Mr. Jim Cannizzo

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Wind Energy Boom with Mr. Jim Cannizzo

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GUEST: MR. JIM CANNIZZO

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[Upbeat Intro Music].

SHOW EXCERPTS, MR. CANNIZZO:
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ANNOUNCER:
Welcome to The Air Force Judge Advocate General's Reporter Podcast, where we interview leaders, innovators, and influencers on the law, leadership, and best practices of the day. And now to your host from **The Air Force Judge Advocate General's School**.

MAJ HANRAHAN:
Welcome to another episode from The Air Force Judge Advocate General's School at Maxwell Air Force Base. I'm your host, Major Rick Hanrahan. Remember, if you like the show, please consider subscribing on an Apple Podcast, Spotify, or your favorite podcast platform and leaving a review. This helps us to grow in outreach to the JAG Corps and beyond.

Today's interview is the second consecutive interview with an environmental law subject matter expert. In this interview we have the pleasure to speak with Mr. Jim Cannizzo, a retired Air Force JAG and the current Senior Attorney Advisor in the mission sustainment and planning branch of the environmental law field support center in San Antonio, Texas.

We plan to discuss the wind energy boom and impact on military operations, including some of the biggest wind energy challenges faced both within the Air Force and DoD, and we plan to continue our discussion on the interplay between environmental law and military operational law and how this impacts our national security. Sir, thank you for coming on to talk with us today.

MR. CANNIZZO:
Thank you. I'm glad to be here. Thanks for giving us a voice.

GUEST INTRODUCTION

MAJ HANRAHAN:
So, our guest today, Mr. Jim Cannizzo is the senior attorney advisor in the mission sustainment and planning branch of the environmental law field support center, within the environmental law and litigation division, operations international law directorate of the office of the judge advocate general, located in San Antonio, Texas. The mission sustainment and planning branch provides legal advice to Air Force attorneys at all levels of command and to Air Force engineers at the Air Force civil engineer center on planning documents for Air Force projects in the United States and overseas. Mr. Cannizzo is the branch's expert on issues involving range and training route, airspace and encroachment, including off base energy project sightings.

Sir, could you start off by providing a little more background on your current duty position and what you do?

MR. CANNIZZO:
So, in my current job, a lot of what I do is planning documents. So, when the Air Force proposes an action, they have to follow the National Environmental Policy Act of 1969 and do environmental analysis before they can implement those decisions. And so, say for instance if you are based in New Mexico and you want to expand your airspace, you can't just do it without environmental analysis and without involving the public. So, we do an environmental assessment, environmental impact, [unintelligible] or whatever the appropriate level of deep analysis is before we do that. So, that's a lot of what I do.

The other big portion of my duties is what used to be called encroachment, now we call it mission sustainment, and we look at proposed developments near bases to see if they're compatible and we may make comments to the zoning and planning authorities about the compatibility of those developments. We look at wind farms, for example, and other proposals under our airspace or near our radars. And that's the large portion of my job and that's really a fast-growing portion of what I have done due to the boom and energy development in the United States.

I've read articles by the Department of Energy that say that we're now already at close to 10% of U.S. energy generated by alternate sources; about 8% of it by wind farms and 2% or so by solar, and their projections that by 2050 we may be up as high as 35% of our energy is generated by alternate energy.

So, yeah, it's good for greening the environment, it's good for reducing emissions, but it causes a lot of mission impacts; all of our flying training routes, it also—spinning turbines of the wind farms causes clutter on our radars and makes them much less effective.

So, that's really the two main areas I do, planning and the mission sustainment component.

PODCAST INTERVIEW

MAJ HANRAHAN:

Yes, sir. In our prior interview with Mr. Joseph Miller, we took a more strategic view in environmental law as a whole. In this interview, as you've kind of just alluded to, I definitely want to hone in on your particular expertise dealing with wind energy and wind farm mitigation. You've already kind of alluded to that a bit here on the current state of wind energy and wind farm technology in the U.S., but could you offer a little more insight on that? I mean, what is the kind of current energy production of wind energy within the U.S.? How has that grown over time and how does that compare to other countries?

