

PRDD CO₂ CAPTURE & REPURPOSE PROCESS

- PRESENTED BY:
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- Richard Feely Ph.D.
- Nina Bednarsek Ph.D.
- Chris Langdon Ph.D.
- Laura Nuzzo MS
- Anders Skibdal

What if I told you there was a
process
that could return more than
three times the award to you,
and capture 60,000 tons of
CO₂/year
from the paid for full scale
project?

PRDD is that grantee,
let me show you how this claim
is true.

PRDD GAS SCRUBBING EXPERTISE

CONCEPT TO FINISHED PRODUCT



Patented technologies -
Proven methodology:

- CO₂
- NO_x
- Sulfur compounds
- Indoor air
- And more



Time is of the essence to prevent 1.5°C temperature rise threshold for a repeat extinction catastrophe



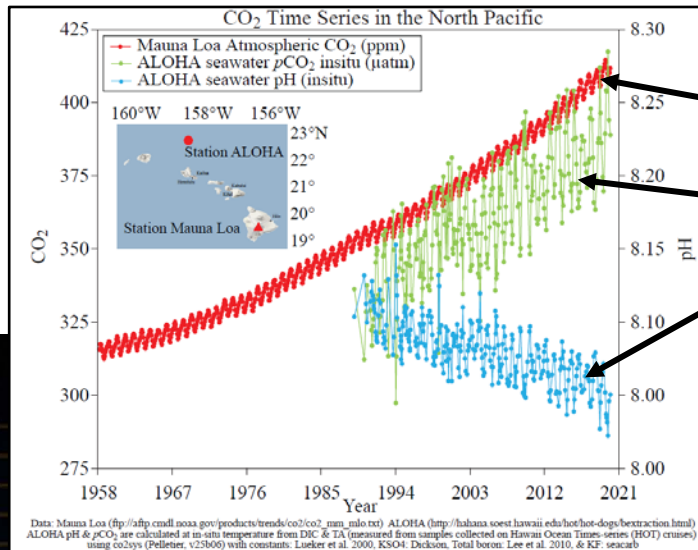
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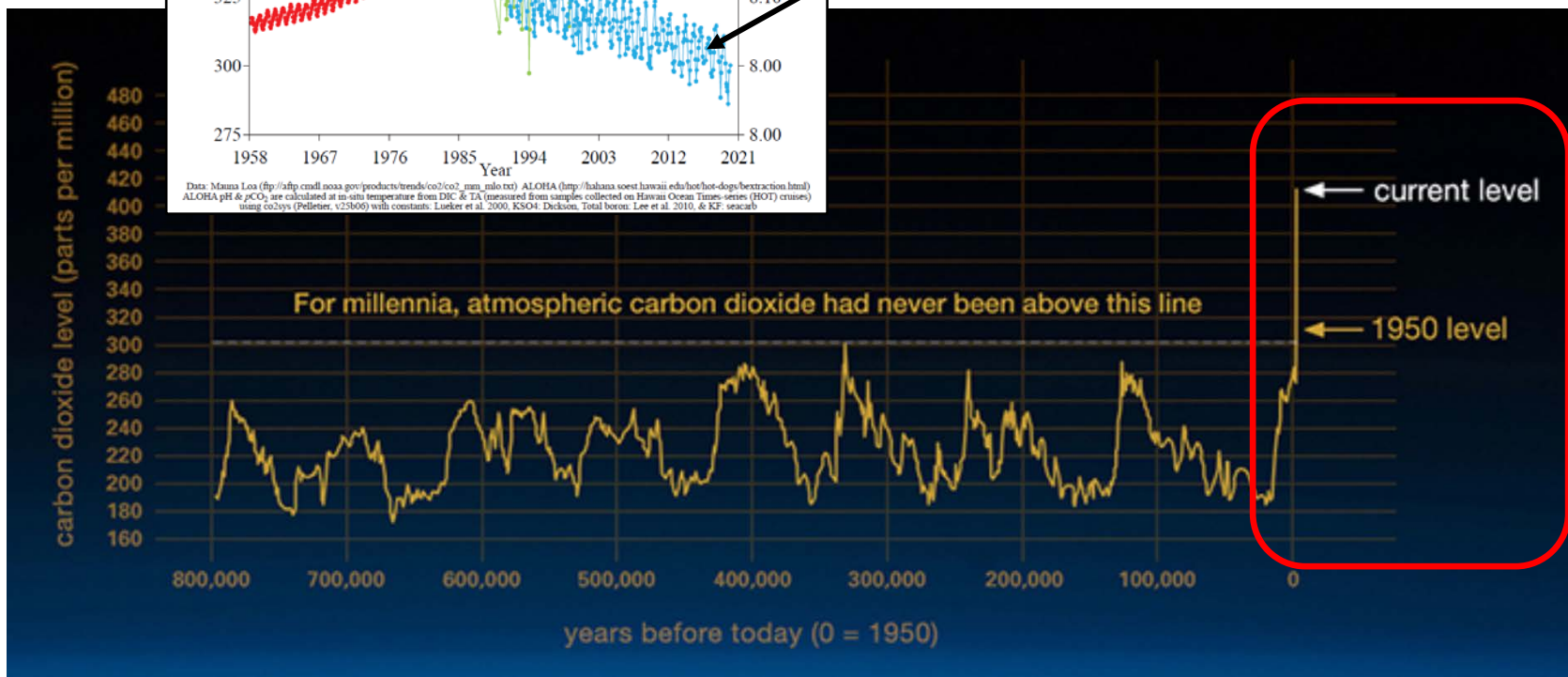
PRDD TAKES THIS DEADLINE SERIOUSLY. IN LESS THAN A SINGLE YEAR, PRDD HAS DEVELOPED THE CO₂ CAPTURE TECHNOLOGY, FILED FOR PATENT, BUILT A POWERFUL TEAM THAT IS PROACTIVELY TAKING ACTION EVEN BEFORE EXTERNAL FUNDING IS AVAILABLE.

