



ESG Report

2020

MISSION

CalWave's mission is to unlock the vast energy of ocean waves with superior, scalable power-generating technology.

Through rigorous research, innovation, and testing we are creating next-generation solutions that will protect our planet and uplift the potential of all global citizens.



FAST FACTS

- **About 40% of the world's population lives within 100km from the coast.** Island communities account for 11% of the world's total population (730 million people).
- **Oceans absorb about 30% of the carbon dioxide produced by humans,** buffering the impacts of climate change. However, this process which results in ocean acidification (~26% increase since the industrial revolution), is destroying marine and coastal ecosystems.
- "Deleterious effects of climate change are already affecting many marine and coastal resources, and **will continue to affect the health, reproduction capabilities, and biodiversity of populations of fish, shellfish, marine mammals, and birds, and other living organisms.**" - 2020 State of the Science report
- **Coastal communities are experiencing the cumulative burden of environmental stress** from coastal activities, overcrowding, and from upstream and inland development.
- More than **3 billion people depend on marine and coastal biodiversity** for their livelihoods.
- **Ocean wave power is 20-60 times more energy dense,** predictable, and consistent than wind or solar by hour-to-hour output.
- **Wave power has the technical potential to sustainably provide 30% of the world's power.**
- Forecasts show that ocean energy has the potential to **reduce/sequester up to 1.38 - 1.9 GtCO₂e annually.**
- "**Technological progress is the foundation of efforts to achieve environmental objectives,** such as increased resource and energy-efficiency. Without technology and innovation, industrialization will not happen, and without industrialization, development will not happen." - UN Sustainable Development Goals

Forecasts show that ocean energy has the potential to sequester up to 1.38 – 1.9 GtCO₂e annually. [2][3]

ECOLOGICAL IMPACT

Wave power has the potential to provide 20-30% of the global energy demand [2]

AN UNSUSTAINABLE PAST

Over the past 10 years, the energy sector has contributed to more greenhouse gas (GHG) emissions than any other sector on the planet, accounting for 73% of global emissions in 2016 [1].

As the demand for energy increases with population and industrial growth, the failure to leverage fossil fuel alternatives will impact us all in far-reaching ways. Without innovation and intervention to reduce GHG emissions, climate change will become increasingly disruptive to both human and ecological systems through this century and beyond.

In order to address climate change and its impacts, Calwave is offering a unique solution to reduce reliance on fossil fuels and provide clean renewable energy to communities around the world. We have developed a revolutionary technology that harvests energy from ocean waves, thus providing coastal communities with a reliable, renewable power source at a carbon-neutral power source at a competitive cost.

Ocean wave power is 20-60 times more energy dense, predictable, and consistent than wind or solar by hour-to-hour output, our solution has been designed to effectively absorb this energy to produce electricity with the environment and humanity in mind.

HARNESSING OCEAN ENERGY TO COMBAT CLIMATE CHANGE

The Intergovernmental Panel on Climate Change (IPCC) has recognized the significant potential of ocean energy as a means to mitigating climate change and for achieving the goals of the Paris Agreement [2]. Not only does wave power have the potential to provide 20-30% of the global energy demand, but forecasts also show that ocean energy has the ability to reduce/sequester up to 1.38 - 1.9 GtCO₂eq annually [2][3]. Assuming wave energy development follows the similar trajectory anticipated for offshore wind, this production can exponentially increase to achieve CalWave's target of displacing 500 million tons of GHG equivalent annually by 2050.

Furthermore, research and projections from the High Level Panel for the Sustainable Ocean Economy demonstrate that ocean-based mitigation options could reduce global GHG emissions by nearly 4 billion tons of carbon dioxide equivalent per year in 2030 and by more than 11 billion tons annually by 2050 [4].