MR. CANNIZZO:

Okay. The U.S. energy, alternate energy has really grown by leaps and bounds. The last estimate I saw from the DOE was that they're close to 60,000 wind turbines in the United States. And one of the phenomenon is that they are growing taller and taller. When they first came out 10 years ago, really first started proliferating 10 years ago, your typical turbine was between 300 and 400 feet. Then the last several years, it's really gone up to about 500 feet, and now we're seeing a lot of 650 feet tall turbines. So, that creates some major challenges under our military training routes. Keep in mind, the military, we have a lot a low-level training routes across the United States, and unfortunately a lot of them are in wind rich areas.

For wind farms, on the other side of the coin, the industry, they can't just build anywhere. So, they can't just pick some isolated area of a desert in a remote area and build all of their turbines there. They have to—they have maps called—that map out the wind rich areas, a lot of them are along the Texas coast, or in Oklahoma, or in Washington State, increasing like, in North Dakota, Colorado areas. And they're all in wind rich areas, and unfortunately that's also where we have a lot of military training routes.

We also have a lot of **NORAD** radars. And wind turbines, it's not the fact that there's an obstruction that's tall, that's really the main problem we have with aircraft, but it's the spinning of the blades. The spinning the blades of a wind turbine creates clutter on a radar and makes it much less effective for air traffic control radar, if an aircraft is flying near turbines, the tower controller's probably not going to be able to see those aircraft and control them and keep them apart from colliding on his radar scope. And for NORAD, their ability to detect targets and track them is much diminished when the turbines are spinning if target's flying near wind turbines.

So, it's an increasingly multiplying phenomena across the United States, but again, mostly in wind rich areas. On the airspace end of it, you know, if you look at the FAA's map of the national airspace system, it looks like a giant spaghetti that's nearly blotted out the whole U.S. So, it's not like the Air Force can move our training route to other areas, because a lot of those other areas are already used by the FAA by aviation routes.

So, it's a diminishing resource having land that the Air Force could use for training, and it's also, again, a finite resource that the wind industry can site, it's got to be in a wind rich area. So, we have a scarcity problem going several different ways that really causes a lot of the need for coordination between the Air Force and the other services and the wind industry.

MAJ HANRAHAN:

Yes, sir. And I would concur that it appears to be that there's been a wind energy boom over the last number of years. And as you would mention, when these wind turbines were initially being built in the U.S. and abroad, they averaged 300 to 400 feet. In prep for this interview, I read online that, from one source, that there are certain wind turbines now reaching over 800 feet tall with blades as long as a football field.

MR. CANNIZZO:
Yeah. That's new giant turbine that GE's coming out with. Now, those are normally used for maritime operations, you know, out in the ocean. Land-based, it's a little shy of that, but the direction they're going, it's more efficient to have bigger turbines; you only have one ground site and your blades are so much bigger you can produce a large, large amount of energy from just one turbine. And you know, the turbine fields are amazing how they vary; your average small size field is typically 35 to 65 turbines, and you have a lot of medium-size ones that maybe 65 to a few hundred. But we we've even had a few proposed turbine farms that were in the neighborhood of a thousand turbines. So, we're talking very, very large areas of land and you can't just have turbines stacked upon each other. Turbines have to be set apart from each other so that the one doesn't cause turbulence that affects the other one.

So, when you have like, for instance, I was dealing with one this afternoon in a Mitigation Response Team, and they were talking about 35 turbines on about 5,000 acres. So, it takes a lot of acreage for a wind farm.