AT PRDD: THE CO₂ PROBLEM BECOMES THE OCEANS SOLUTION

These charts from NOAA confirm oceans and atmosphere are showing the impacts of anthropogenic CO₂ emissions.



KEY:
 As CO₂ increases in the air,
 CO₂ also increases in the sea, and
 Decreased pH causes increased acidity.



COMMERCIAL VALUE OF PRDD CO₂ TECHNOLOGY

Applicable for developed & underdeveloped countries

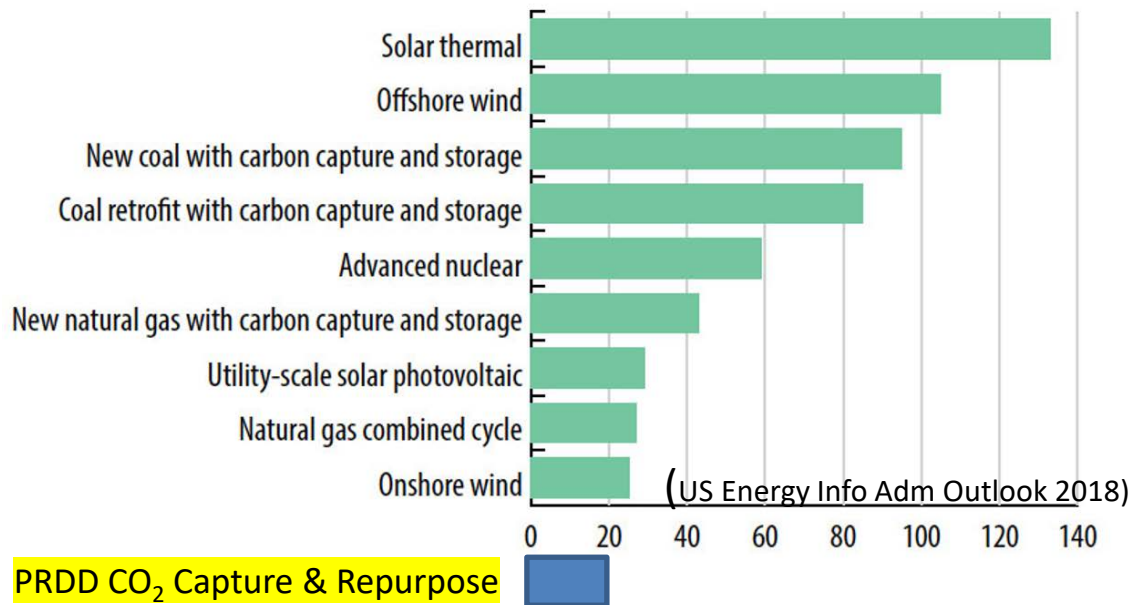
EQUIPMENT & OPERATING COSTS

At \$20.75/ ton of carbon captured, PRDD probably has the lowest cost renewable energy solution

Comparing costs

Renewable-energy technologies are among the least costly relative to existing coal generation.