¹ www.climatewatchdata.org/ ² www.ipcc.ch ³ drawdown.org ⁴ oceanpanel.org

Wave Power has one of the lowest lifecycle emissions at 17 gCO₂eq/kWh [2]

Options	Direct emissions	Infrastructure & supply chain emissions	Biogenic CO ₂ emissions and albedo effect	Methane emissions	Lifecycle emissions (incl. albedo effect)
	Min/Median/Max	Typical values			Min/Median/Max
Currently Commercially Available Technologies					
Coal—PC	670/760/870	9.6	0	47	740/820/910
Gas—Combined Cycle	350/370/490	1.6	0	91	410/490/650
Biomass—cofiring	n.a. ⁱⁱ	–	–	–	620/740/890 ⁱⁱ
Biomass—dedicated	n.a. ⁱⁱ	210	27	0	130/230/420 ^{iv}
Geothermal	0	45	0	0	6.0/38/79
Hydropower	0	19	0	88	1.0/24/2200
Nuclear	0	18	0	0	3.7/12/110
Concentrated Solar Power	0	29	0	0	8.8/27/63
Solar PV—rooftop	0	42	0	0	26/41/60
Solar PV—utility	0	66	0	0	18/48/180
Wind onshore	0	15	0	0	7.0/11/56
Wind offshore	0	17	0	0	8.0/12/35
Pre-commercial Technologies					
CCS—Coal—Oxyfuel	14/76/110	17	0	67	100/160/200
CCS—Coal—PC	95/120/140	28	0	68	190/220/250
CCS—Coal—IGCC	100/120/150	9.9	0	62	170/200/230
CCS—Gas—Combined Cycle	30/57/98	8.9	0	110	94/170/340
Ocean	0	17	0	0	5.6/17/28

Figure 1: Emissions of selected electricity supply technologies in gCo₂eq/kWh. [2]

Reductions of this magnitude are larger than the emissions from all current coal fired power plants worldwide and more than China’s total emissions in 2014. Furthermore, ocean-based mitigation options could reduce the “emissions gap” (the difference between emissions expected if current trends and policies continue and emissions consistent with limiting global temperature increase) by up to 21% on a 1.5°C pathway, and by about 25% on a 2.0°C pathway, by 2050.

Calwave recognizes that the ocean is an untapped source of potential solutions and innovation. Our proprietary technology has been designed to deploy rapid actions reducing greenhouse gas emissions and in turn, help limit changes in the ocean ecosystem. Calwave works to halt the rapid decline in global ice mass and preserve ecosystems and livelihoods that depend on them.

Oceans absorb about 30% of the carbon dioxide produced by humans [4]

PROTECTING MARINE ECOSYSTEMS THROUGH DESIGN

Knowing that our oceans drive the global systems that make Earth habitable for living forces, Calwave's technology protects marine and coastal ecosystems through our intentional design and functionality. Calwave's devices are slow moving buoys reducing the risk for collisions with marine animals.

REVERSING OCEAN ACIDIFICATION

Oceans absorb about 30% of the carbon dioxide produced by humans, buffering the impacts of climate change. However, this process results in ocean acidification (~26% increase since the industrial revolution) and is destroying marine and coastal ecosystems. By ethically tapping into the power of our oceans for energy production, we can reduce the impact of climate change and in turn, reverse the harms of ocean acidification.

