
Jennifer Stock: You're listening to Ocean Currents, a podcast brought to you by NOAA's Cordell Bank National Marine Sanctuary. This radio program was originally broadcast on KWMR in Point Reyes Station, California. Thanks for listening!

(Music)

Jennifer Stock: And welcome everyone. This is Jennifer Stock and you're listening to Ocean Currents on KWMR and on this show we talk about the blue part of our planet, the ocean. We talk about natural history, conservation, research, exploration, and ways for us land-based folks to learn more and get involved. I bring this show to you from NOAA's Cordell Bank National Marine Sanctuary, one of four amazing and unique national marine sanctuaries off the California coast working to protect the unique and diverse marine ecosystems we have here in California. So, we have a lot to cover today. So, I want to jump right in.

While California is spared of the oil and gas development for five more years by the president's recent announcement, the announcement opens up other areas that are abundant in marine wildlife in the Atlantic and Arctic Ocean. If you tuned in last month or if you caught the podcast episode, I had Riki Ott on the air on March 1st talking a lot about the impact oil can have on a coastal economy and an ecosystem in detail.

So, if you want to catch up on oil impacts, come back to our website, cordellbank.noaa.gov to catch that, but today we're going to look at alternative sources of energy from the ocean that are not hydro-carbon based. Generating technologies for getting power from the ocean include tidal power, wave power, ocean thermal energy conversion, ocean currents, ocean winds, and salinity gradients. Of these, the three most well-developed technologies are tidal power, ocean thermal energy conversion and wave power. While tidal power requires large tidal difference, which in the US occur only in Maine and Alaska, ocean thermal energy conversion is limited to tropical regions, such as Hawaii and to a portion of the Atlantic Coast, but wave energy has more general application a lot of potential along the California coast.

The western coastline has the highest wave potential in the United States. In California, the greatest potential is along the northern coast of which we are situated here in Point Reyes. So, today we're going to talk about how this potential technology is being tested here and discuss its potential as well as the tradeoffs that could

exist. It's pretty interesting to think that the very thing that makes this coast so productive with marine life is also potentially generating a valid sustainable source of energy. So, we'll discuss this topic of wave energy with Laura Engeman, who is a project manager with the California Ocean Protection Council working on this effort. So, stay with us, we'll be right back.

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Jennifer Stock: I am joined on the phone by Laura Engeman of the California Ocean Protection Council. Laura has been with the council for three years and has a masters in international environmental policy from the Monterey Institute of International Studies. She has been tracking the offshore wave energy, testing and development in California on behalf of the council. So, welcome, Laura, you're live on the air.

Laura Engeman: Great. Thanks, Jennifer

Jennifer Stock: Thanks for joining me today. First, I'd like to start off asking a little bit more about the California Ocean Protection Council and its role. What role does it play in ocean protection matters?

Laura Engeman: Sure. So, a lot of folks aren't necessarily that familiar with the California Ocean Protection Council. We were actually developed...we were created as a separate council about five years ago and part of the emphasis for creating us was some of the larger ocean policy reports that came out from the Pew Commissions and the Ocean Commission about five or six years ago and the focus of the ocean protection council was to develop an innovative collaborative agency and by agency, I'll explain a little bit more, but we are actually made up of a board that is repressive of those agencies that have mandates or responsibilities over ocean and coastal management and to address some of the issues of management disjointedness, I would say, or some of the connections between our wildlife agencies, our resource agencies, our water quality, our habitat...needs to address those needs on a more comprehensive level.

The Ocean Protection Council has board members that are representative from the EPA and the chair is currently the secretary of the Natural Resources Agency and under the Natural Resource Agents, we have the Department of Fish and Game and the resources agency itself as well as things like the state lands commission, which has authority over our sea bed and so, the idea is that the Ocean Protection Council can provide some value as far

as connecting these agencies and finding sort of gaps and overlaps where we can improve the way the state manages these resources and also, address, maybe, more of an ecosystem-based approach. So, instead of each agency having its responsibility for a specific habitat or a specific species we look at the broader issue and try to create sort of a joint management plan, the joint strategies for addressing some of those issues.