MILITARY OPERATIONS IMPACT

MAJ HANRAHAN:
Yes, sir. And it seems that the issue is, from at least a military operational standpoint that as these turbines get bigger and bigger and the farms get bigger and bigger they can impact military operations with respect to, as you mentioned military training routes, ranges, on radar systems. Is that where you were going with that, sir?

MR. CANNIZZO:
That's very accurate. And the thing that we try to do, it isn't an all or nothing approach. There's a federal statute that was originally passed in 2011, it was amended in 2017, it's at 10 U.S. Code section 183, and it set up a DoD energy siting clearinghouse. And DoD is the decision maker. The Services each have personnel that provides inputs to DoD. And what we do, and we're successful in most of the cases, and that's try to resolve the differences through what we call a Mitigation Response Team. That's what I mentioned earlier, I was on one of them this afternoon.

And what we try to come up with is what's called, although it's a statute, calls is feasible and affordable mitigation. Examples of such mitigation would be, can the developer rearrange the set-up of his turbines? Can he move them to a different side of our—if you say it's a military training route, where they're not in the middle or a large part of the training route.

If it's near a radar, can he make them shorter? Can he make them taller, but much less of them and change the array of them? There's various ways of mitigating the adverse effects on military operations. A lot of the times, the radars, we do a mitigation strategy, also that's called "radar optimization", where the wind farm developer will pay for a reprogramming of the software of the radar. It's not a complete cure, but it minimizes the issues by mapping where the turbines are and tuning the radar software. It's not terribly expensive, typically $80,000 and there's authority in that statue, 10 USC 183(a) for the wind farm developer to pay for that radar optimization.

Also, sometimes we'll do a mechanism called a "curtailment agreement", where they will agree if we have a national security emergency, say if it's a NORAD radar, that if we give them notice, within a few minutes they will either turn off their spinning turbines or feather them; "feather" is a term for making them go very, very slow. And that greatly reduces the clutter, or if they're stopped, it totally reduces the clutter on the radar scopes, and then when the national emergency's over we give them the green light, and then they restart them.

So, there's a lot of different ways to mitigate the wind farm issues. And we even have, you know, some of our ones that really cause [broken up].

MAJ HANRAHAN:
If I could interject for a second, could you just discuss kind of this process, so you mentioned the DoD Siting

Clearinghouse. Could you just walk our listeners through kind of how this process works? So, let's say we have a developer that's looking to build a wind farm somewhere, and it may be within range of military operations. What is the process, like, how does that go about, because you were talking about wind farm mitigation there, which is kind of further down the road on the process.

SITING CLEARINGHOUSE

MR. CANNIZZO:

So, the process starts with—it can be an informal process where they come to us tell, tell us a general project area, and then the DoD **Siting Clearinghouse** will farm it out to whatever base, whatever commands have assets in that area, and we'll get on conference calls and hash out the details and exchange maps and e-mails and ideas until we can figure out a way to mitigate it. That's informal mitigation.

Then there's also a formal mitigation, which is what most of them are, and that's where they've actually filed with the FAA's obstructions and navigation system. That system, it's been along for many, many decades. It predates the 2011 federal statute that created the DoD Energy Siting Clearinghouse. And what that statute did, it added a layer to that FAA for federal aviation regulation part 477 process of obstructions and navigation.

The **OE/AAA** process, that's what's obstructions and navigations called, it's triggered by building a tower that's over 200 feet tall or very close to an airport. And so what that federal statute in 2011 did is added a coordination layer, where FAA will notify DoD and give us the opportunity to request a Mitigation Response Team if we see issue. So, we start out with what's called a "notice of presumed hazard" and that's our starting point. It's not by any means a bar or a prohibition on a developer moving forward. It really starts the process of the Mitigation Response Team with a dialogue and we talk and the vast majority of cases, we figure out a way to come up with a mitigation agreement.