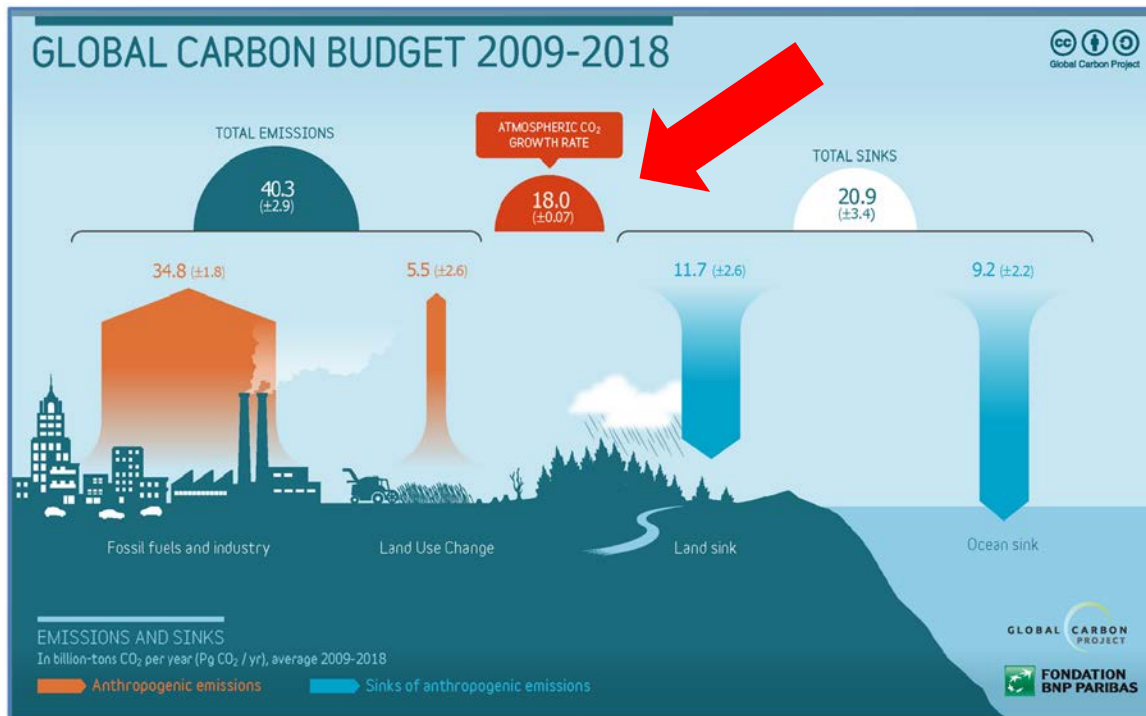
(Dollars per ton of carbon dioxide, in 2017 dollars)



The PRDD CO₂ Capture & Repurpose process is well below the industry average \$100-\$200/Ton CO₂ cost of other CO₂ capture technologies.

PRDD CO₂ CAPTURE & REPURPOSE TECHNOLOGY EQUIPMENT VALUE

The world adds approximately 18 billion tons CO₂ to the atmosphere per year.



**PRDD EQUIPMENT
COST TO TREAT 25%
OF THE
18 BILLION TONS OF
CO₂
AT \$20.75/TON IS**

\$93.38 BILLION

INCOME FROM
SEQUESTERING
CAPTURED CO₂ INTO
CONCRETE
USING A PRDD PROCESS

The world made 1,600,000,000
metric tons of concrete in 2000

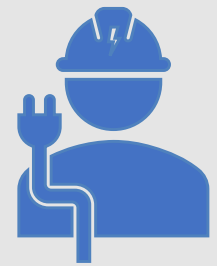
IF 25% USED THIS PROCESS
AT A ROYALTY COST OF
\$0.05/TON IT WOULD EARN

\$20,000,000.00/YEAR



PRDD PROCESS
INTEGRATES CO₂
& CARBONATE MADE
FROM CAPTURED CO₂
TO MAKE A STRONGER
& MORE CARBON
NEUTRAL PRODUCT

INCOME FROM OPERATING PRDD CO₂ CAPTURE & REPURPOSE EQUIPMENT



CALIFORNIA LEADS THE WORLD IN INCENTIVES FOR CAPTURING CO₂

THE NEW WORLD AWARENESS OF THE NEED FOR CLIMATE CHANGE SOLUTIONS
IS EXPECTED TO RESULT IN OTHERS FOLLOWING CALIFORNIA'S EXAMPLE

1ST CLIENT RESIDUAL INCOME EXAMPLE

Federal Tax and CARB Credit Value for CO₂ from 3 small oilfield steam generators (photo to right) at California facility.



Year Count	Year	CO2e MT/Year	Fed 45Q Tax Credit \$/MT	Fed 45Q Tax Credit Amount	CARB LCFS CO2 Credit \$/MT	CARB LCFS CO2 Credit Value	Total Value of Credits
1	2021	60000	\$ 34.81	\$ 2,088,600.00	\$195.00	\$ 11,700,000.00	\$ 13,788,600.00
2	2022	60000	\$ 37.85	\$ 2,271,000.00	\$195.00	\$ 11,700,000.00	\$ 13,971,000.00
3	2023	60000	\$ 40.89	\$ 2,453,400.00	\$195.00	\$ 11,700,000.00	\$ 14,153,400.00
4	2024	60000	\$ 43.92	\$ 2,635,200.00	\$195.00	\$ 11,700,000.00	\$ 14,335,200.00
5	2025	60000	\$ 46.96	\$ 2,817,600.00	\$195.00	\$ 11,700,000.00	\$ 14,517,600.00
6	2026	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
7	2027	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
8	2028	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
9	2029	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
10	2030	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
11	2031	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
12	2032	60000	\$ 50.00	\$ 3,000,000.00	\$195.00	\$ 11,700,000.00	\$ 14,700,000.00
			TOTAL	\$ 33,265,800.00	TOTAL	\$140,400,000.00	\$173,665,800.00

12 YEAR INCOME ←

CO2e ton/yr based on 3 Steam Generators operating at 50% load (actual historical operation)

Fed 45Q Tax Credits available for 12-year period from start of project. Project must commence by 2023.

