldwide in 2022

Solar power generation, 2022

Electricity generation from solar, measured in terawatt-hours (TWh) per year.

Our World
in Data



Data source: Ember's Yearly Electricity Data; Ember's European Electricity Review; Energy Institute Statistical Review of World Energy
OurWorldInData.org/renewable-energy | CC BY

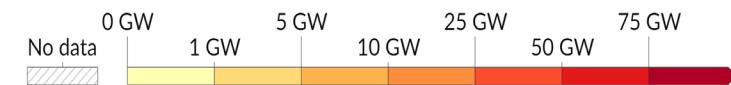
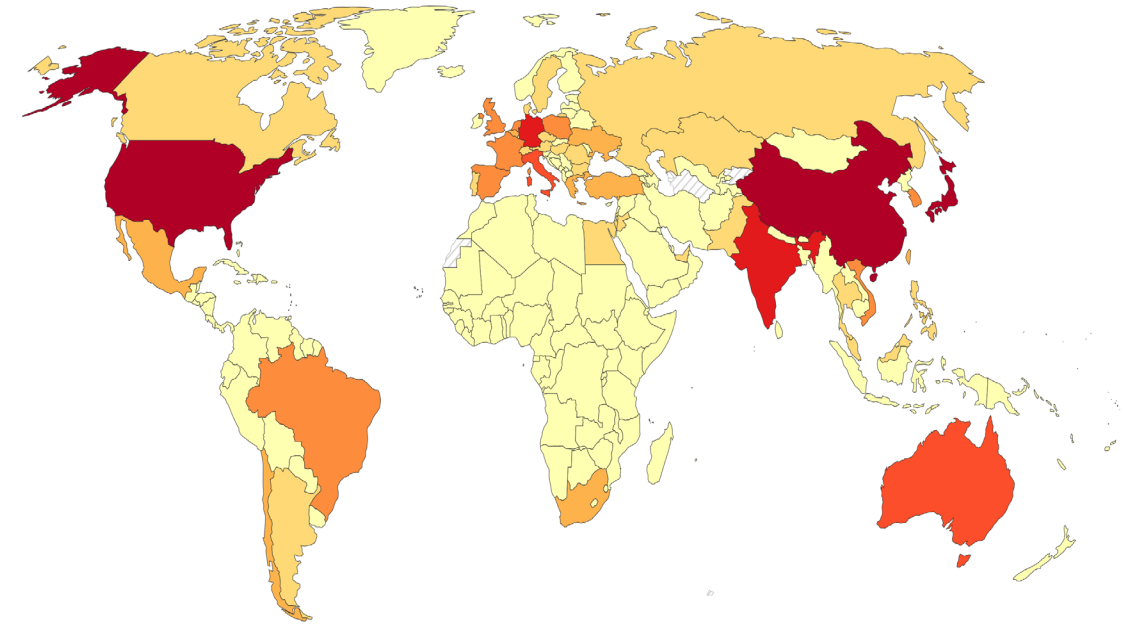
From Our World in Data

Cumulative installed solar capacity in gigawatts (GW) worldwide in 2022

Installed solar energy capacity, 2022

Cumulative installed solar capacity, measured in gigawatts (GW).

Our World
in Data

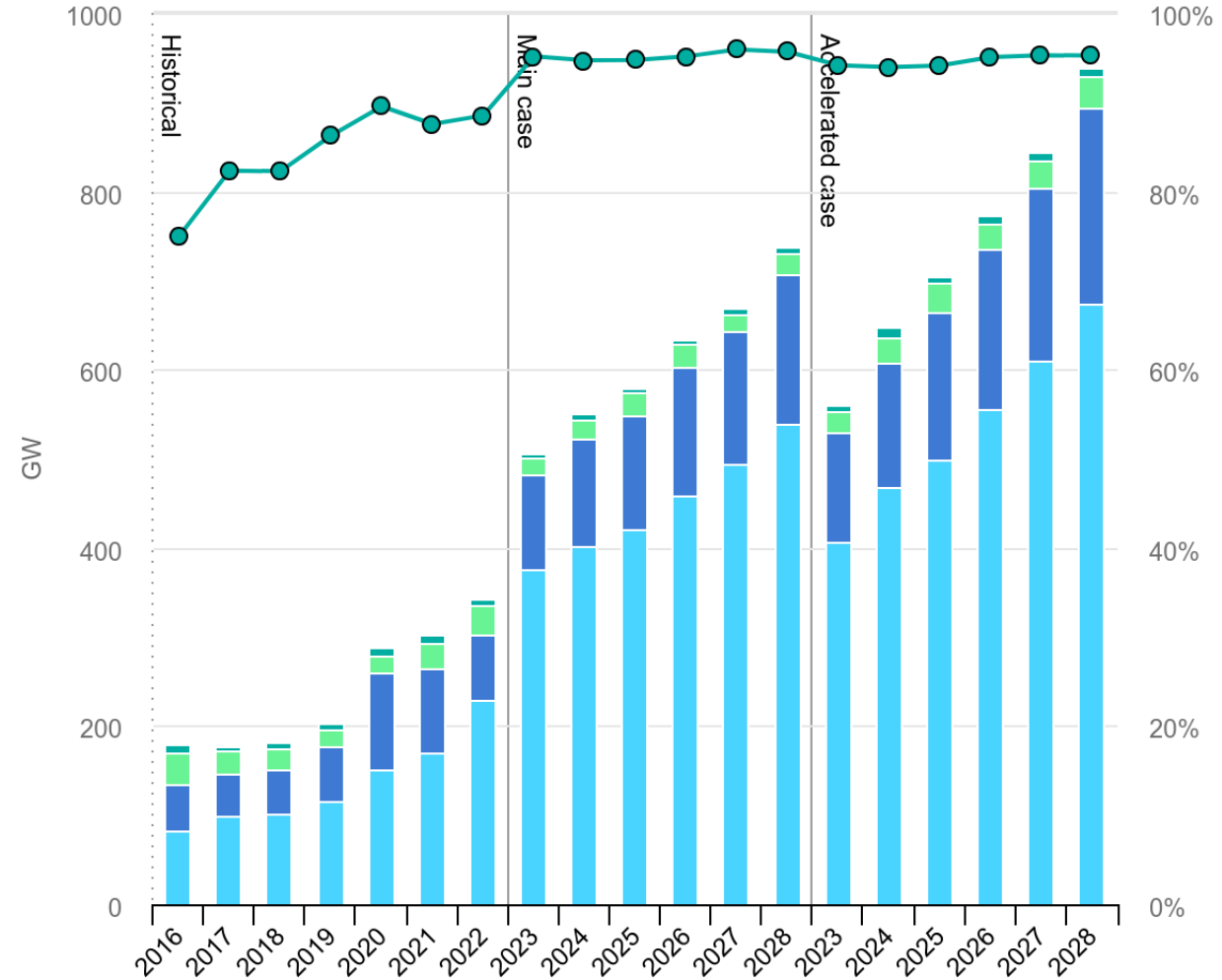


Data source: International Renewable Energy Agency (2023)