Obviously, a big one that's come up is climate change over the last few years. So, that's a perfect example of how a number of agencies have to sit down together and work on that and the Ocean Protection Council's main mission is to, like I said, improve management, but through policy recommendations. So, we recommend policies at the state and national level and then we also invest funds in critical areas necessary either for management or research. We invest funds in everything from fisheries reform to research that happens, monitoring the ocean to putting in money to the marine life protection act process and gathering data for that effort as well as, like I said, climate change, invasive species, water quality. It's a wide portfolio.

Jennifer Stock:

The big hit list of must-do items in terms of research. That's great. So, I take it that there's some money being invested in looking at the research in terms of wave energy. So, let's talk a little bit about the wave energy stuff that you are following. Just to back up for folks, because earlier I mentioned a couple different ways that there are technologies involved of getting power from the ocean and wave energy seems to be one of the ones that sticks around as having a real potential, but when did it really hit the scenes in terms of being a viable technology and really start hitting the ground getting tested in the ocean?

Laura Engeman:

You know, I think I believe there was some initial interest in wave energy about a decade ago, but mostly, those technologies didn't quite pan out and so, the interest in the viability of the technology sort of went into the background for a while and then over the last couple of years, there has been a resurgence of newer technologies that are proving more viable for the industry and most of that originally occurred in Europe. So, we saw a few companies start to really move forward in the UK and Portugal in terms of having more of a design on paper and getting some support from financial partners as well as the government and then, obviously, those companies began to look elsewhere for other potential areas where they could test or demonstrate their technologies and the first firm that really sort of took a look at that was the Electric Power Research Institute did a number of reports.

I would say about three years ago, they issued a number of reports that were general assessments in the US what the potential was for offshore wind, offshore wave, and tidal energy in California and the US and what they sort of came up with were these maps that showed that there was strong potential for offshore wind development along the east coast and some along the west coast and then there was the most viable areas for wave resources were on the west coast out here with mainly, Point Conception north and then there was some tidal power possibilities in places like Puget Sound and then with a possibility of San Francisco Bay.

So, I think the Electric Power Research Group Information really provided a foundation for some of the companies to really take a closer look and that's when we saw a sort of flurry of companies taking a look at the west coast as possible areas to do further research and test their technologies.

Jennifer Stock:

So, how does it actually work? It seems that from the research I was doing, there's a couple different ways wave energy can work. Could you talk about some of those different platforms of how does it physically create energy for our grid?

Laura Engeman:

Well, I will throw the caveat out that I'm not an engineer first. So, I'll to describe this in broad terms. So, wave energy technologies at this point in time, there has been, sort of, discussed four different categories of technologies although, now, it's six, but I will also throw the disclaimer out there that these are some of the technologies out there that are more proven and there seems to be a new one every week. So, this is not the end all, be all. There's a lot of innovative, really fascinating ideas for these types of devices. So, I will give you kind of a general idea just so it's a little bit more of a tangible picture.

So, the one that's most often looked at first is the buoy system and I think some of you may have seen the news article about the buoy that was tested off of the Oregon Coast that ended up not functioning properly with the bilge system and sunk, but the basic technology is really based on the NOAA buoys and it's actually a floating buoy, but then it is moored down to the actual sea bed floor and when the waves move through, the buoy actually just rises and falls with the waves and when it rises and falls, it's creating it's own power within that buoy system.

So, it's just moving up and down and generating power along, kind of, a cable line. So, that's what's called a point absorber, I guess I would say, in some of the research on wave energy technologies

and then you have what is called an attenuator and that one, we sort of refer to as the snake-like-looking-device. It's a device mainly developed by one company called the Polamus system and what it looks like is sort of a train-chain system. So, it's a number of floating pieces.

They're on top of the water as opposed to being moored to the sea floor, that float perpendicular to the shore line and so, when a wave comes through it actually moves those...there's usually like four connected pieces, it moves those four pieces up and down with the wave and creates kind of a joint movement between the two, between the actual pieces. I'm not sure if I'm describing this that well. But we've got a visual.

Jennifer Stock:

Well, one thing it reminds me of, when I saw the pictures of it and the way you're describing it with the joints is sometimes you see those really annoying things on the side of the road that are powered by air fans that have...it's like a body or some type of a character to advertise a car dealership or what not and it has these joints that kind of...are flexible or what not, and the plan kind of reminds me of that when I see the pictures of it.

