DLZ
www.dlz.com

# DLZ'S HYDROGEN PROJECTS

2024 Ohio Fuel Cell and Hydrogen Symposium

LET'S GET STARTED

# Ram Rajadhyaksha PE

Executive Vice President/Equity Partner

Contact: ramr@dlz.com
Phone: (614) 987-0286

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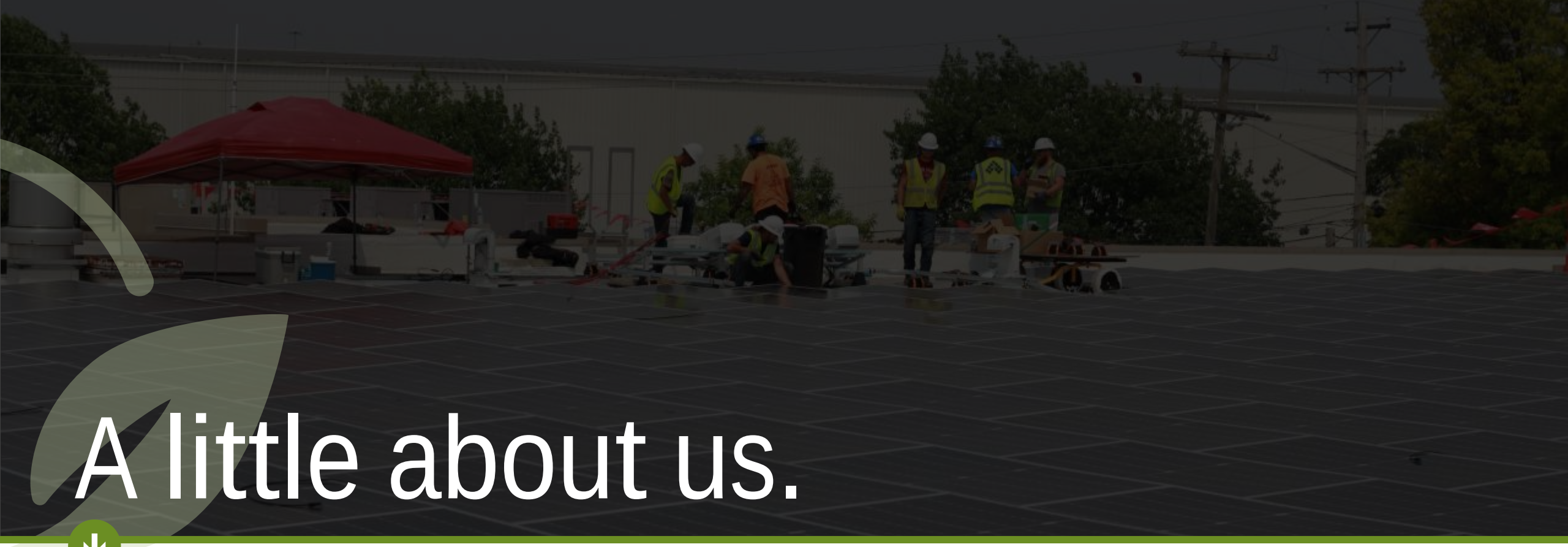
# Bruce Bauchmire