OurWorldInData.org/renewable-energy | CC BY

From IEA

Renewable electricity capacity additions by technology and segment, 2016-2028

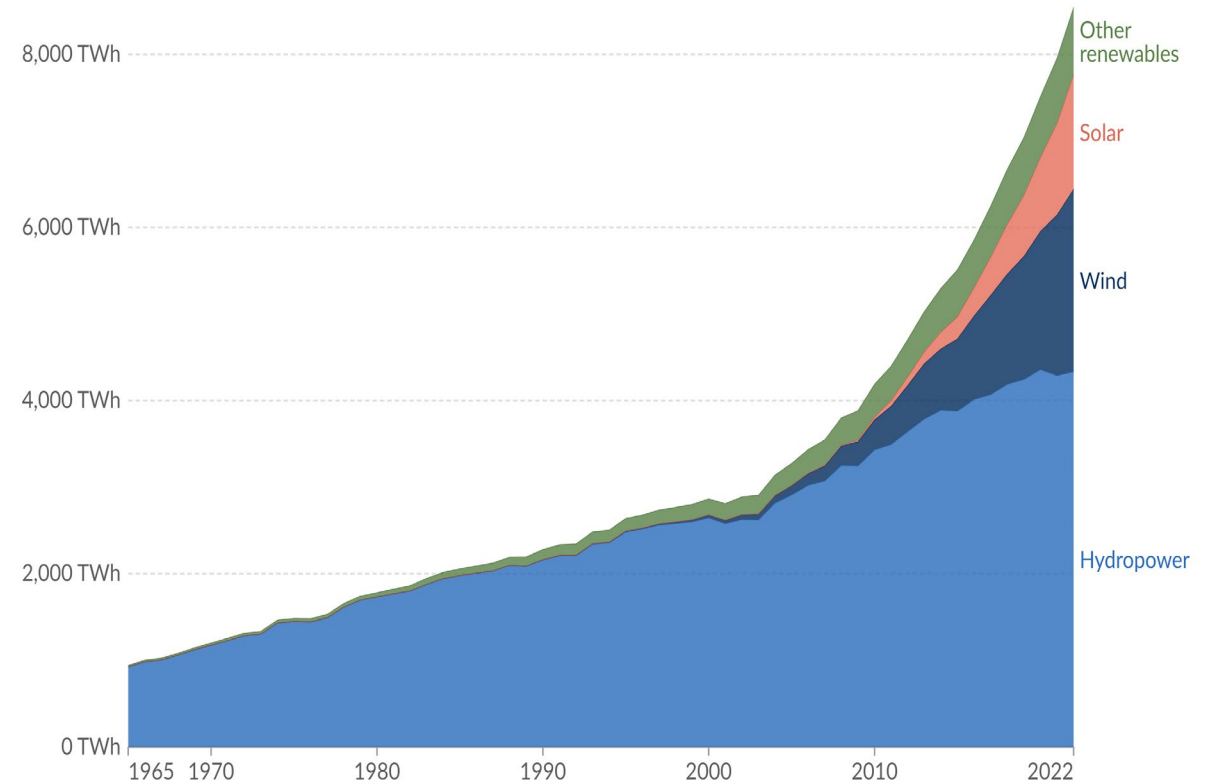


From Our World in Data

Renewable electricity generation, Worldwide

Renewable electricity generation, World

Our World in Data



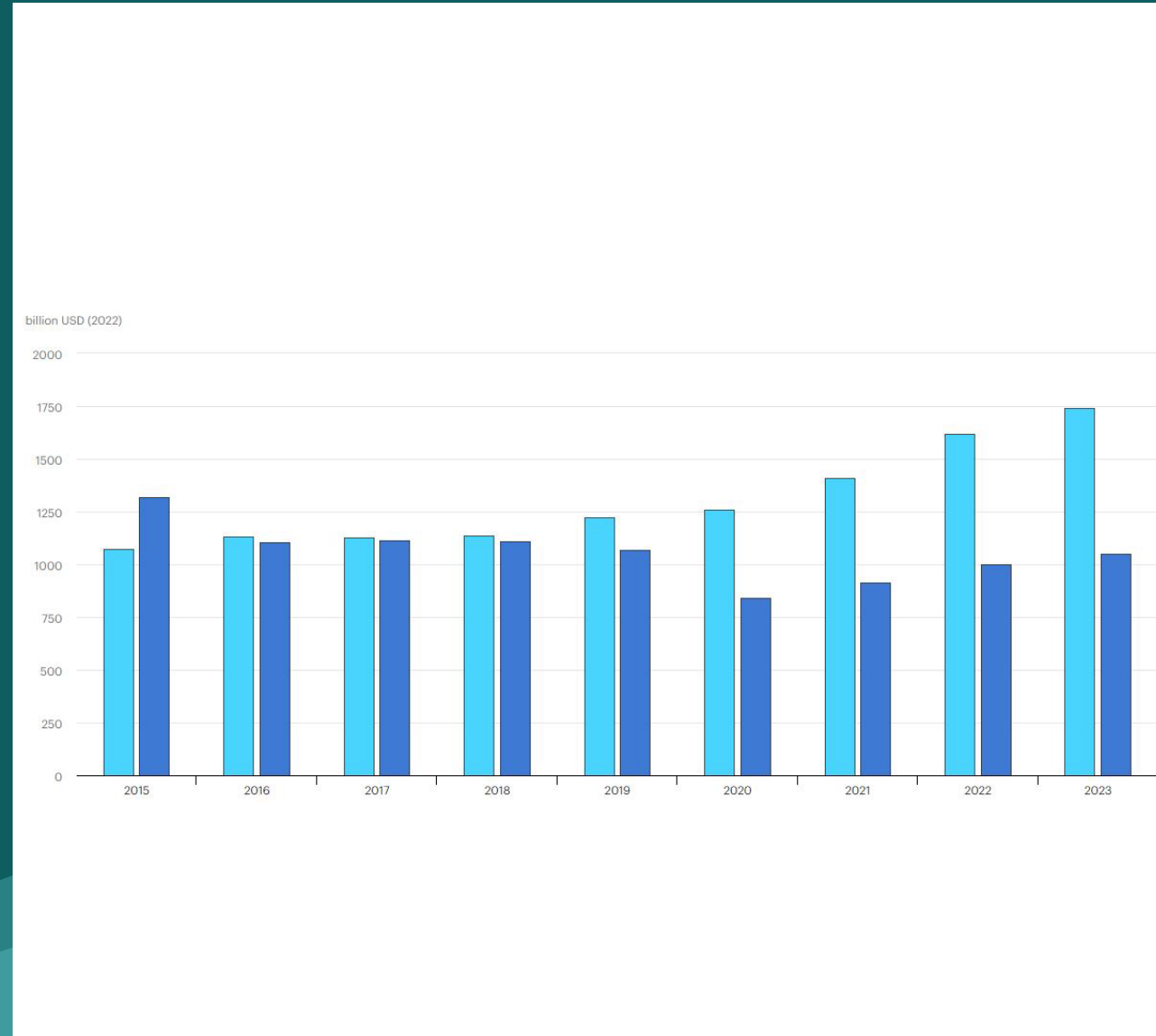
Data source: Energy Institute - Statistical Review of World Energy (2023)