CARB LCFS Credit of \$195.00/MT based on current market value in May 2020. Value will likely increase.



Client Project Budget & Return on Investment

ANNUAL INCOME FROM USE OF PRDD CO₂ CAPTURE & REPURPOSE TECHNOLOGY	
2021 CARB LCFS CREDITS FOR CO ₂ (BASED ON \$195.00/met.ton)*	\$ 11,700,000.00
2021 FED. 45Q TAX CREDIT (BASED ON \$34.81/met. ton)	\$ 2,088,600.00
(*) Currently only available in California	
TOTAL 2021 CREDIT VALUE	\$ 13,788,600.00
100% CAPITAL EXPENSES FOR PRDD CO₂ CAPTURE & REPURPOSE TECHNOLOGY	
EST. COST OF CO ₂ CAPTURE & REPURPOSE EQUIP.	\$ 1,095,000.00
EST. COST OF SITE PREPARATION, INSTALLATION & ONSITE MTLs HANDLING EQUIPMENT	\$ 3,500,000.00
ONE TIME COMMERCIALIZATION COST OF PRDD CO ₂ CAPTURE & REPURPOSE PROCESS	\$ 6,030,000.00
TOTAL COMMERCIALIZATION COST, EQUIPMENT COST & INSTALLATION COSTS	\$ 10,625,000.00
ANNUAL OPERATING COSTS	
CONSUMABLE CHEMICAL (BRINE) PUMPED FROM AQUIFUR	\$ -
POWER AT CA COMMERCIAL RATE	\$ 1,570,000.00
MAINTANCE	\$ 200,000.00
TOTAL OPERATING COSTS	\$ 1,770,000.00
TOTAL CAPITOL AND OPERATING COSTS	\$ 12,395,000.00
BALANCE	\$ 1,393,600.00
FIRST YEAR RETURN ON INVESTMENT	110%

The process has an ROI of 110% despite a one-time development & capitalization cost and all equipment & operating costs.

The PRDD CO₂ Capture & Repurpose process is Carbon Negative if renewable energy is used.

EXPANDED TIMESCALE FOR CASH FLOW OF THE JOB DESCRIBED ABOVE, WITH ADDED DEVELOPMENT AND COMMERCIALIZATION COSTS.

ALL COSTS FOR PROCESS DEVELOPMENT, EQUIPMENT & 2 YEARS OPERATION FOR 1ST PRDD PROJECT.

COMMERCIALIZATION OF TECH. TO MAKE PROCESS CONSUMABLE FROM TABLE SALT (SEAWATER)

COMMERCIALIZING CO₂/CARBONATE CONCRETE AND FIRST PART OF OCEAN ACIDIFICATION REDUCTION RESEARCH

THE INCOME IS PREDICTABLE
IT IS DERIVED FROM GOV. POLICY
NOT PERSONAL WHIM, FOR EXAMPLE:
WHICH RESTAURANT TO CHOOSE FOR LUNCH.