Director Renewable Energy Services

Contact: bbauchmire@dlz.com
Phone: (614) 987-0203



# A little about us.

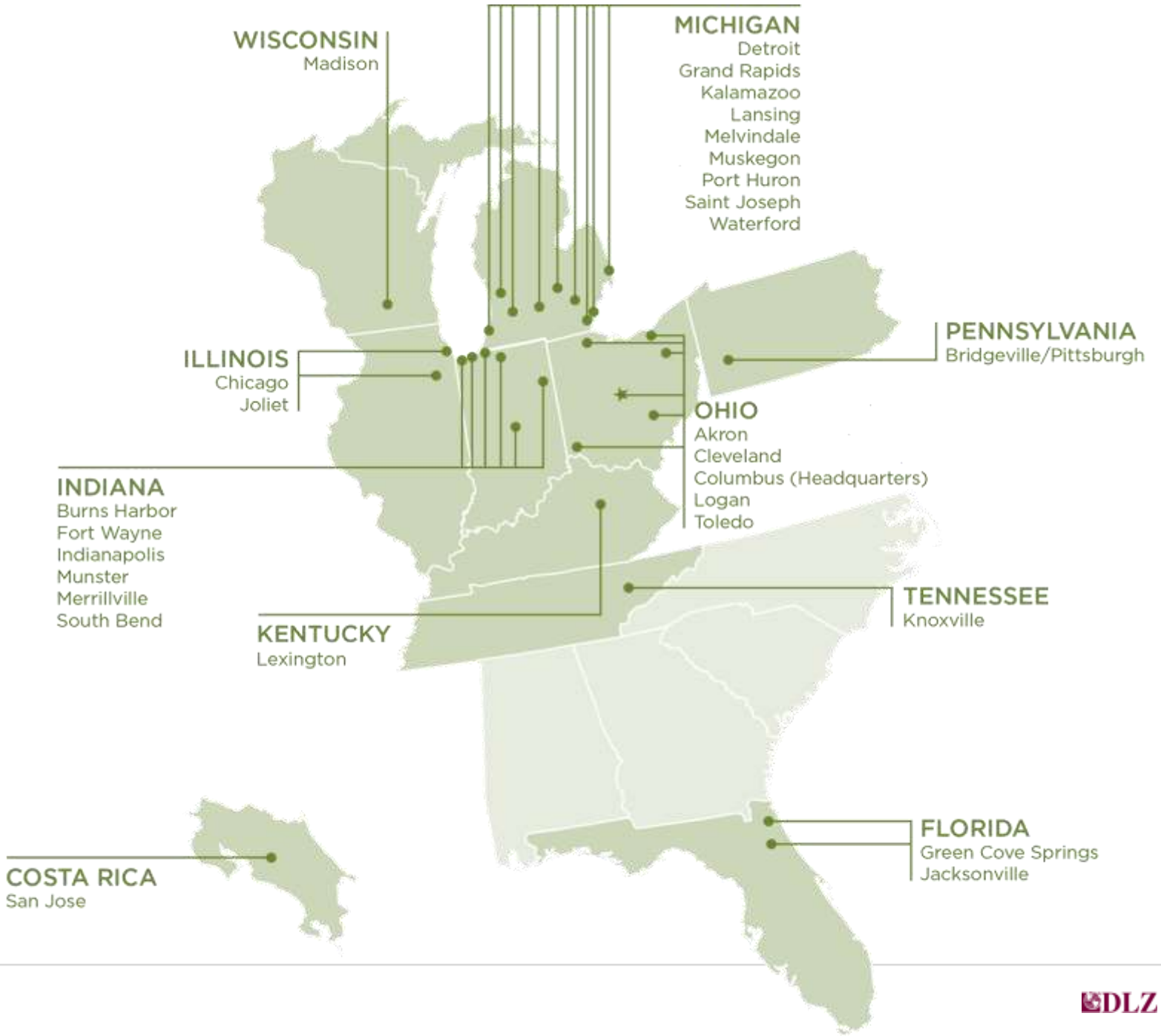
## DLZ is an architecture, engineering, and construction (a/e/c) services firm.

Headquartered in Ohio, DLZ is an award-winning professional services firm providing architecture, engineering, surveying, environmental and construction services.

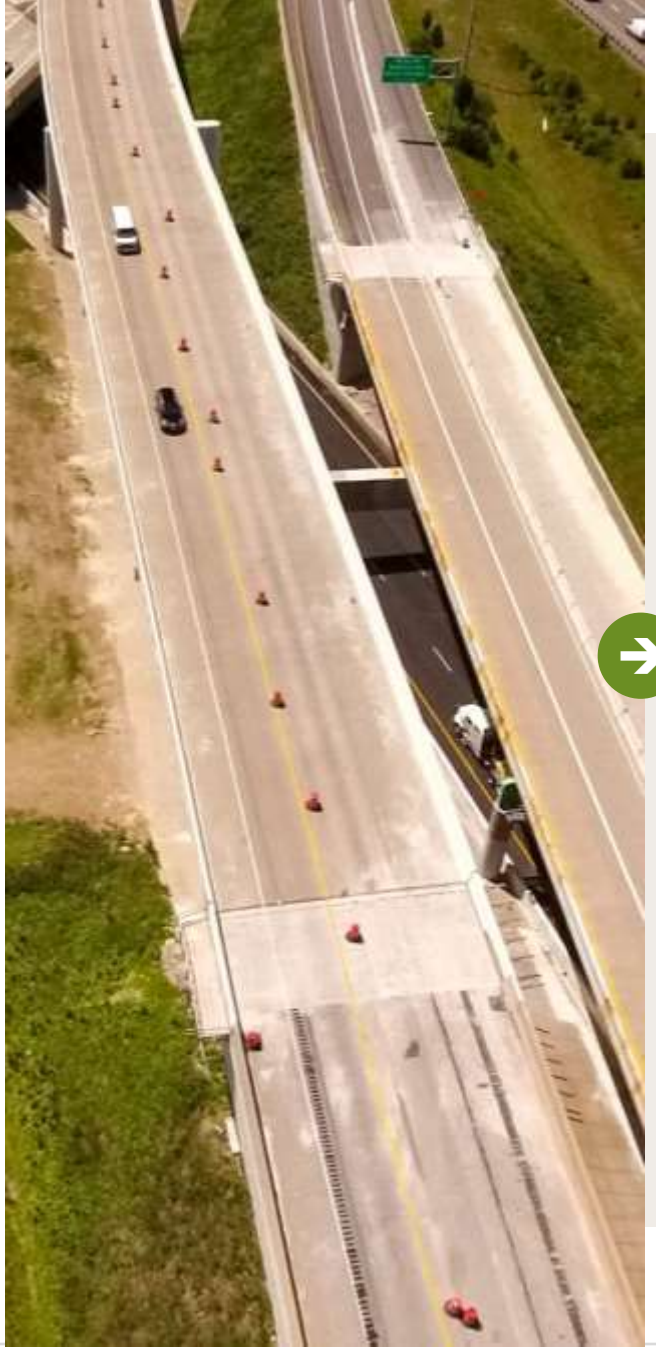
# Our Services.