OurWorldInData.org/renewable-energy | CC BY

Note: 'Other renewables' refers to renewable sources including geothermal, biomass, waste, wave and tidal. Traditional biomass is not included.

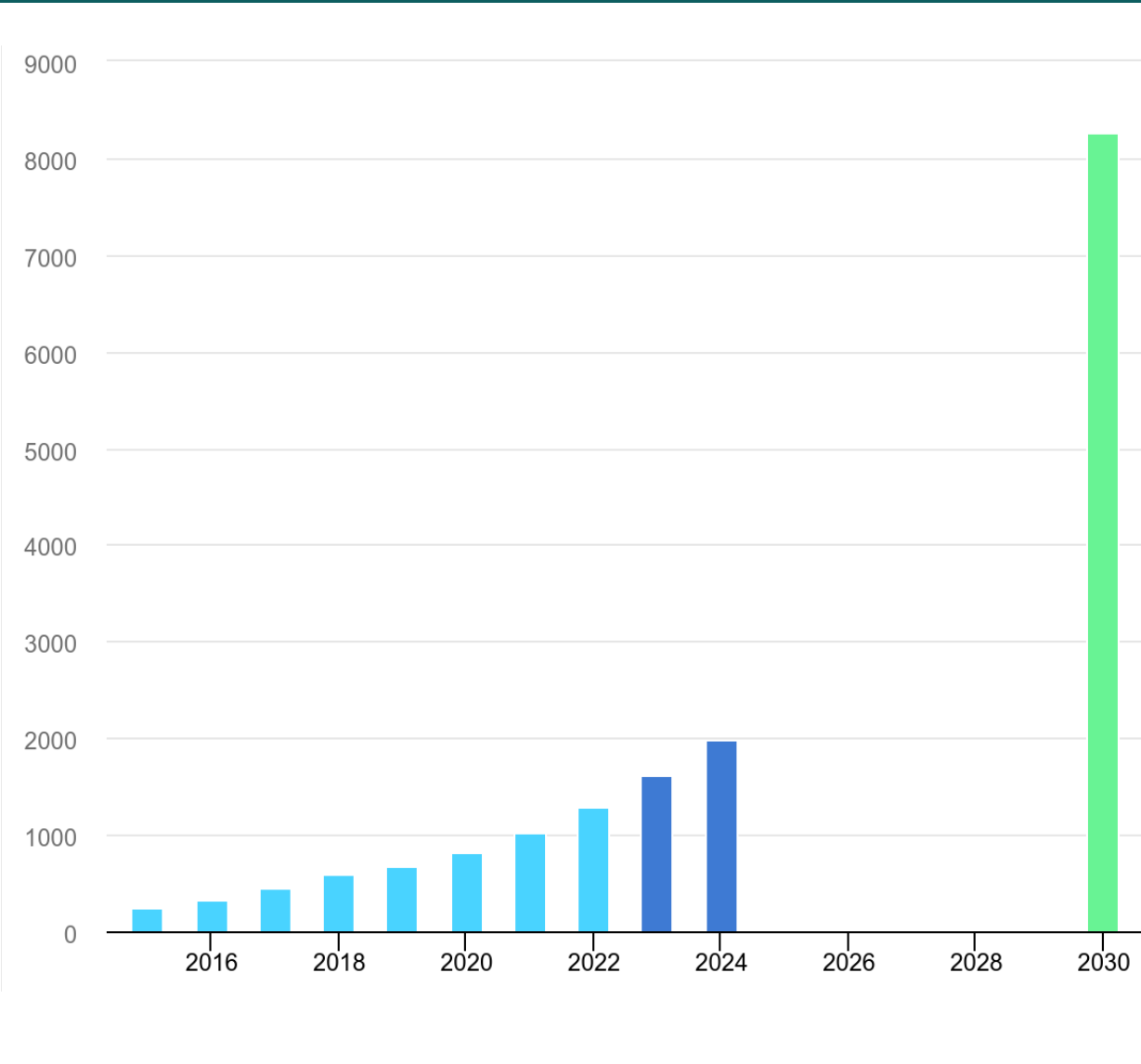
From IEA

Energy investment in 2023



From IEA

Solar PV power generation in the Net Zero Scenario, 2015-2030



From BofA Global Research (March 2023)

Delivering the energy transition: where are the bottlenecks and constraints?

“

...What might hamper progress? Common obstacles are:

- 1) slow permitting,
- 2) supply chains not receiving the attention they deserve,
- 3) shortages of skilled linemen and trades,
- 4) the need for system integration and
- 5) cost inflation and low returns....

”

From BofA Global Research

(March 2023)

Exhibit 8: Applications helping to decarbonise the economy, along with the commodities required
The energy transition will not happen without metals; most exchange traded metals are in deficit by 2030

Commodity	Generation		Storage, transmission/ distribution		Consumption				Net Zero scenario	
	Wind	Solar photovoltaic	Energy storage	Power infrastructure	Electric vehicles	Electric motors	Carbon capture and storage	Electrification of economy	Supply constrained in 2030	Deficit, of supply in 2030
Exchange-traded										
Aluminium	X	X	X	X	X	X	X	X	Yes	30%
Copper	X	X		X	X	X	X	X	Yes	17%
Nickel	X	X	X		X		X	X	Yes	46%
Zinc	X	X						X	No	
Lead	X	X						X	No	
Silver		X			X			X	Yes	125%
Platinum			X		X			X	Yes	35%
Steel	X	X		X	X			X	No	
Cobalt	X		X		X		X	X	Yes	45%
Lithium	X				X			X	Yes	65%
Non exchange-traded										
Cadmium		X						X		
Chromium	X						X	X		
Gallium		X						X		
Graphite	X				X			X		
Indium		X					X	X		
Iridium			X		X			X		
Manganese	X		X		X		X	X		
Molybdenum	X	X					X	X		
Rare Earths Elements	X				X	X		X		
Silicon	X	X			X			X		
Tellurium		X						X		
Uranium								X		