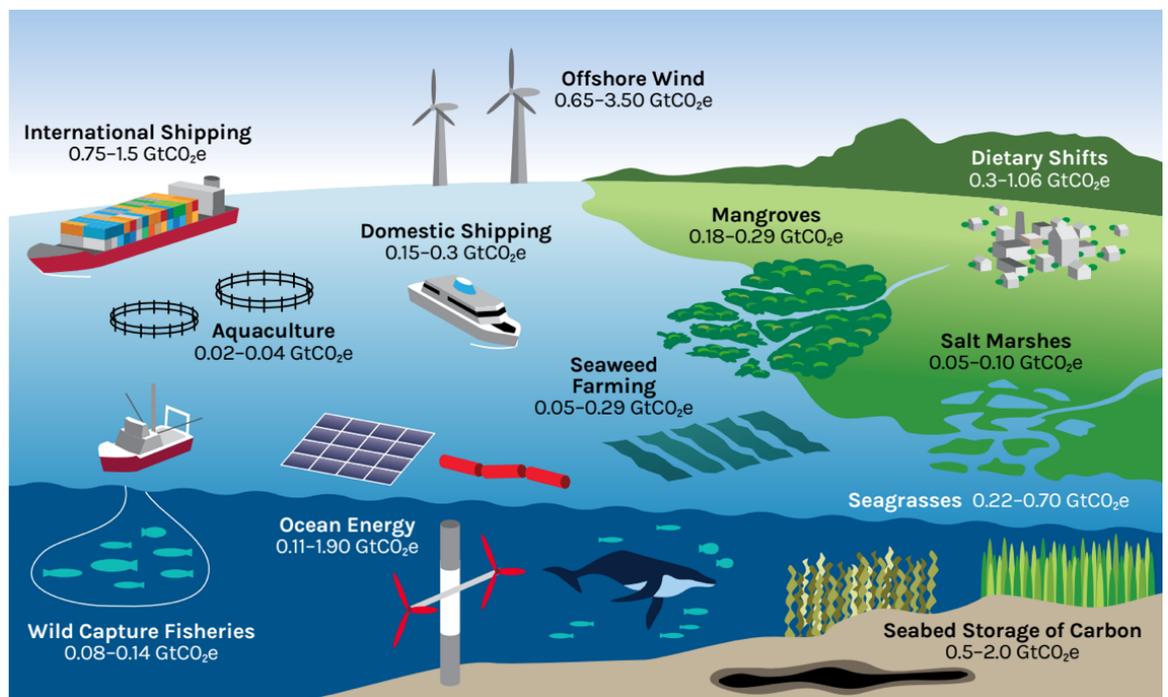


Figure 2: Ocean-based Mitigation Options Explored in This Report and Associated Annual Mitigation Potential in 2050. [4]

SOCIAL IMPACT

Coastal communities are especially vulnerable to poor electrification.

COMMUNITIES NEED ANOTHER OPTION

Calwave is fully committed to improving the lives of the communities that we serve.

We recognize that about 40% of the world's population lives within 100km from the coast and island communities account for 11% of the world's total population [5]. Today, one in seven people are without access to electricity and rural coastal communities are especially vulnerable to poor electrification, environmental degradation, rising sea levels, and health challenges. Over 90% of power on islands is generated through imported fossil fuels, which creates a huge burden on developing economies and the environment. As global migration continues to place pressure on coastal territories, Calwave believes that pursuing our mission means prioritizing efforts to ensure the resiliency, security, and sustainability of these regions and human settlements.

SUPPORTING SUSTAINABLE INFRASTRUCTURE AND ECONOMIC GROWTH

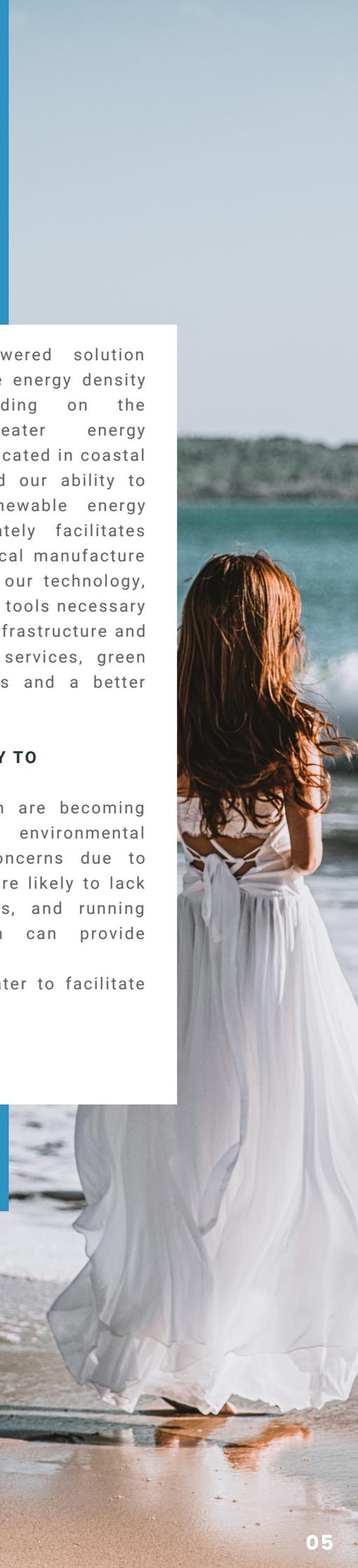
Calwave recognizes that the urgent need for low-carbon energy sources is likely to create economic opportunities for the ocean energy