PROFIT IS 3.3X THE TOTAL GRANT INVESTMENT

12 YEAR CASHFLOW PROJECTION (JOB #1)	
INCOME	
(US\$)	
INCOME 12 YEARS JOB #1 (SEE FIGURE 2)	\$ 173,665,800.00
EXPENSES	
ONE TIME EXPENSES REQUIRED TO START INCOME	
COMMERCIALIZATION OF PRDD CO2 CAPTURE & REPURPOSE TECH	\$ 6,030,000.00
FULL SCALE EQUIPMENT & INSTALLATION CURRENT CO ₂ CAPTURE CLIENT	\$ 4,595,000.00
FIRST CLIENT SITE OPERATIONAL COSTS FOR 2 YEARS	\$ 3,540,000.00
SUBTOTAL	\$ 14,165,000.00
ONE TIME EXPENSES THAT REDUCE OPERATING COST	
COMMERCIALIZATION OF NO-MEMBRANE ELECTROCHEMICAL PRODUCTION OF NaOH FROM NaCl	\$ 7,500,000.00
SUBTOTAL	\$ 7,500,000.00
ONE TIME COSTS THAT SEQUESTER BYPRODUCTS	
FIRST OF THREE STEPS IN THE OPTIMIZATION OF TECHNOLOGY TO TREAT OCEAN ACIDITY WITH BYPRODUCTS OF THE PRDD CO ₂ CAPTURE & REPURPOSE TECHNOLOGY	\$ 2,450,000.00
COMMERCIALIZATION OF PRDD CO ₂ & CARBONATE IMPREGNATED CONCRETE PROCESS	\$ 3,345,000.00
SUBTOTAL	\$ 5,795,000.00
TOTAL	\$ 27,460,000.00
ANNUAL RECURING COSTS	
POWER (COMMERCIAL RATE)	\$ 1,570,000.00
SITE MAINTENANCE	\$ 200,000.00
SERVICE CONTRACT & ROYALTY	\$ 1,400,000.00
SITE LEASE (APPROXIMATE)	\$ 1,400,000.00
ANNUAL SUB TOTAL	\$ 4,570,000.00
12 YEAR SUB TOTAL	\$ 54,840,000.00
TOTAL EXPENSES	\$ 82,300,000.00
12 YEAR PROFIT	\$ 91,365,800.00

ENVIRONMENTAL STEWARDSHIP AND ADDITIONAL PROFIT

The byproduct of PRDD's CO₂ Capture & Repurpose process: sodium carbonate and sodium bicarbonate (baking soda) has many beneficial uses including treating ocean acidification.

The work with NOAA is paving the way for world recognized control of ocean acidification caused by CO₂ from the atmosphere with byproducts from PRDD's CO₂ Capture and Repurpose process. **THE PROBLEM BECOMES THE SOLUTION!**

US tax code allows a tax donation at full appraised value for the baking soda.

Based on PRDD's First CO₂ client data, the annual tax deduction could be:

\$26,400,000.00



PATH FORWARD

1.

COMMERCIALIZATION
OF THE PRDD CO₂
CAPTURE & REPURPOSE
PROCESS

2.

OPTIMIZED DOSING OF
CARBONATE &
BICARBONATE INTO THE
SEA

3.

COMMERCIALIZE CO₂
INTEGRATED CONCRETE

**PRDD INVENTED THE BEST AVAILABLE
CO₂ CAPTURE & REPURPOSE TECHNOLOGY
AND IS NOW ACTIVELY BRINGING
THE SOLUTION TO MARKET THROUGH
THREE INTEGRATED PATHS.**

**A PROJECT OF THIS SIZE REQUIRES
COLLABORATION, SO WE BRING TOGETHER
THE BEST IN:**

- SCIENCE
- TECHNOLOGY
- BUSINESS & FUNDING
- DEPLOYMENT & USE AROUND THE WORLD

**TOGETHER WE TURN THE PROBLEM
INTO A SOLUTION**



1. PRDD PROCESS COMMERCIALIZATION

Take the patent pending PRDD CO₂ Capture and Repurpose process through:

- Lab pilot scale and then to
- Field commercial scale performance confirmation.