Source: World Bank, The Growing Role of Minerals and Metals for a Low Carbon Future, CRU, Woodmac, company reports, BofA Global Research

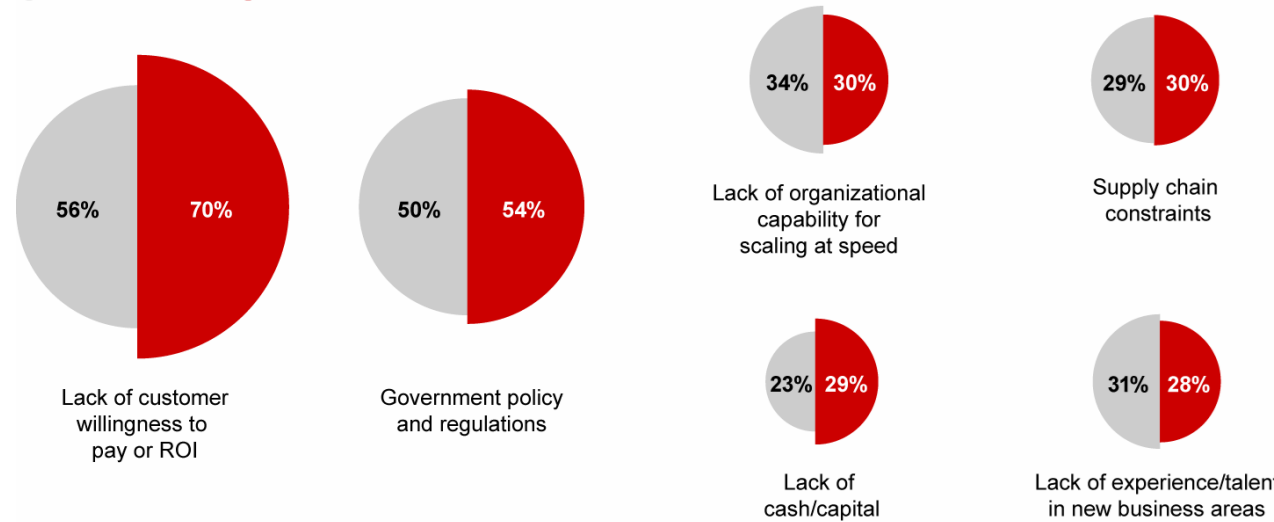
BofA GLOBAL RESEARCH

From Bain (March 2024)

Reality Check: Energy and Natural Resource Executive Pulse 2024

Share of executives who consider each factor to be a very significant roadblock to scaling their energy transition-oriented growth businesses

● 2023 survey ● 2024 survey



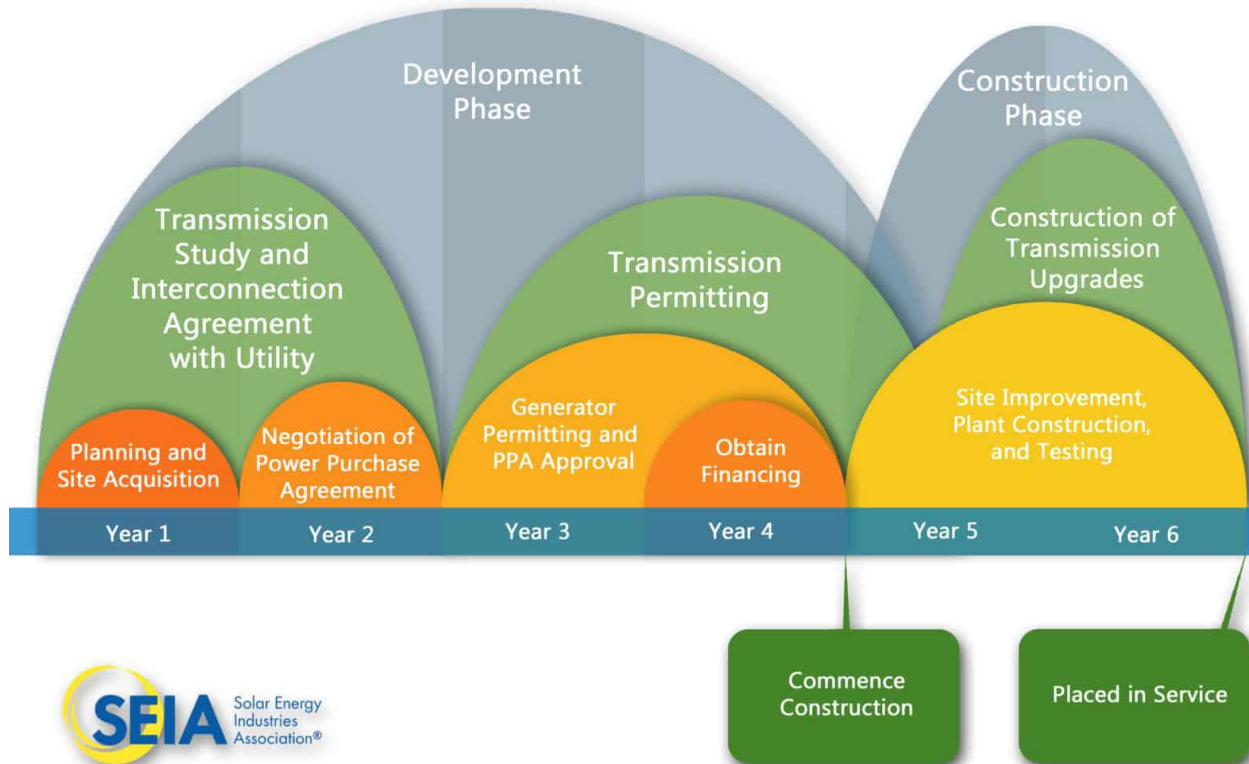
Note: Not all categories are shown

Sources: Bain ENR Transition Survey 2023 (n=608); Bain ENR Transition Survey 2024 (n=638)

From SEIA

In fact...
In short...
It's pretty long...