Laura Engeman:

Sure. Yeah. So, instead of going up and down in the water column, it sits on top of the surface of the water and its joints just flex back and forth which then creates...produces energy by that movement and I think one of the benefits of that technology has been by, you know, marketed by that company as...you don't necessarily need huge amounts of swell, it's just a consistent wave movement because the more that flexes...more often that flexes...the more energy they'll produce. It doesn't have to be a huge wave and then there is what's called an over-topping device and an over-topping device is any kind of system where it would float...there would be sort of a...let's see...something that sits up on top of the water.

When the wave comes through, the wave actually dumps into a holding tank of some sort and then it would flush the water back out into the ocean and while it is being pumped back out to the ocean underneath, it would move a turbine and some of the...we can talk a little bit more about what potential effects there would be, but obviously with that, the water is moving through a system and so, there's a little bit more concern with animals or species or other things getting stuck.

There's also other ones that I would say that are coming out now and they look more like...they're called...they're similar to the tidal devices in that they look more like a sea fan-type device and

they sort of just swing back and forth. Some are related to something that's floating in actual water that would be either more to the seabed or to the sea floor. There's a number of those new devices that are becoming really popular.

Jennifer Stock: Interesting. So, the general gist is somehow capturing the movement of the surface of the water or energy driven up by winds and waves and somehow capturing that to be able to create energy. One of the things that I've read that I was kind of surprised at, I'm wondering if you could help explain this, it says, "The incidence of wave power at deep ocean sites is three to eight times the wave power at adjacent coastal sites," which I would think there'd be more energy at those coastal sites where there's a lot more energy released, but it sounds, from what I'm reading here that there's more at a deeper site and I'm wondering, can you explain that at all?

Laura Engeman: Well, I mean, we do have...yeah, the wave resources, as they're called, or wave energy resources are better in the north coast, which is where we have a deeper continental shelf and so, like I said, it's not always the heights of the waves. I think when we think wave power, we often think of the size of the wave and the height of the wave, but it's the wave surge that you're talking about. So, it's the sort of volume of water and the consistency of the power of that volume of water as opposed to the, sort of, amount of waves crashing on the beach that you would see. So, we are talking...instead of thinking right on the shoreline, we're actually talking about much more...we're talking about wave movements that are farther offshore.

Jennifer Stock: Got it.

Laura Engeman: So, these aren't necessarily waves that are actually crashing. These are more swell movements and so, you're talking about a volume of water and the rate at which it moves and the rate at which it moves, how often, as I said, though, I think a lot of what they're looking for is something that's more consistent as opposed to stronger.

Jennifer Stock: Right because the ones that break at the coast, those are intermittent. Those are not always going to be breaking whereas that constant movement is going to be constantly working to create...got it. I think for those of us that don't really know a lot about ocean energy and waves, it's confusing. I remember when I was learning about waves back in marine science. It's very in-depth in terms of where the energy actually comes from an where you

measure it and what not. So, that actually helped ring a couple of bells for me in terms of where most of that energy exists. So, here's a little bit about...here's some background.

We talked a little bit about some of the potential wave generation devices and how this potentially works. For those just tuning in, you're listening to Ocean Currents and my guest today is Laura Engeman from the California Ocean Protection Council who is helping follow the development of wave energy technology in California and here more locally, just north of us, there is some testing going on. Sonoma County Water Agency has recently initiated a process by buying rights to develop some wave energy. Can you give us some background on this project and give us an update of where they are in the development?

Laura Engeman:

Sure. So, in Sonoma County, originally there was some other interest, I believe, maybe it was from another energy company a couple of years ago and they backed out of that area, but at the same time, there was sort of this growing interest in the entire coast and so, gas and electric started to move forward with some project ideas and so, some of the local communities including the Sonoma County Board of Supervisors began to look at this issue and discuss the benefits of having, sort of, a community-owned process and feasibility projects and so, the Sonoma County Board of Supervisors discussed the idea of testing devices that could power Sonoma County energy needs and so, they specifically, I believe, gave the Sonoma County Water Agency the thumbs up to go ahead and move forward with submitting projects, they're called preliminary permit applications, through the Federal Energy Regulatory Commission and basically what that means is you get a three-year time frame to study an area and during that time, you sort of reserve that space and nobody else, no other company, or entity can come in and reserve that area.