If it's just changing the locations, normally they can just cancel some of their filings with the FAA, and then we do what's called a "siting memo". If it requires more formal components, say for instance that, that radar optimization, or a curtailment agreement, or some other sort of very formal mechanism that isn't just canceling the filings that are in an area that causes problems, then we do a formal mitigation agreement signed by the developer, signed by DoD Siting Clearinghouse and the Air Force so that we have enforceability of the agreement.

MAJ HANRAHAN:

Let me make sure I'm tracking correctly, there's two main processes for this, which would be the informal and then the formal review; there's less informal reviews there versus the informal reviews and it seems that to go submit an informal review, that seems to be done to kinda get an idea on where DoD and/or Air Force stands on particular issues?

MR. CANNIZZO:

It's more to give them a geographical idea. That's so—so, it takes a lot of engineering to plan out a wind farm. They have to do a lot of coordination with local regulatory authorities, local residents, do environmental due diligence. And so, very often it takes them a long time to get precise locations until—to the point where they have those filings with FAA for the structure and navigations, that requires coordinates.

So, what they'll do is if they have a concept, they will often come to us for the informal consultation, the informal coordination. That's that informal process. So, normally in the informal, they won't have precise locations, they'll have an overall geographic area and they'll see what issues it triggers.

TAX CREDIT

MAJ HANRAHAN:
Yes, sir. And looking also at the numbers from the Military Aviation and Installation Assurance Siting Clearinghouse website, it looks that **formal reviews** have went up by over 300% from 2012 with over 1700 reviews, to 2019 with over 5100 reviews. And that same source shows that informal reviews have also went up, I don't know, 250 to 300% as well. What is causing the dramatic rise in all these reviews?

MR. CANNIZZO:
Well, big picture wise, it's the trend towards switching to alternative energy. And again, 10 years ago, it was low single digits, the percentage of our electricity was generated from wind farms, and now it's 8% already. And again, the projection of DOE is it could be as high as 35% by 2050.

So, that's the macro phenomenon, the macro trend. The other thing is the production tax credit. There have been around for a number of years energy credits that can pay up to 30% of the developer's project cost. And there was a lot of fear the last few years because they were only renewed one year at a time, so there was a lot of fear in the developers, they want to get their foot in the door and get a project filed and book the energy tax credit.

They don't have to, under the way the Internal Revenue Service has interpreted that credit, they don't have to have the whole farm all built out to get the credit. They basically have to pass completion thresholds, which can be completed basically by buying equipment. So, they normally won't spend tens of millions of dollars and some of these projects are billion dollar project. A typical, even say a medium-size wind turbine field, maybe $100 million or $200 million. We're talking some large amounts of money.

So, they normally won't spend the money to book the credit, unless they have a fairly fair amount of certainty over the location. And so, that's why they do the MRT processes and they try to get along the MRT process as far as they can. It's an accounting game, whether they can book the credit. We've had a lot of filings this year because right now the credit is due to expire December 31, and it hasn't been yet renewed by Congress.

They have also lowered the, credit the percentage that can be taken the last few years, it's gone down every year a significant amount. And there's a lot of speculation, will it be renewed as it was last year, it was renewed in December on a one-year renewal, a kind of last-minute thing as part of the budget process.

So, that's what's driving the short-term high numbers, is that the uncertainty surrounding the production tax credit.

BALANCING ACT

MAJ HANRAHAN:
Yes, sir. I think you mentioned that to me too, that you were working pretty diligently on all those additional submissions because of that tax credit that looks to be ending at the end of 2020. It seems too, that production of renewable energy projects like wind farm would be good, you know, generally speaking from a national security standpoint, to have renewable energy resources. However, that also has an impact on our operations within the military and at large. It seems to be somewhat of a balancing act here with how you deal with these issues. Would you say that's a fair....

MR. CANNIZZO:
It definitely is. And they—Congress acknowledges that in the statute, when they passed the statute, it says that it acknowledges that both values of military readiness, military operations, and also alternate energy, and switching to cleaner energy.