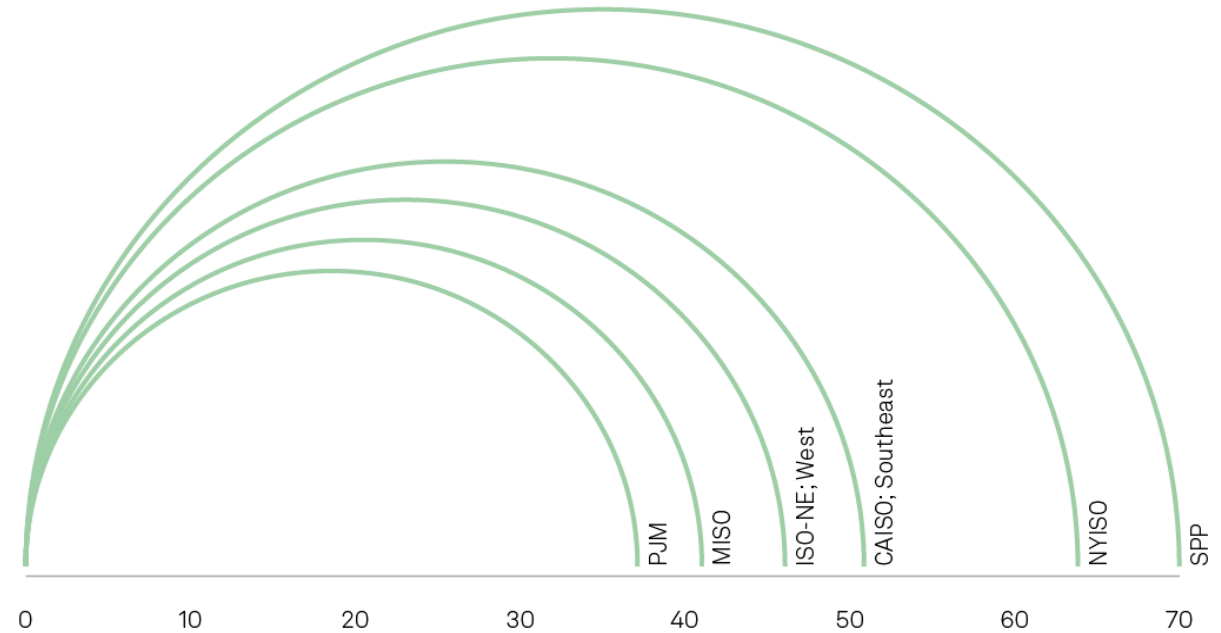
Ideal Development Timeline for a Utility-Scale Solar Power Plant (250 MW)



From S&P Global

Excessively long...

Average time from queue date to proposed online date (months)



As of June 28, 2023.
Active queues only.
Only includes interconnection queues for which sufficient details were available.
Source: Public company reports (see Excel attachment for details).
© 2023 S&P Global.

From S&P Global

Transmission upgrades are expensive & necessary

Estimated electric transmission and distribution capex, 2022-2026 (\$M)

	Electric transmission					Est. total
	2022	2023	2024	2025	2026	
Electric						
Alliate Inc. (ALE)	35	160	240	255	315	1,005
American Electric Power Co. Inc. (AEP)	2,880	2,880	2,880	2,880	2,880	14,400
Edison International (EIX)	500	600	NA	NA	NA	1,100
Entergy Corp. (ETR)	755	765	795	NA	NA	2,315
Evergy Inc. (EVRG)	626	600	591	592	679	3,088
Eversource Energy (ES)	1,118	979	861	834	808	4,600
Exelon Corp. (EXC)	1,500	1,525	1,600	1,725	NA	6,350
FirstEnergy Corp. (FE)	1,500	1,600	1,700	1,750	NA	6,550
Hawaiian Electric Industries Inc. (HE)	8	22	1	NA	NA	31
Idacorp Inc. (IDA)	68	162	170	161	126	687
NextEra Energy Inc. (NEE)	1,269	1,063	1,061	1,268	1,350	6,011
OGE Energy Corp. (OGE)	175	180	190	225	225	995
Otter Tail Corp. (OTTR)	26	28	24	20	27	125
Pinnacle West Capital Corp. (PNW)	250	210	210	NA	NA	670
PNM Resources Inc. (PNM)	296	331	283	276	NA	1,186
Portland General Electric Co. (POR)	77	82	82	82	82	405
Total electric	11,083	11,187	10,688	10,068	6,492	49,518
Multi-utility						
Alliant Energy Corp.	NA	NA	NA	NA	NA	NA
Ameren Corp.	740	740	740	740	NA	2,960
Avangrid Inc.	723	723	723	723	723	3,615
Black Hills Corp.	72	62	86	89	93	402
CenterPoint Energy Inc.	575	806	639	483	751	3,253
CMS Energy Corp.	NA	NA	NA	NA	NA	NA
Consolidated Edison Inc.	73	42	10	NA	NA	125
DTE Energy Co.	NA	NA	NA	NA	NA	NA
Duke Energy Corp.	2,408	2,367	2,317	2,158	2,192	11,442
MDU Resources Group Inc.	74	52	38	NA	NA	164
MGE Energy Inc.	NA	NA	NA	NA	NA	NA
NorthWestern Corp.	131	117	92	86	78	505
Public Service Enterprise Group Inc.	865	800	595	NA	NA	2,260
Sempra Energy	2,040	2,040	2,040	2,040	2,040	10,200
Southern Co.	1,500	1,600	1,600	1,700	1,600	8,000
WEC Energy Group Inc.	333	343	278	208	183	1,345
Xcel Energy Inc.	1,105	1,220	1,575	1,965	1,555	7,420
Total multi-utility	10,639	10,912	10,733	10,192	9,215	51,691
Grand total	21,722	22,099	21,421	20,260	15,707	101,209

Compiled and updated April 22, 2022.