So, currently the Sonoma County Water Agency has preliminary permits for off the coast of Sonoma and they have a number areas that they're looking at, but they are in that three year research stage. So, at this point their main objective to raise funds and identify research that they believe needs to be done in order to determine whether those areas are even feasible for wave energy and maybe what types of technology and who would benefit from that power and I believe they're looking at the benefactor of the power. It would actually be the water agency itself.

Jennifer Stock:

And that would probably be used to move the water...moving their water, basically.

Laura Engeman: Moving their water. It's part of their larger strategy. So, they want to be, sort of, a self-sustaining clean energy agency in general. So, this is part of their strategy for finding other alternatives for power.

Jennifer Stock: Now, the Federal Energy Regulatory Commission, they have the authority within three miles, is that correct?

Laura Engeman: Correct.

Jennifer Stock: And then beyond that, it's the Marine Minerals Management Service?

Laura Engeman: Minerals Management Service.

Jennifer Stock: And that goes out to 200 miles, like federal waters?

Laura Engeman: Yes. So, Minerals Management Service is usually what we're...the agency that we're most familiar if you have followed anything to do with offshore oil rigs. So, Minerals Management Service has historically been the agency that has the leases offshore for things like offshore oil drilling, but the Federal Energy Regulatory Commission typically has jurisdictions and you may also be very familiar with this, over dams, and those energy structures that are within streams and what they call navigable waters.

So, this is where the confusion came early on over which of these agencies actually has authority over these projects in either the state waters, which are navigable waters according to this definition or offshore areas, which are the Minerals Management Service jurisdiction, typically, and what has resulted is there now is an MOU between those two agencies. There's a bit of a shared approach.

So, within the state waters, the Federal Energy Regulatory Commission will issue these preliminary permits for studies and they will also issue licenses for pilot projects, which can be approximately five years, but now they're looking at maybe extending that to ten years because folks like PG&E have said that they can't do it within a five year time frame and then, licenses, actual commercial licenses for anything that may happen in state waters and then Minerals Management Service would have to issue a lease for anything that happens outside the state waters, but that project would also get a license from the Federal Energy Regulatory Commission. So, it's a little confusing.

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- Jennifer Stock:* It is a little confusing, I can see.
- Laura Engeman:* Within state waters, you're one agency with out of state waters, you have to get both...you have to get approval from both.
- Jennifer Stock:* That's interesting. So, what is the Minerals Management Service regulatory policy for alternative energy technology? Do they have a policy?
- Laura Engeman:* Well, they have...they recently under the most recent energy act, they now have an alternative energy and alternative use program and I encourage folks who are interested in that program, they released that final rule a little over a year ago, a year and a half ago and their website has some great information on their program. They've been really good about outreach and education on that. So, that includes any alternative, renewable energy source.
- So, they have jurisdiction over offshore wind and wave energy and anything else that you could possibly think of in that area and then alternate use. So, part of that is what if somebody wanted to use an oil rig to then put an offshore wind turbine on top of it? There's sort of this grey area of, "We don't quite know what innovative ideas somebody might come up with so that's sort of alternate use.
- Jennifer Stock:* Yeah. There's a lot of potential and I'm imagining listeners are probably wondering, "What about the environment?" And we are going to focus on that part in a little bit. We have just a few more minutes left before we take a break and on the second half I'd really like to talk about how we assess the environmental impacts and look at the tradeoffs there, but before we do that, are there other projects happening in California where some of these may be able to share ideas, share technology? Like, I think there's something happening in Humboldt Bay as well as maybe southern California, Santa Barbara region?
- Laura Engeman:* The project that's the furthest along and that's still in the very beginning stages, but the project that's furthest along is Pacific Gas and Electric, their project called the wave connect and they actually have two sites under that one project and you can go to their website, pgande.com, I think backslash wave connect and there's a whole lot of information about meetings and what they're up to there. They basically are looking at a site off of Humboldt Bay and they have a committee of all sorts of stakeholders and local governments and they also have a permitting committee with all of the agencies involved and they looked at a large area outside of Humboldt Bay.