LABORATORY
PILOT SCALE
PROCESS
DEVELOPMENT

COMMERCIAL
SCALE PROCESS
PERFORMANCE
CONFIRMATION
AT PRDD'S FIRST
FULL SCALE
CLIENT'S SITE IN
CALIFORNIA

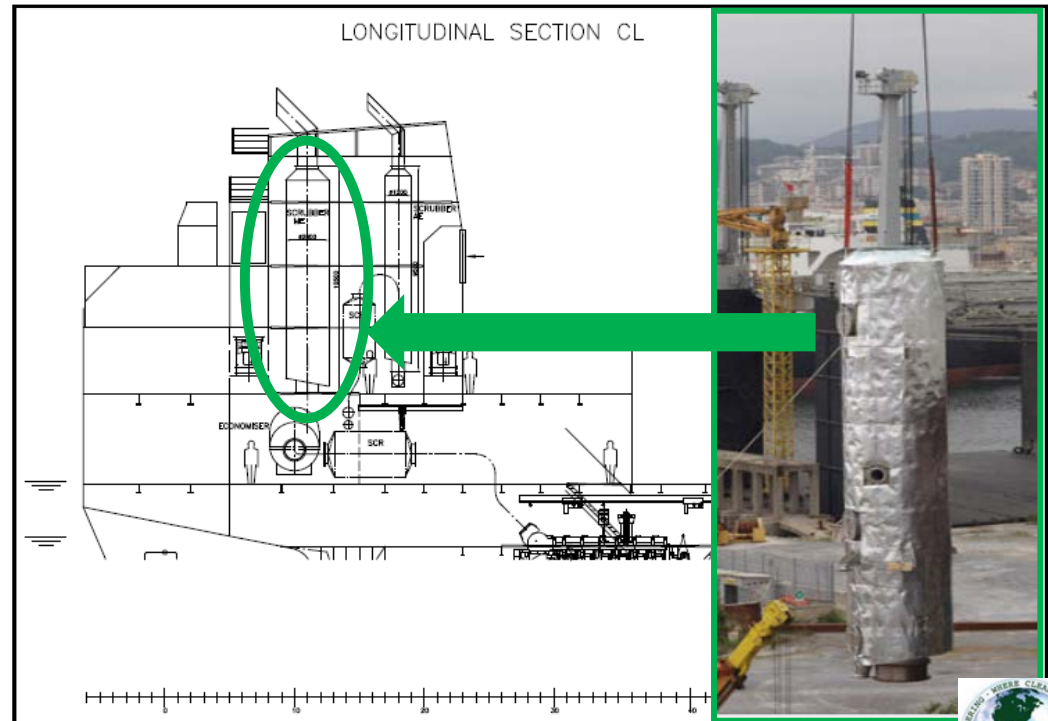


PRDD AND PURETEQ ARE COLLABORATING ON SCRUBBER DESIGN

PROCESS DEVELOPMENT TO MAXIMIZE EFFICIENCY AND MINIMIZE SIZE

- Just a simple tube, that is small enough to be used on a ship with no need for bypass ducting or catalyst or packing.
- When combined with PRDD chemistry it delivers the best available technology for CO₂, NOx or SOx removal from exhaust gas.
- The byproducts from CO₂ scrubbing reduces ocean acidification and more.
- The support equipment for NOx scrubbing can also be used to clean ballast water, indoor air, waste-water, drinking water etc. to save cost & space.

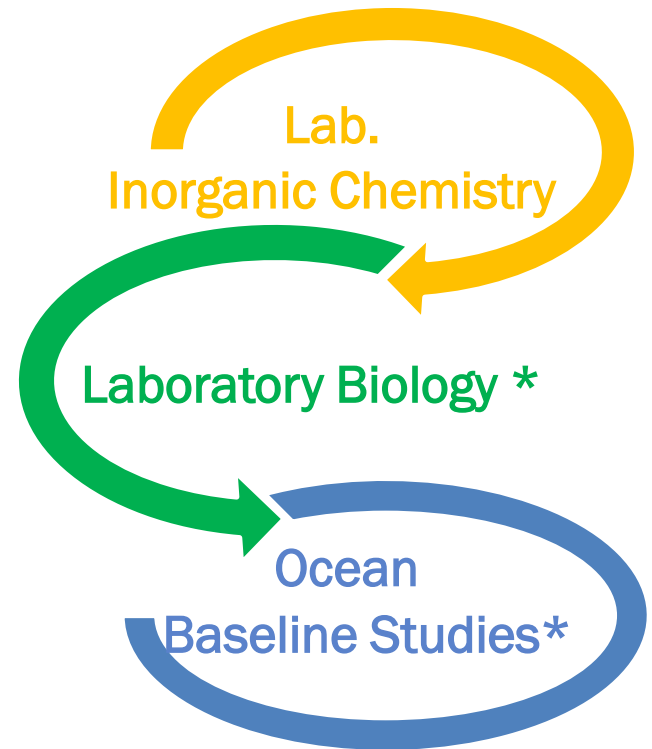
An international team with results for
LAND AND SHIP APPLICATIONS



2. OPTIMIZED DOSING OF CARBONATE & BICARBONATE INTO THE OCEAN

A TEAM OF SCIENTISTS ARE PLANNING COLLABORATION ON CARBONATE/BICARBONATE DOSING STUDIES INTENDED TO IDENTIFY THE OPTIMUM NATURAL METHOD TO REGULATE OCEAN ACIDIFICATION & ENHANCE POSITIVE RESPONSE IN VULNERABLE MARINE COMMUNITIES.