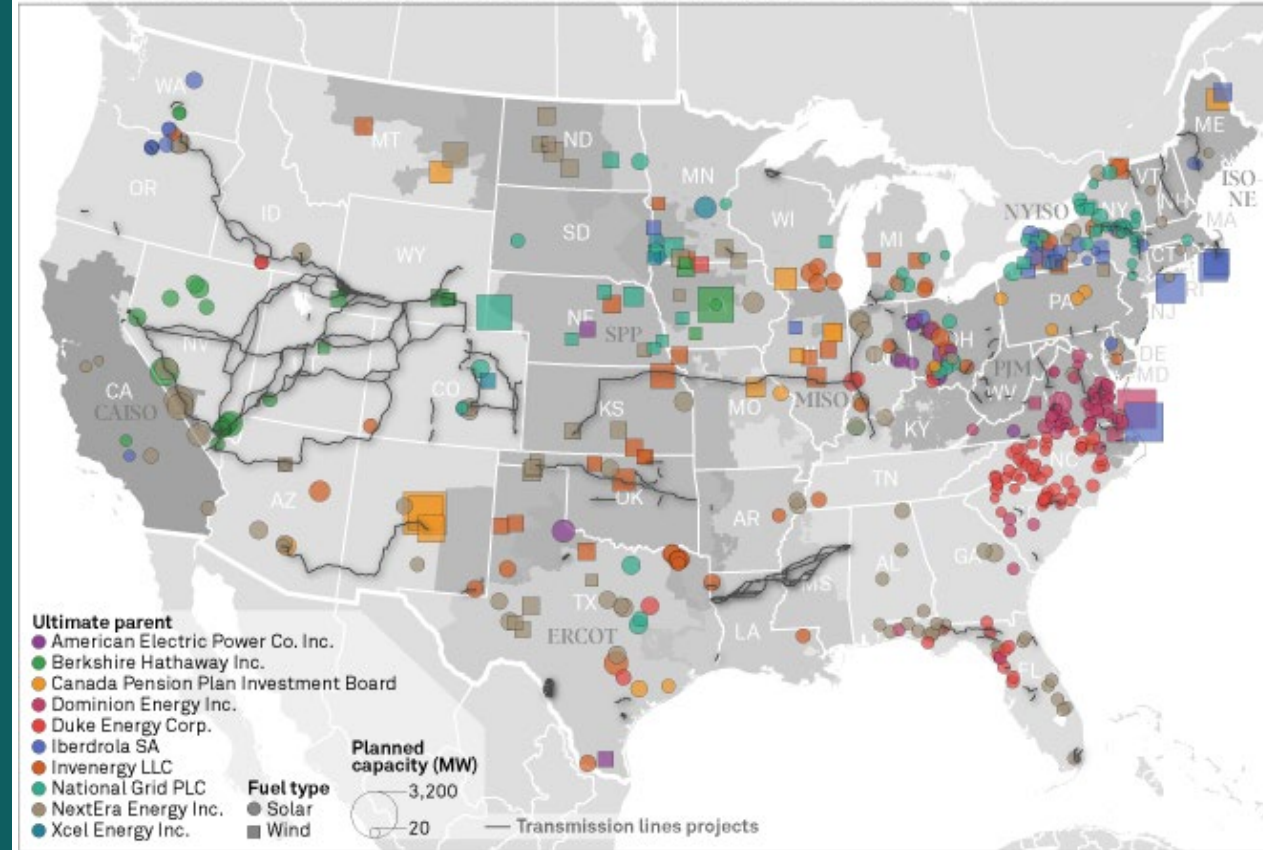
NA = not available/applicable

Source: S&P Global Market Intelligence, company surveys and Regulatory Research Associates adjustments

From S&P Global

Transmission projects

Planned transmission projects and renewable projects – notable owners



As of Sept. 5, 2022.

Does not include seven recently announced transmission projects not yet mapped.

Wind and solar projects include planned capacities of at least 20 MW.

Includes wind and solar projects tagged to companies as owner, developer, interconnected utility and/or primary power purchase agreement counterparty.

Map credit: Ciaralou Agpalo Palicpic

Source: S&P Commodity Insights

You might have heard of BANANA

Build
Absolutely
Nothing
Anywhere
Near
Anything



Why is having hope justified?

Technological Innovation: The field of clean energy is witnessing rapid technological advancements. Improvements in solar panel efficiency, wind turbine design, battery storage, and other green technologies are making clean energy more efficient and cost-effective. At no point in our history have technologies been "perfect". The nature of technology is a "work-in-progress". That said, these technological strides offer hope for a more sustainable energy future.

Increasing Global Awareness and Commitment: Increasing Global Awareness and Commitment: There is a growing global awareness of the importance of addressing climate change and moving towards a sustainable future. This awareness is translating into action, with governments and corporations setting ambitious goals for reducing carbon emissions and investing in green technologies. We don't have to look too hard to find examples: over 140 countries have made pledges. Events like Climate Week NYC and the upcoming COP28 highlight this global commitment.

Economic Viability and Investment: In many parts of the world, clean energy sources are now more cost-effective than traditional fossil fuels. Additionally, there has been a significant increase in investment from both public and private sectors in clean energy and sustainability initiatives. A notable impact of this trend is evident in the creation of new jobs and the escalating commitment of corporations to clean energy.

Policy and Regulatory Support: governments worldwide are actively enacting a range of policies and regulations designed to facilitate the shift towards clean energy. These measures encompass various forms of support, including subsidies, tax incentives, and clean energy mandates. The implementation of such policies is instrumental in driving the expansion and development of the clean energy sector. A prime example of this supportive framework is the inclusion of Clean Energy Tax Provisions in the Inflation Reduction Act.

03. Zoom Out — Risk Management & Insurance Considerations for Solar Projects by T Lee, 2024

Diversification of Energy Sources The diversification of energy sources, including the development of hybrid systems that integrate clean with more traditional forms of energy, can enhance energy security and reliability. This balanced approach can help smooth the transition to a low-carbon future. Denmark serves as an example, where the deliberate decision to integrate clean energy was made following the oil crisis in the 1970s.

Resilience in Response to Challenges: The energy sector's ability to adapt and respond to challenges, such as supply chain issues and geopolitical tensions, demonstrates resilience. Learning from these challenges can lead to more robust and sustainable energy strategies in the future. For example, one of the three strategic objectives of the European Central Bank regarding climate change is to manage and mitigate the financial risks associated with climate change and to assess its economic impact, ensuring comprehensive and effective risk management.

Long-Term Environmental and Health Benefits: The transition to a low-carbon future promises significant long-term benefits, including reduced air and water pollution, improved public health, and a more stable climate. These benefits provide a strong incentive to continue pushing for a sustainable energy transition. For the first time, we have a "Chief Heat Officer" position, underscoring the growing recognition of climate-related challenges.

From LinkedIn article "My 1000-Day+ Journey in the Renewable Energy Industry"

What could happen... if we keep passing tipping points of +1.5 degree?

While that is a complex question, we may face a realistic risk of *irreversible* effect to the Earth's system

Increased Frequency and Severity of Weather Events: Surpassing the 1.5-degree limit is likely to result in more frequent and severe heatwaves, droughts, floods, and hurricanes. These events can devastate communities, destroy infrastructure, and disrupt economies.

Ecosystems and Biodiversity: Higher temperatures could lead to the loss of ecosystems, such as coral reefs, which are highly sensitive to temperature changes. This loss would affect biodiversity, fisheries, and the livelihoods of people depending on these ecosystems.