They...narrowed it down to a more specific project area where they submitted an application to work for a pilot project and the idea behind that is that they, as a utility, are not necessarily confident in one specific technology. So, they're going to set up a...basically, a testing facility where they can test, I think it's three to four different types of technologies in that area. They'll basically run those technologies and collect data on those technologies, everything from environmental impacts to energy productivity in those areas and then determine from there what they think is the most effective technology or viable technology either for that area or, even more likely, for offshore, but the wave resources are sort of better offshore.

I think that a lot of the companies realize that aesthetically, people don't necessarily want to see those technologies. So, they're looking at the farther out for these larger scales, but for right now because of the cost of making, maintaining, and sort of checking on these test pilots, most of these test projects, they're being proposed in state waters in that three miles range. So, they want to test three to four devices up by Humboldt Bay and then their center post project that they're now looking at starting is off of Vanderburgh Air Force base, just north of Santa Barbara and that area, they have an agreement with the air force base to use some of their facilities and to maybe generate some energy for the air force base as kind of a test project as well and they're hoping that, one: the Humboldt Bay project which was a little earlier and more advanced, if they get a couple a year or two of data on that project first, they'll be able to then already see which technologies are preferred and maybe build out a little bit more in the central coast by taking those one or two technologies and putting a few more.

So, the one in Humboldt may only be like four devices. The one in the central coast may be a larger project to sort of move one step furthers.

Jennifer Stock:

Excellent. Thank you for that overview of those specific projects. We are going to take a quick break right now. So, if you wouldn't mind just hanging on the line, Laura, that would be great. We'll be back in just a second.

(Music)

Jennifer Stock:

And we're back. You're listening to Ocean Currents on KWMR. This is Jennifer Stock and I have Laura Engeman on the phone from the California Ocean Protection Council who is following wave energy projects in California and before I get into

the environmental concerns and tradeoffs and research that's needed, one thing I haven't really asked about is the potential for actual energy production in terms of megawatts and how much energy can be created, do you think, by these projects or do we even know that yet?

Laura Engeman: I would say that the Electric Power Research Institute put out some pretty broad numbers...megawatt estimates for the west coast and nationally, I think that there are a number of components to building a project that will determine how many megawatts projects would actually produce and as you're leading into the issues of environmental impacts and other tradeoffs, that's exactly...those are exactly the components that would determine how many megawatts a project would actually produce. So, for instance, off of maybe, Sonoma Coast, you could do a full commercial build out to maximize the amount of megawatts that you would want to produce, but you may end up with a couple hundred devices in order to get to that point if the devices aren't extremely efficient, but I don't think that most of the local communities, northern residents of California necessarily want the entire Sonoma Coast covered with wave energy devices. So, it's a lot...that may even not be efficient or cost effective for developers.

So, there's a number of components that will dictate how big a project would be and how much energy it would produce. So, it's a tough question.

Jennifer Stock: Yeah. I can imagine, too, just extracting energy...the whole process of getting the technology in place requires energy and maintaining it and what not. So, the whole cost-benefit analysis there would be interesting.

Laura Engeman: Right and you have to run transmission cables to shore and there has to be a facility on the shore and so, you're looking at some pretty high costs for the energy developed for who would actually build these out and so, as far as being a new technology and being sort of in its early phases. It's more likely that folks would start with smaller projects and then slowly build to something a little larger and that's what I think has been kind of seen in other countries as well because the UK and Portugal have looked at testing devices and they're just as far as we are. They may put in devices before we do, but they're still just demonstration projects and not full scale commercial.

Jennifer Stock: Ok. Interesting. Good to know that. So, while we're talking here and hearing about the movements of these things and these joints

and this energy, I'm also thinking about this part of the coast that is just so important for the food web and important to commercial fisheries and I'm thinking about the biologists, the researchers that are trying to learn about these regions, and thinking about the potential impact of this hardware in the ocean. So, what are some of the ways that you are encouraging development of environmental impact reports in terms of planning how to assess that?