THREE STEPS



NOTE (*) = NOT INCLUDED IN THIS FUNDING REQUEST

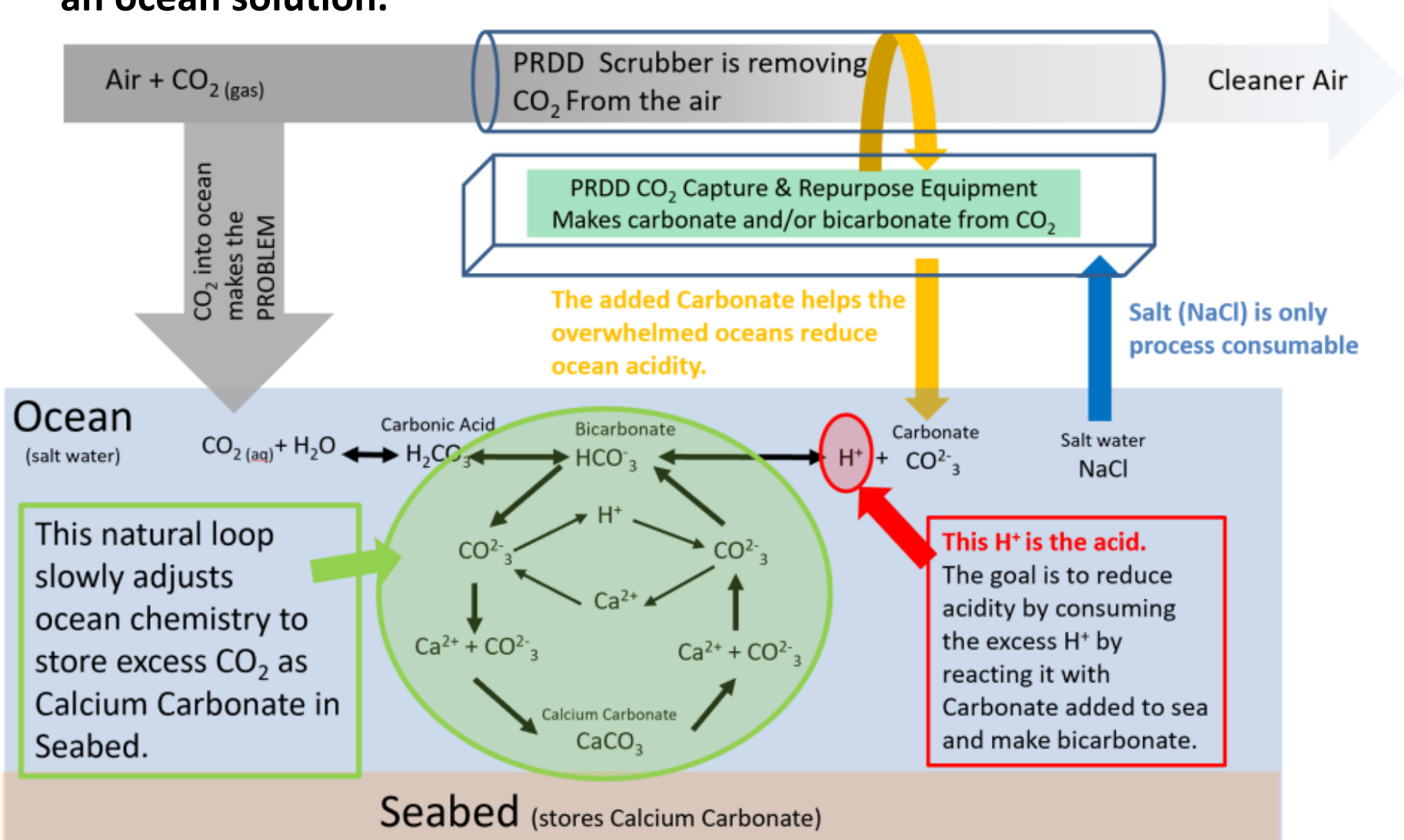
ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE

PACIFIC RIM
DESIGN & DEVELOPMENT INC.
MISSION: CLEAN AIR

ENVIRONMENTAL LABORATORY



Today's oceans are overwhelmed with excess CO_2 from air
Fortunately, the PRDD technology turns the air's CO_2 problem into an ocean solution.



3. SEQUESTERING CAPTURED CO₂ INTO CONCRETE USING A PRDD PROCESS

COMMERCIALIZATION SEQUENCE

- Pilot scale process development in PRDD laboratory.
- Field test & further develop process.
- License to full scale system manufacturer