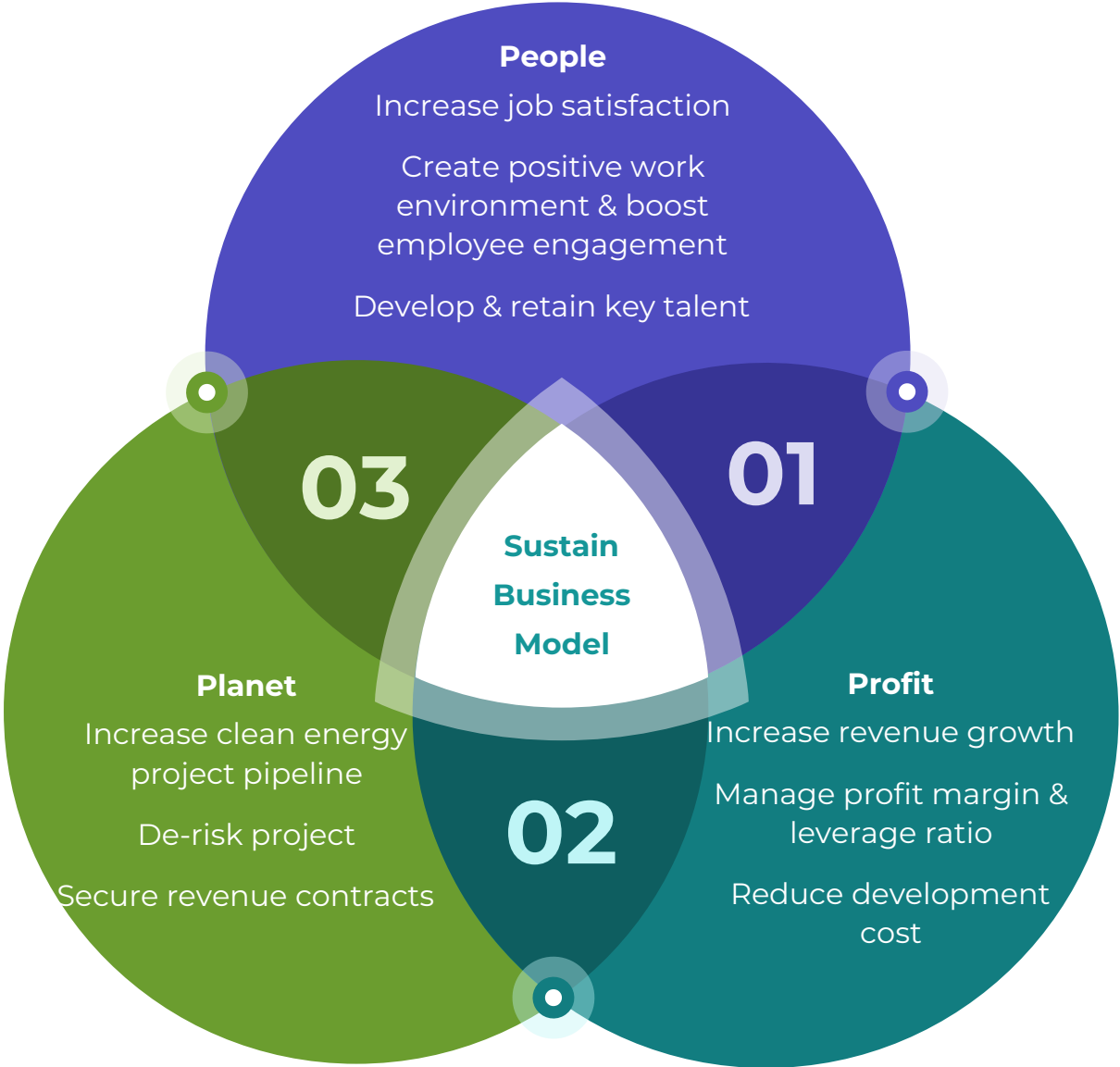
Sea Level Rise: Exceeding 1.5 degrees Celsius would contribute to faster and more significant sea level rise due to the melting of ice sheets and glaciers, threatening coastal communities and low-lying areas.

Agriculture and Food Security: Changes in temperature and precipitation patterns could negatively impact agricultural productivity, leading to food scarcity and higher food prices. This situation would affect food security and increase the risk of hunger in vulnerable populations.

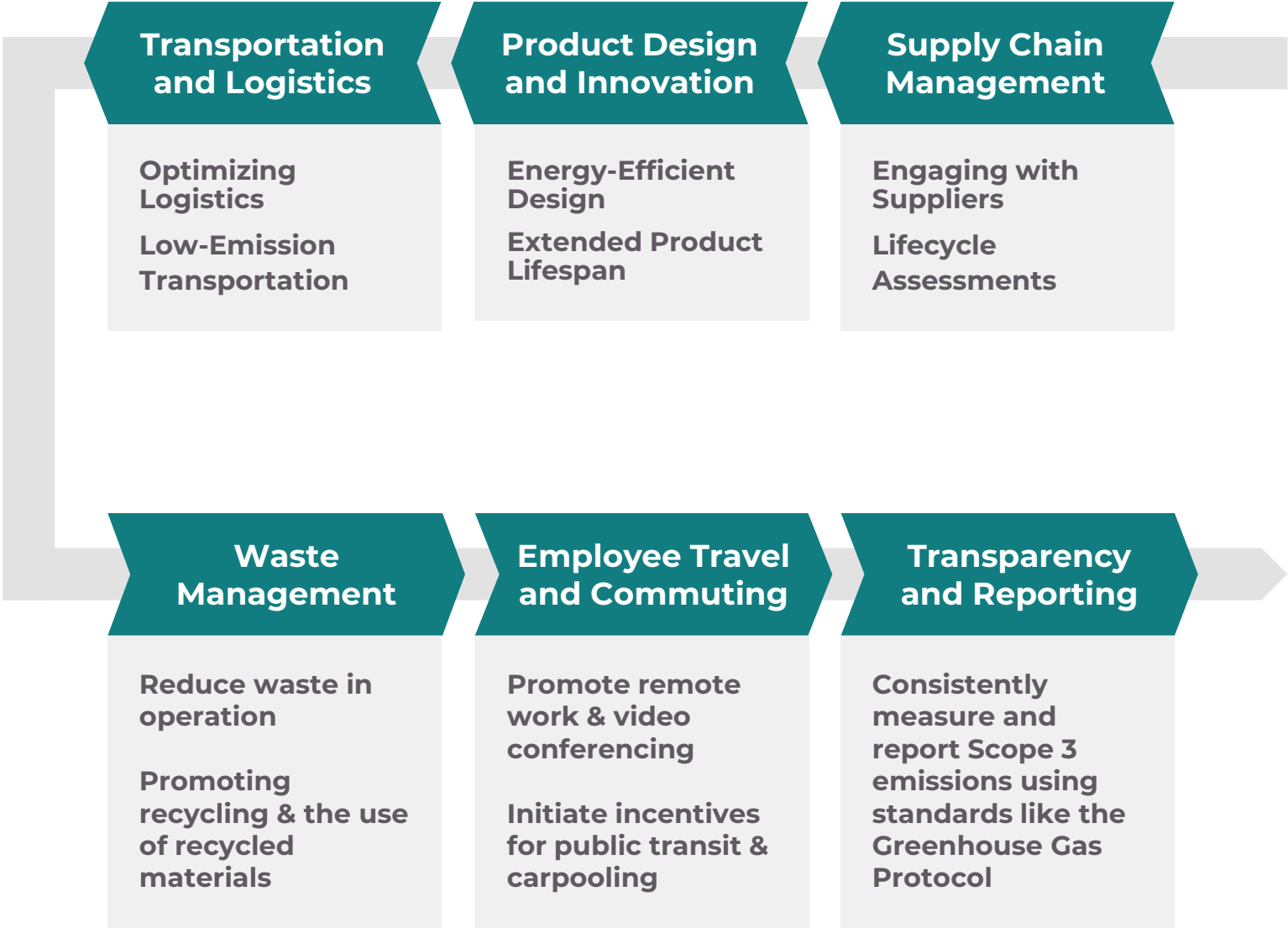
Health Impacts: The increased prevalence of extreme weather events and changes in environmental conditions could lead to more health issues, including heat-related illnesses, vector-borne diseases, and respiratory problems due to poor air quality.