Laura Engeman: So, one of the first things that we did a couple years ago when this issue came up and there just seemed to be this huge amount of uncertainty, which there still is, but about what this was and what type of technology if it had any similar characteristics to anything else that we work with now. My agency, the Ocean Protection Council, got together with the California Energy Commission, which has a program called their peer program, which often produces a number of reports and research for energy impacts related to renewable energy devices and so, we got together to co-fund just an initial evaluation of what the potential environmental effects might be and what also, the potential socioeconomic effects might be because that's also a really big issue as far as tradeoffs for the uses of our marine environment and so, we put together a team of researchers, which included John Largier from the Bodega Marine Lab, Bill Fitomin, who now works for his own firm, the Farallones Institute for Advanced Ecosystem Research.

I apologize, if I get that it's a long acronym...and then, I had some folks from UC Santa Cruz and another kind of professor on Monday down there to look at benthic issues and then, leading the paper was Pete Nelson, who was formerly with the Sea Grant program up in Humboldt and now works for a firm called H.T. Harvey and Associates, took a look at some of the fisheries issues and we had a whole chapter on the socioeconomics. So, it kind of tried to run the full gamut of looking at the potential effects and just give a very, very initial cursory look at what we might be talking about and some of the ideas that came out of that was that a lot of these devices would be moored to the seafloor and so, obviously, your tussling with some benthic habitat disturbance. Imagine that most of them would be on sort of sandy habitats as opposed to rocky, but it's not a definite at this point and it would depend on how many devices.

Obviously, you don't want five devices with moorings on the sea floor that's not much different from others that we have out there, but if you're talking about a hundred different mooring devices, that may be a significant impact to that benthic environment. Other

issues that were thought of are just the amount of infrastructure in the ocean as far as fish attraction. So, wouldn't that change the population dynamics of the area if you now had similar to rigs and other buoy systems that often act as an attractant for certain species?

Jennifer Stock: Sort of like an artificial habitat.

Laura Engeman: Right. So, you're talking about if you have 25 to 50 devices in the water, that presents a whole new artificial habitat that wasn't there before and then in addition to that, if you...depending on the types of devices, the buoys are often shown as an array, they call it an array of buoys where they're linked with cables, they're linked together and so, how those cables are linked together and whether there would be any issues as far as entanglement by marine mammals or the two sort of biggest unknown issues are acoustic electromagnetic fields. With that many cables out there or these various devices moving up and down, how much noise would they produce and what sort of impacts might they have on larger species such as whale migrations?

Would they avoid the area completely, which would be a good thing as far as avoiding impacts, however, is that significantly change their migration patterns or their feeding patterns, et cetera and then, some other interesting ideas that came up were with a small project, you're not really effecting the wave's movement that much, but with a larger project where you have multiple devices taking the power out of the waves, essentially, and the essence has been everywhere from three percent to 15 percent. Would there be what's called shadow effects behind that array, meaning that in the environment, between that array and shore, would there be sort of a reduced amount of wave power and would that effect maybe inter-tidal zones or the habitat that exists that may rely a little bit more on that wave power?

Especially along the north coast, there is estuaries or sediment movement or specific sensitive inter-tidal communities. Those are things that are considerations for that.

Jennifer Stock: Definitely. Those are big ones. Also, I'm imagining seabirds maybe being attracted to areas to land and maybe finding things to hit. They often are attracted artificially to lights and what not.

Laura Engeman: So, yeah and with the attraction we do have some information out there based on other offshore infrastructure, but yes, hauling out,

creating more issues as far as seal haul outs or attracting sea birds as well as, maybe effecting their feeding patterns as well.

Jennifer Stock: Right.

Laura Engeman: And then in the socioeconomics, we're talking about areas that have significant crab fisheries, marine uses as far as boating and kayaking and other, if you're in state waters and you're close to the shore, are they going to be taking up areas that are frequented by the marine uses that maybe we value or are there issues of collision with other major maritime industries or shipping channels or other boat traffic, coast guard issues. So, there's a number of things think about...

Jennifer Stock: Definitely.

Laura Engeman: ...projects

Jennifer Stock: You highlighted the ones I wanted to, specifically the navigation one, this coast is littered with shipwrecks from historic transiting here without a lot of navigational aids and we still have unfortunate losses with navigation aids in place, but with the pilot studies that are going to go into...or the pilot projects that will eventually get into the water, will there be a monitoring program in place with that to help look at these issues in some level?