PRDD PROCESS
INTEGRATES CO₂
& CARBONATE MADE
FROM CAPTURED CO₂
TO MAKE A STRONGER
& MORE CARBON
NEUTRAL PRODUCT

CAPTURE CO₂ FROM LAND & SEA SOURCES

PRDD IS REWRITING THE FUTURE ON HOW AIR IS CLEANED

Large Power Plants



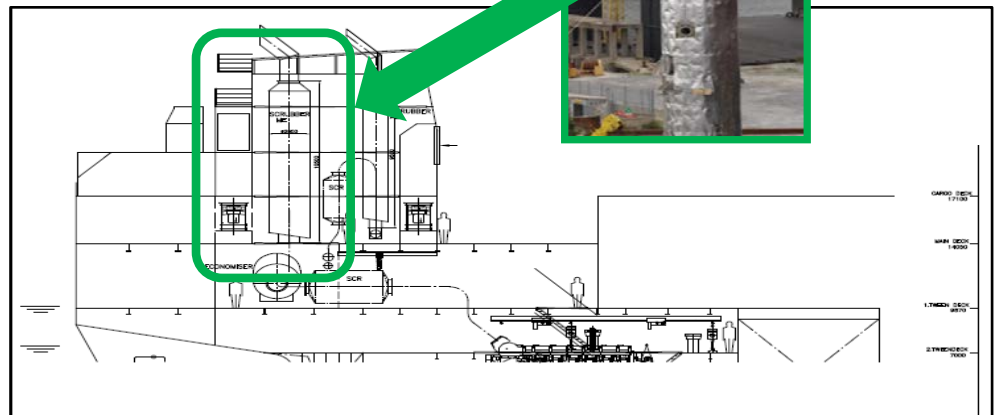
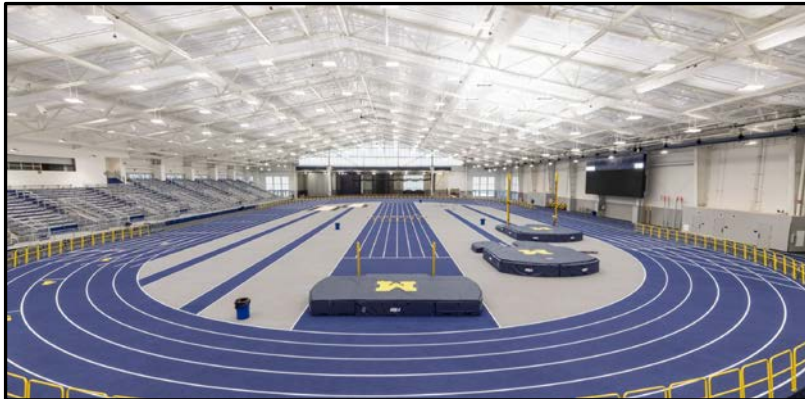
Small Steam Generators



Ship Exhaust



Indoor Air Recycle



PRDD CO₂ PROCESS IS VERY SCALABLE & BROADLY APPLICABLE

- Applicable to any size boiler, or other combustion exhaust. Also applies to chemical processes.
- Reactions occur in ducting that can be oriented in any direction, as equipment has small physical footprint.
- PRDD has developed integrated pretreatment for gas streams with CO₂, NO_x, SO_x, VOC, sulfur compounds and more.
- All of the processes can create their own consumables from salt water and recycle all other process chemicals using waste heat – **CARBON NEGATIVE PROCESSES**
- Biproducts from the CO₂ process reverse human impacts on the ocean's health.



TEAM

- **Robert Richardson Ph.D. (CEO @ PRDD) Team leader**



Robert's specialty is finding solutions for air treatment challenges when conventional solutions are lacking. Many of the solutions have become patents and all of them are environmentally responsible. Most of the processes convert the problem into commercially viable byproducts and all of them have low or negative carbon footprints. Robert (also a contractor) adroitly commercializes newly developed processes.

- **Richard Feely Ph.D. (Senior Scientist Pacific Marine Environmental Lab)**



Senior scientist at Pacific Marine Environmental Laboratory
Dr. Feely's research over the last four decades has been deeply involved with ocean acidification across global, regional and local scales. He is an internationally acclaimed scientist with a deep understanding of the carbonate chemistry system, observational needs, and modelling.

- **Nina Bednarsek Ph.D (Principal Investigator)**



Dr. Bednarsek's research links the chemistry changes due to ocean acidification with the biological responses on the ecologically and economically important calcifying organisms, including crabs, pteropods, mussels, oysters, etc. She conducts experimental studies with observational and modelling approaches to assess the current and future status of ocean health.

- **Chris Langdon Ph.D. (Professor Marine Biology & Ecology – RSMAS, University of Miami)**



Dr. Langdon studies the biology and ecology of corals with an emphasis on their responses to ocean warming and acidification. Dr. Langdon's research* has already confirmed that the addition of sodium carbonate and sodium bicarbonates to seawater in concentrations that simulated pre-industrial age ocean chemistry caused 100% increase in coral growth.

Note (*) = This research confirms the planned ocean enhancement through similar dosing of the same biproducts from the PRDD CO₂ Capture & Repurpose technology has value.

- **Laura Nuzzo MS (President, Nuzzo Environmental)**



Ms. Nuzzo is a highly experienced air quality professional with over 28 years in the environmental field. As owner of Nuzzo Environmental, her current expertise lies in assisting clients to meet unique regulatory challenges where both innovative technology and creative compliance strategies are necessary to achieve smart business solutions in California's complex regulatory environment.

Anders Skibdal (CEO PureteQ)



Mr. Skibdal is an extensively experienced, robust and hands-on CEO of a firm that specializes in the development of gas scrubbing technology for marine and terrestrial applications. His solid business acumen and understanding of economics resulted in P&L greater than \$65 million per year.

PureteQ is now collaborating with PRDD on CO₂ scrubber technology design.

PRDD's fast moving
project
is the inevitable
technology for CO₂
capture and repurpose to
treat climate change,
reverse ocean
acidification and improve
concrete for our planet.

THANK YOU



PACIFIC RIM
DESIGN & DEVELOPMENT INC.
MISSION: CLEAN AIR

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