And what Congress did is so that we have to fully consider feasible and affordable mitigation and only, as a last resort, what, will DoD object to a project that, based on its effect on our national security and our military operations. And it's only been done a handful

of times. We normally are able to figure out mitigation that resolves the issues to everyone's satisfaction.

MAJ HANRAHAN:
Yes, sir. And based on some of the resources I had read, it said the Clearinghouse has made very few unacceptable risk determinations out of likely thousands of wind energy submissions. Is that your understanding as well?

MR. CANNIZZO:
That's true. Now, there is one other phenomena. Sometimes the developer, rather than, have an objection and a lot of developers don't want that to be public, that they made a proposal that created an objection, they'll withdraw their project. So, that will happen sometimes to.

WIND FARM MITIGATION

MAJ HANRAHAN:
So, could you also talk a little more detail about wind farm mitigation? You've kind of discussed it a bit already, but what exactly is "wind farm mitigation" and is this where you're working to try to meet the intent of Congress?

MR. CANNIZZO:
Exactly. And it really varies. If we're talking low-level training routes, say for instance, South Texas and you have the T-38's, T-37's, T-6's flying a low-level training route near Del Rio, your way of mitigation is quite different than what you would do for a radar—let's say for instance a NORAD radar.

Normally you would like to turbines to be lower if possible or you'd like them to move them laterally outside our training route. Training routes are usually 10 to 12 miles wide. And so, often you can move them outside the route, or to one edge of the route, so you at least have a clear 6 or 8 miles of your route open. So, that's usually lateral moves or trying to persuade the developer to do shorter turbines, that's the mitigation you normally would do for aircraft in low, low-level flying training routes.

Now, for our radar, it's a lot different. It's all geared on the line of sight. You know, radars have what they call a "line of sight". Sometimes, if people could move their turbines into lower terrain a little bit, that very, very rarely is a solution because your higher terrain is a more wind rich area. But they can also change the array of a radial pattern, mitigates to some degree the radar interference. There's also the strategy I talked about earlier, about radar optimization or a curtailment agreement. You've got a radar, it's not like it is with an aircraft. The mere height of the turbine as an obstruction that an aircraft could crash into or is going to have to go a long way away to avoid it.

For a radar, it's the clutter. So, if they will stop or feather their blades through a curtailment agreement for that short amount of time that NORAD needs that air surveillance capability in that area that could in resolves every different strategies depending on what you facts are.

MAJ HANRAHAN:
What percentage, you think you deal with between the wind energy farms and radar?

MR. CANNIZZO:
The radar has become much more of an issue with the proliferation of wind turbine farms. NORAD has criteria, that what they call "saturation", that when an area of a radar's coverage becomes so saturated, they can't meet effectiveness ratio rates that they're supposed to meet on detecting objects. And they have several of their large radars, which they have made very well-known to the wind industry energy that those radars are saturated at, so they're going to have much less ability to mitigate any new proposed wind farms in those areas. Now, some of their other radars are in areas where there's a lot less wind farm so they don't have saturation issue, yet, they haven't reached it.

So, we had a lot more MRT's for NORAD the last two years, so way, way more. They used to be a small fraction of our Mitigation Response Teams, probably 10 to 15%,

and now they're probably 30 to 40%. So, the radar issue is because the saturation issue, the proliferation of wind farms has become much more of an issue.

MAJ HANRAHAN:
So, sir, I'm thinking of a lot of our listeners here that are perhaps working at a base legal office, and/or our civilians that maybe living near one of these wind farms, for the folks that are working at a base legal office and maybe there's a project like this underway, what is their involvement in this and/or with your team, and also with landowners what involvement could landowners have in this process?