Laura Engeman: Absolutely. As part of the Federal Energy Regulatory Commission's pilot license, there are requirements for monitoring the environments and the state regulatory agencies will also be informing those if...they may be issuing their own permits and licenses as well, but we're also looking at how to incorporate those into the FERC license and the FERC license does have some language built into it that basically outlines that if there are significant impacts to the environment demonstrated then that project needs to be decommissioned.

Jennifer Stock: I see.

Laura Engeman: So, Minerals Management Service has some similar language as well, sort of precautionary measures as far as testing projects and not leaving them in when we know that it's exceeding the thresholds and, like I said, with the acoustics and, like, electromagnetic fields, those are an area where we really don't know that much at this point in time, but things like that where we could look at certain thresholds of acoustic interference or disturbance and try and monitor that and determine whether the

developer can change the design of the technology to reduce that or whether there's significantly more disturbance originally thought.

Jennifer Stock: Wonderful. I just want to...we're going to need to wrap it up here in a few minutes and it sounds like with your role, you really have a special role in the sense that you bring together many different agencies, authorities, permitting agencies, all the different players, you have that ability to kind of bring everybody together, which is a really neat role. How has the process...when will the process reach out to the public and ask for public input into these?

Laura Engeman: Well, as part of our efforts, I've been trying to work with some of the early developers like natural gas and electric to really help encourage them as well to do these stakeholder processes or have a steering committee basically set up and they have been. So, if you are in a region where that specific gas and electric projects are happening, they have requests out there for anybody that wants to volunteer themselves to be part of their committees. So, I think they've actually done a pretty good job at doing that and I think they're also establishing with which others are looking to.

So, I would say for specific projects, the proponents often have a specific meeting schedule and process for input, but in addition to that, I think that at the state level, we're looking at a number of research topics and ideas and hoping that I can encourage the scientific community to really start looking at this issue and using it as topics with their students. So, I think more and more, we'll see opportunities for performing some of that research and there's also a lot of federal dollars and investment in research in this area that we're increasingly seeing over the next couple of years.

Jennifer Stock: Well, that's good. Are there any websites you would like to direct people to to get involved or to learn more and anything else you'd like to share about the work that you're doing?

Laura Engeman: Sure. As I mentioned earlier, the main websites for the projects right now that I know are up are the P,G & E projects. So, that one's just www.pge.com and then I think backslash wave connect and then the other projects for Sonoma County I believe that one is easiest, I think, to find through their Sonoma County Water Agency website. And they have a little bit of information there. There's also some contact names and phone numbers there as well.

Jennifer Stock: Fantastic. And how about for the California Ocean Protection Council?

Laura Engeman: Sure. So, the Ocean Protection Council is working on updating our website, I apologize. We should probably have some additional information available on our site and the next week or so and we are at www.opc.ca.gov.

Jennifer Stock: Fantastic. Wonderful. Well, thanks, Laura, so much for sharing a big overview of a lot of different things. It sounds like it's so initial and there's a lot that's still to come in terms of developing this energy source and really identifying the impacts that we could have, but I think the biggest thing that we'll all be having to think about are what are the tradeoffs that we have to generate non-hydrocarbon energy for something that could have an impact on the environment too. So, that'll be really interesting to see how we are going to evolve in our thinking in regards to that. Thank you so much. Do you want to share anything else before we end up?

Laura Engeman: I think that's it. I think people should feel free to look around. There's a couple of folks that are following this issue, but it is a fascinating one that changes, like I said, the technologies that are changing very quickly and other things, but it is one that I think, as you mentioned, offers the state as far as us meeting our renewable energy goals, we have some very aggressive renewable energy goals in the state. It is an interesting avenue for us to take a look at and see if even if it's at the local level of producing power for coastal communities that are more isolated such as the Humboldt, the north coast and Humboldt Bay, it affords an opportunity that may be there if we can make it work, like you said.

Jennifer Stock: Wonderful. Well, thanks again. I really appreciate you taking the whole time today to talk about wave energy with us and good luck following the process.

Laura Engeman: Alright. Great. Thank you.

Jennifer Stock: Take care.

Laura Engeman: Bye.