sector [6]. Our ocean-powered solution produces an annual average energy density of 20-60 kW/m depending on the location, providing greater energy accessibility for end users located in coastal cities and communities and our ability to generate decentralized renewable energy from ocean waves ultimately facilitates lower overhead costs for local manufacture and infrastructure. Through our technology, we equip our clients with the tools necessary for supporting sustainable infrastructure and providing access to basic services, green and good paying local jobs and a better quality of life for all.

CONVERTING OCEAN ENERGY TO FRESHWATER

Coastal communities, which are becoming increasingly threatened by environmental degradation and health concerns due to climate change, are also more likely to lack access to electricity, roads, and running water. CalWave's solution can provide process power in the form of pressurized salt water to facilitate sustainable desalination.

⁵ www.un.org ⁶ www.etipocean.eu



SUMMARY

- **One in seven people on the planet are without access to electricity** - rural coastal communities are especially vulnerable to poor electrification, environmental degradation, rising sea levels, and health challenges.
- **About 40% of the world's population lives within 100km from the coast.** Island communities account for 11% of the world's total population (730 million people).
- **Over 90% of power on islands is generated through imported fossil fuels,** which creates a huge burden on developing economies and the environment.
- **Several governments are transitioning to 100% clean energy.** For example, California passed SB 100 in 2018, which will mandate 100% clean, carbon-free energy by 2045, including a 60% renewable electricity goal by 2030.
- **Non-renewable fuels, which include coal, oil, and natural gas, currently supply about 80% of the world's energy.**
- **Over the past 10 years, the energy sector has contributed to more greenhouse gas (GHG) emissions than any other sector on the planet, accounting for 73% of global emissions in 2016.**
- **Forecasts show that ocean energy can reduce/sequester 1.38 gigaton CO2 equivalent,** Calwave is working to unleash the power of this untapped resource.
- **Coastal communities are experiencing the cumulative burden of environmental stress** from coastal activities, overcrowding, and from upstream and inland development.
- **Ocean wave power is 20-60 times more energy dense,** predictable, and consistent than wind or solar by hour-to-hour output.
- **Wave power has the technical potential to sustainably provide 30% of the world's power.**
- **Oceans absorb about 30% of the carbon dioxide produced by humans,** buffering the impacts of climate change. However, this process which results in ocean acidification (~26% increase since the industrial revolution), is destroying marine and coastal ecosystems.
- **"Deleterious effects of climate change are already affecting many marine and coastal resources,** and will continue to affect the health, reproduction capabilities, and biodiversity of populations of fish, shellfish, marine mammals, and birds, and other living organisms." - Annex IV
- **More than 3 billion people depend on marine and coastal biodiversity for their livelihoods.**
- **"Investments in infrastructure are crucial to achieving sustainable development and empowering communities throughout the world.** It has long been recognized that growth in productivity and incomes, and improvements in health and education outcomes require investment in infrastructure." - UN SDG
- **"Manufacturing is an important driver of economic development and employment.** At the current time, however, manufacturing value added per capita is only US\$100 in the least developed countries compared to over US\$4,500 in Europe and Northern America. Another important factor to consider is the emission of Carbon Dioxide during manufacturing processes. Emissions have decreased over the past decade in many countries but the pace of decline has not been even around the world." - UN Sustainable Development Goals
- **"Technological progress is the foundation of efforts to achieve environmental objectives,** such as increased resource and energy-efficiency. Without technology and innovation, industrialization will not happen, and without industrialization, development will not happen." - UN Sustainable Development Goals

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www.CalWave.energy