Economic Costs: The economic costs associated with the impacts of climate change (rebuilding after extreme weather events, lost productivity, healthcare costs, etc.) are expected to rise significantly as global temperatures increase beyond 1.5 degrees Celsius.

Sustainable Business Model



Scope 3 Emission



TRY THIS

...With [*this initiative*], how do we ensure that the pursuit of clean energy not only fostering innovation and profitability but also upholding social equity and environmental stewardship, securing sustainable success for current and future generations?...

Headwinds do not spell fear,
nor do tailwinds promise success.
Master the skill of sailing with the wind.

In Closing

Will you allow the headwinds to refine your skills
and the tailwinds to guide you to your success?

Parting thoughts

04. PRACTICAL TAKEAWAYS

Immediate / Medium / Long Term Actions

Can Do

Deliver Values When the Deliverables Supporting the Overarching Strategy (Know the Key Strategies)

Practicality: Aligning specific deliverables with the broader strategy ensures that every effort contributes towards the main goals, enhancing efficiency and effectiveness.

Impact: This alignment is essential for strategic coherence, ensuring that all efforts are not just productive but also directionally correct and aligned with long-term objectives.

Collaborate with Suitable Partners (Evaluate Your Current Key Relationships)

Practicality: A methodology for evaluating these relationships would enhance its utility.

Impact: Effective collaborations can significantly amplify the success of a project or business venture by leveraging diverse strengths and resources.

Frame 1 Solution with Multiple Problems (Connect More Dots)

Practicality: Encouraging a mindset of looking for multipurpose solutions is beneficial but should be balanced with the need for targeted interventions.

Impact: This approach can lead to more scalable and versatile solutions, potentially saving resources (human & financial) and increasing impact across different areas of a project or business.

Can STOP Doing

Stop Eliminate Risks at All Costs. Remind yourself - risk and opportunity.

Practicality: Let's challenge the conventional notion that all risks must be mitigated. By recognizing that risk often accompanies opportunity, risk managers are encouraged to balance risk mitigation with the potential for gain. This perspective is crucial for fostering innovation and growth.

Impact: Let's see beyond mere risk avoidance can lead to more dynamic and growth-oriented strategies.

Stop Working in Silos. Remind yourself - you touch a wide surface including supporting strategy, cultivating culture, and across various stages of a solar project lifecycle.

Stop Confusing the Audience (or trying to sound smart by talking "insurance" language). Remind yourself that the purpose of communication is to be understood.

While more insurance can sometimes be necessary, emphasizing strategic purchases can lead to cost savings and more effective risk mitigation.

Let's encourage risk managers to focus on buying insurance that aligns with their specific needs and risk profile rather than defaulting to more coverage.

Stop "Buy" Insurance Like You Buy a Product. Remind yourself to seek advisory services.

Let's view insurance as part of a broader risk management strategy rather than a standalone solution. Seeking advisory services can provide tailored advice and insights, leading to better outcomes.

Active learning involves embracing new knowledge while discarding outdated practices that no longer benefit us.

In Closing

What is the 1 thing you can commit to doing?

Parting thoughts

05. RESOURCES

✦ **Insurance Sector:**

- <https://www.iii.org/publications/insurance-handbook/economic-and-financial-data/world-insurance-marketplace>
- <https://www.investopedia.com/ask/answers/051915/how-does-insurance-sector-work.asp>
- <https://www.reinsurancene.ws/top-global-insurance-reinsurance-brokers/>
- <https://www.reinsurancene.ws/top-50-reinsurance-groups/>

✦ **Tax:**

- <https://www.cruclimate.com/>
- <https://infocastinc.com/>
- <https://www.novoco.com/podcast>
- <https://www.projectfinance.law/>
- <https://www.reunioninfra.com/>

✦ **Risk Management**

- <https://www.fsb-tcfd.org/workshops-in-a-box/>
- <https://www.rims.org/>
- Risk in Context Podcast on Apple Podcasts

✦ **Inflation Reduction Act**

- <https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy>
- <https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf>

✦ **Research**

- <https://www.bain.com/insights/>
- <https://business.bofa.com/content/dam/flagship/global-research/challenges-to-renewable-energy-transition.pdf>
- <https://am.jpmorgan.com/us/en/asset-management/institutional/insights/market-insights/eye-on-the-market/energy-paper-2024/>
- <https://centres.weforum.org/centre-nature-and-climate/home>
- <https://centres.weforum.org/centre-for-energy-and-materials/home>
- <https://www.spglobal.com/marketintelligence/en/news-insights/research/us-interconnection-queues-analysis-2023>
- <https://www.spglobal.com/marketintelligence/en/news-insights/research/as-ira-drives-renewables-investment-attention-turns-to-transmission-upgrades>
- <https://www.worldbank.org/en/topic/climatechange>
- <https://www.worldbank.org/en/topic/sustainableinfrastructurefinance>

Before we say goodbye...



Let's

Add what benefits you

Subtract what doesn't

Sprinkle your personal touch!

Thank You

For more information, visit
<https://cleanpowerwhisperer.ai/>



<https://www.linkedin.com/in/thilee/>



ChatGPT [Clean Power Whisperer](#)