MR. CANNIZZO:
That's very complex. In terms of the MRT's, occasionally we will have base attorneys call in and participate, but these are very technical issues. So normally, they do a lot more listening than an active engagement. We always welcome base input, that's who we rely on, is the aviators from the base, you're talking like, about low-level training routes. They're the ones who run the show because it's all about safety and they're the ones who know how they fly. I don't know how they fly. I don't plan to be an aviator. I learn a lot in these calls about operations, and it's really supporting the mission.

It's really a fun phenomenon for me to be in a mission and an enabler and after the end of the day to think about how we saved training routes or we saved radar capabilities that enable the Air Force to do its mission. So, this is one where the Air Force lawyers, we're not just paper pushers or whatever term you want to use. We're enabling the mission in a very real way.

In terms of landowners, that's a lot of tension. The base doesn't normally deal with the landowners. On a very rare occasion we'll have the landowners on the MRT calls. It has happened a few times. Normally, it's the wind farm project developer. If it's an informal, they usually don't even have land leases yet, so they don't really know for sure who their landowners will be. If it's a formal, they've probably got leases or at least a lease in negotiation established. Some of those will have the landowners on the calls.

And the other thing, the phenomena I really need to enforce is through that whole clearinghouse process, we've gone through how with very few cases do we actually have an objection. But even if we were to have an objection and if FAA were to enroll it in their system as a formal obstruction to navigation and sustain our objection, it still isn't a veto. This isn't like in other forums where FAA's a strict regulator. Again, it's a recommendation.

Normally, those recommendations are followed because people don't want to cause safety issues and often times, they have problems getting financing or insurance if their project is deemed an instruction to navigation. But even in the ultimate end of things, we don't have a veto. DoD certainly doesn't have a veto. We make our own recommendation system, and the service, we don't even have the ability to enter an objection, it's only DoD. So, the service makes a recommendation to DoD who enters it in the FAA system.

OPERATIONAL CHALLENGES

MAJ HANRAHAN:
So, sir, we've discussed kind of some of the operational challenges and wanted to give you just a little more time to discuss that. What is the interplay, more or less, with wind energy today and our operational law landscape as it pertains to our national security?

MR. CANNIZZO:
The interplay is now, ever since 2011, we've had that Energy Siting Clearinghouse statute that enables us through FAA's obstructions and navigation process to have a voice, and to try to work out mitigation strategies on wind farms. So, operationally, is that this process is really important. We can get wind farm project developers to move some of their turbines or all their turbines in a proposed wind farm out of our low-level training routes. Or, we can get them to move them out of the line of sight of our NORAD or air traffic control

or weather radar. Or, we can get them to do mitigation strategies like radar optimization, where they reprogram the radar, or curtailment, where they agreed to stop or feather the blades during time periods, critical time periods, of national security that we need those turbine blades stopped spinning so that our radars can see much more clearly what's going on in those so certain areas.

So, the interplay of operations and law here is a very strong, very important one because without this, we have no really formal way to engage with wind farm developers. And this system, it's not just the ability to voice the concerns and to negotiate mitigation strategies. It's also, just the notification. That whole process, without it, it would be, you know, a needle in a hay sack sort of thing, because with this process, we basically get tied into, and we have access to FAA's system, and we see the filings and they provide notifications on all the proposals. And a lot of them, they're not near a training route, they're not near radar, not an issue. But the ones that are, we will enter that finding, the notice of presume hazard, and it will kick off a Mitigation Response Team and we can have a dialogue and try to come up with reasonable mitigation.

MAJ HANRAHAN:
Sir, it also seems that most of the time you're able to get to a win-win situation here for both military operations, the developer, and maybe even the landowner; it may be a triple win. Is that typically how these—that's the goal?

MR. CANNIZZO:
That's always a goal. And that's really what the 2011 statute sets out. As we talked earlier, it's a balancing act. It's not one anyone side gets a win. It's trying to figure out feasible and affordable mitigation, is what this statute, the term it uses to resolve the issues.

ADDITIONAL RESOURCES

MAJ HANRAHAN:
And sir, might you have any additional resources that you could recommend to our listeners if they want to learn more about today's topic?