Jennifer Stock: We're just been talking with Laura Engeman from the California Ocean Protection Council and we've been discussing wave energy technology development here in California and in just a few minutes, I'll come back with a couple announcements of other things that are happening around here. Stay with us.

(Music)

Jennifer Stock:

And that was the Elderberries featuring Jenny Steelquist. so, earlier we were talking about wave energy development in California and the technology potential, but also some of the tradeoffs that need to be examined in terms of impact to wildlife and very interesting process to follow along and something that I was just reflecting on this proposed wave energy technology generates 10 percent of our country's energy and ten percent comes from solar and 10 percent from wind and 10 percent from hydropower, we could be on our way to developing energy that relies less and less on hydrocarbons.

So, it's a very interesting time for research and development for these technologies and I think we all need to just stay mindful of what is involved with the development of them because all these little pieces can add up to be something significant. Just a few announcements, this Thursday we have a double-header of sanctuary advisory council meetings on Thursdsay, both the Cordell Bank Sancturay Advisory Council and the Guld of the Farallones Sanctuary Advisory Council have their meetings here in Point Reyes at the Point Reyes National Seashore Association Building, The Cordell Bank Sanctuary Advisory council will be meeting at 9:45 in the red barn building of the Point Reyes National Seashore... the Gulf of the Farallones Sanctuary Advisory Council will be meeting.

And in the afternoon, and these are all public meetings, so anybody can come. In the afternoon will be a joint session between both the Gulf of the Farallones and Cordell Bank Councils and they'll be discussing a climate change site scenario planning process and how are we planning for climate change within these areas and there will be an update on an ocean acidification task force that the sanctuaries are leading up, how to deal with ocean acidification as well as a vessel traffic on sanctuary resources discussion and salmon as a sanctuary resource discussion as well.

So, very interesting topics at the Gulf of the Farallones meeting earlier in the morning there will be an update by a shark researcher, Michael Domier of the Marine Conservation Science Institute about some recent tagging efforts at the Farallon Islands. So, that should be a rather interesting update. You can go to farallones.noaa.gov for the sanctuary advisory council agenda for Gulf of the Farallones and CordellBank.noaa.gov for the agenda for that meeting. So, this Thursday, very interesting. Lots of things going on.

There's a couple other things this Saturday. In Monterey is a free event at the California State University Monterey Bay University

Center and every year, the Monterey Bay National Marine Sanctuary hosts a conference that focuses on science that's happening in the sanctuaries and how this is improving our knowledge of the marine environment and this year it's focusing on voices of hope, science and innovation for the ocean and looking at experts will share talks that are engaging and creative and cutting edge science and technologies to help solve critical problems facing the environment.

So, I bet you there will be something about wave energy there. There's talks and a poster session and it's free all day from 8 to 3pm and that is at the California State University Monterey Bay University Center in Seaside California. So, check that out. You can look at the Monterey Bay National Marine Sanctuary website for more information on that. Lastly, I got another really cool news release through email, but I just had to share and this is through the Monterey Bay Aquarium Research Institute, MBARI, have released a new website called JellyWatch.org and this is actually, a guest that I've had on my show before, Steve Haddock. This is a website that he has generated and it's a way to allow people that visit our shorelines that have discovered huge jellies washing up or huge amounts of jellies to report them and it's somewhat of a social networking marine biology monitoring type of website and you can go ahead on and log in where you've seen jellyfish wash up, take pictures and share them, compare with sightings from other beachcombers around the globe.

So, looks like a really cool new thing, jellywatch.org. I'm hoping to have Steve come back on at some point to talk a little bit about the goals of this site and what he's hoping to learn. Having larger jellyfish populations is one of the expectations of climate change. As we change the acidification of the ocean and nutrients, we're expecting to see a lot more jellies rise up to the top in terms of abundance. So, that should be an interesting source.

That is going to wrap it up for me today on Ocean Currents. If you even have comments or questions you can email me directly at jennifer.stock@noaa.gov. You can always catch past episodes of Ocean Currents on our website, the Cordell Bank National Marine Sanctuary Website at cordellbank.noaa.gov and I'll be back next month with students from the West Marin School talking about their watershed investigations from the school year. So, I hope you'll tune in then. Thanks again for tuning in today. My name is Jennifer and I'm signing off.

(Music)

Jennifer Stock:

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