MR. CANNIZZO:
The Department of Energy has quite a lot of information on it. The wind farm industry also has—they have multiple different websites and reports. The technology is pretty amazing on wind farms; how rapidly it has advanced, how these structures are just gargantuan. And you have some of that, for instance, that GE turbine that's going to be 850 feet tall. It has blades that are 367 feet long, each. And that's just gargantuan. I think we've all, driving down the interstate, we've seen the semis with the one turbine blade on it, and it just boggled our eyes about how big they were. And I think the plan is they're going to get bigger, and bigger, and bigger. I don't know how, I guess eventually there's probably some stress level that metal can't take that will eventually limit the size of what they can do, but it's just amazing how the technology is advancing.

MAJ HANRAHAN:
Yes, sir. And any final thoughts on today's topic you'd like to leave with our listeners?

FINAL THOUGHTS

MR. CANNIZZO:
I think the main thought is this is a really fun JAG position to be in, because you deal with on a day-to-day basis with operators, you deal very much with operational facts that really are, they're the driving force on the results that we get; what the NORAD radar operators tell you, how the radar will be affected, or what your aviators tell you flying routes will be affected. And so, it's a very fun area of law to do and I think it's also, in terms of the Air Force, it's a very valuable area of interface between operations and law.

MAJ HANRAHAN:
Well, thank you, sir, for coming out today. We really appreciate it and we wish you the best with everything you're doing for the rest of this year and into next year.

MR. CANNIZZO:
Okay.

MAJ HANRAHAN:
You have a good one.

MR. CANNIZZO:
You too.

TAKEAWAYS

MAJ HANRAHAN:
That concludes our interview with Mr. Jim Cannizzo. Here are three of my takeaways from the interview.

NUMBER ONE: we are in a new age of wind energy development. Today wind energy is the largest source of renewable energy in the U.S. and continues to grow at an accelerating pace. As of 2020, there approximately 60,000 wind turbines that generate over 100,000 megawatts of electricity spread across the U.S. By some sources, that is enough energy to supply around 30 million homes.

The majority of these turbines are found on wind farms of increasing size and complexity in wind rich areas and states such as Texas, Iowa, California and Oklahoma. In Iowa and Kansas, for example, wind power is now the single largest source of energy at over 40% in each state, surpassing fossil fuel production. This energy output is quite remarkable considering 10 years ago wind energy accounted for only a few percentage points of U.S. energy production. In 2020, it's around 8% or so, and as Mr. Cannizzo mentioned future estimates show that wind energy will account for 35% or more by 2050.

And this is not just a U.S. phenomenon, countries in the European Union, such as Germany, have been world leaders in wind energy for decades. And China has invested heavily into wind energy production where it is the current world leader with over 230,000 megawatts of wind energy, or more than double the U.S. It's safe to say that here, at the beginning of 2021, the race is on to a carbon neutral world with wind energy and other renewables like solar at the forefront of this sprint.

This leads me to point **NUMBER TWO, wind energy development has increased the complexity on military operations.** The growing production in wind energy development, including the size of individual turbines to the quantity of them on wind farms coupled with the competition to build in wind rich areas has placed greater complexity and burden on the DoD and Air Force in managing military operations.

Let's talk about the size of these turbines, 10 years ago a turbine was around 300 to 400 feet and within five years grew to 500 feet or so. Today, turbines on major wind farms average around 650 feet or so. And as mentioned in our interview, GE has a new massive turbine at 850 feet tall with blades over 350 feet, or about as long as the length of a football field, which is able to produce 12 megawatts of power, or enough power to light 16,000 homes. That's one turbine powering 16,000 homes.

To get some context, the Eiffel tower is only about 200 feet taller, standing at 1063 feet, than this new GE turbine with moving blades. And according to GE, a wind farm of these massive turbines will be able to supply one million households with energy. To me, this highlights the new energy paradigm that is taking place.

The sheer number of turbines continues to magnify as well. Normal wind farms might average 35 to 65 turbines, medium-size farms at 65 to a few hundred turbines, and these new mega wind farms with a thousand turbines or more. And as Mr. Cannizzo said, you also can't just have turbines stacked against each other. Rather, they need to be spread out to reduce turbulence, and the spinning of the blades also causes friction on radar and other military assets.

Further, wind farms can't be built just anywhere. These private wind energy farms look for wind rich areas where we often already have military training routes and/or NORAD radars and assets.

So, what does this all mean for military operations? Well, as Mr. Cannizzo mentioned, competition by private energy firms to place ever more turbines of larger size and quantity in these wind rich areas leads to greater legal and operational complexity. And Mr. Cannizzo and his team worked to find solutions through wind farm mitigation and other techniques within the parameters of the law to continue military operations, while also trying to remain true to the intent of Congress to foster wind energy development.

This leads me to the last point, **NUMBER THREE, the wind energy boom is the result of collaboration between big government and big private energy.** For the last decade or longer, the U.S. government has helped to spawn this burgeoning wind energy industry. The government has primarily done so through large tax incentives and breaks to offset the costs. For example, the government has help through an energy tax credit the pays up to 30% of the costs. Without the government's tax credits, many to likely most of these projects, especially the early ones would have never got off the ground.

Further, as discussed in 2011, Congress created the DoD Siting Clearinghouse as a way to beneficially solve conflicts between military operations and private energy development. As Mr. Cannizzo mentioned, the goal of the program is feasible and affordable mitigation, or in other words, Big Government is collaborating with Big Energy to ensure the integrity of military readiness and operations and continue to foster private energy development. It's like a symbolic dance of the Nutcracker between Big Government and Big Business. And after many years of this, now renewables such as wind, are starting to reach a certain parity with fossil fuels, and this trend is across the entire globe, not just in the U.S.

If the trend continues as we believe it will, how and where we get energy in the next few decades will go more and more to renewables. And this will continue to have an ever-growing impact on military operations.

I'd also like to mention an update that we became aware of post-recording; the wind energy tax credit was extended through 2021, which will continue to drive more wind energy development.

Additionally, the environmental law team asked me to briefly highlight the important role that installation legal offices play in this entire process. SJA's and attorneys play a key role in mission sustainment by working closely with their operators to understand specific mission requirements, particularly as they apply to ranges and airspace areas away from the base, such as low-level military training routes.

Performing that role enables installation legal offices to collaborate effectively with the environmental law and litigation experts to more accurately describe the operational requirements and precise potential adverse impacts to that particular installation's mission posed by energy development proposals. Many energy developers have former military consultants who can challenge the asserted requirements. So, the Mitigation Response Teams need to be able to articulate and defend, with legal support, the mission requirements.

Another critical function is to directly advise installation commanders about the statutory provisions limiting authority to object to incompatible wind and solar energy development. As Mr. Cannizzo explained, while the installation commander can assess the actual adverse impacts and recommend an objection, which is elevated through command channels to Department of Air Force Headquarters, only the DoD can formally lodge the objection with FAA as an unacceptable risk to national security.

In closing, continue to stay apprised of this evolving energy landscape. Military members are the eyes and ears of the local mission, like wind farm mitigation issues. And base legal offices should engage with their operators to truly understand the mission and continue to build those relationships. And civilians can get involved through public discourse and hearings.

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[Upbeat Music].

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GLOSSARY

- **AFJAGS:** Air Force Judge Advocate General's School
- **DOE:** Department of Energy
- **FAA:** Federal Aviation Administration
- **JAG:** judge advocate general
- **MRT:** Mitigation Response Team
- **NORAD:** North American Aerospace Defense Command
- **OE/AAA:** Obstruction Evaluation / Airport Airspace Analysis