- Transportation Design
- Water/ Wastewater
- Industrial Engineering
- Construction Services
- Clean Energy
- Architecture
- Survey
- Drilling

# Where we are.


WISCONSIN
Madison
MICHIGAN
Detroit
Grand Rapids
Kalamazoo
Lansing
Melvindale
Muskegon
Port Huron
Saint Joseph
Waterford
PENNSYLVANIA
Bridgeville/Pittsburgh
ILLINOIS
Chicago
Joliet
OHIO
Akron
Cleveland
Columbus (Headquarters)
Logan
Toledo
INDIANA
Burns Harbor
Fort Wayne
Indianapolis
Munster
Merrillville
South Bend
TENNESSEE
Knoxville
KENTUCKY
Lexington
FLORIDA
Green Cove Springs
Jacksonville
COSTA RICA
San Jose

# Local Projects

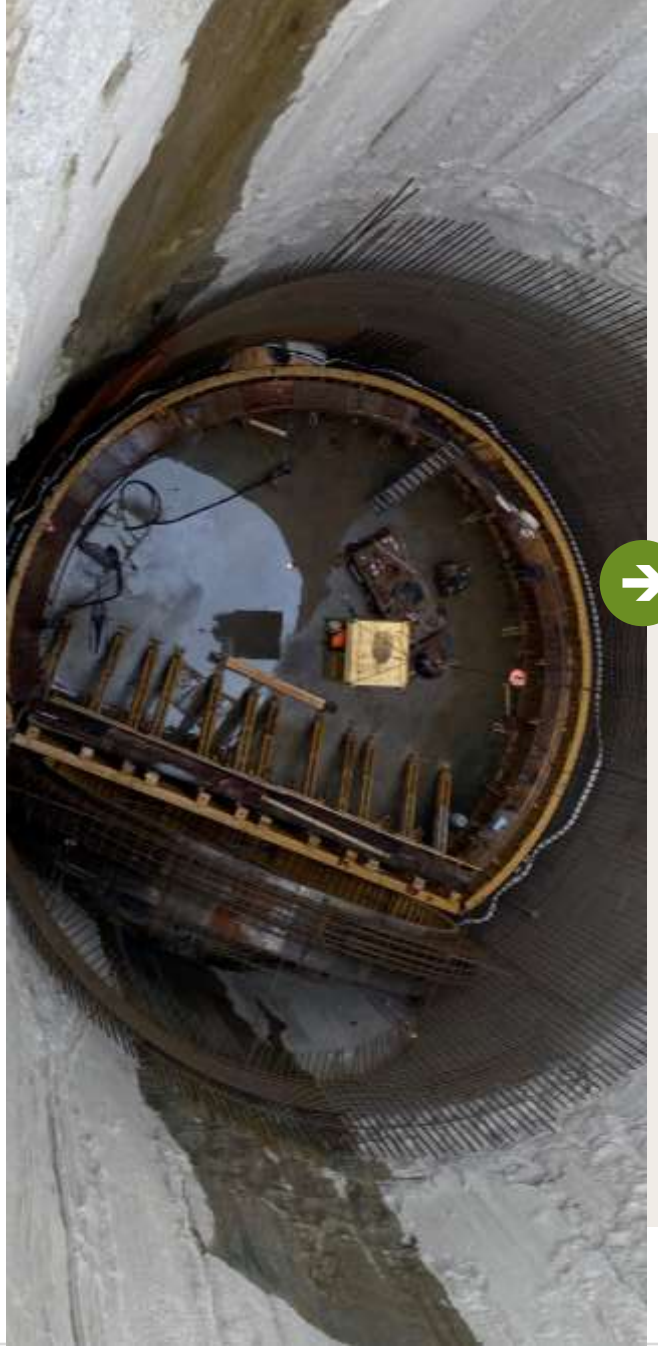


# I-271 Lane Addition Project

**Ohio Department of Transportation**
**District 12**
Cuyahoga/Summit Counties, Ohio



DLZ



# Shoreline Storage Tunnel Project

**Northeast Ohio Regional Sewer District (NEORSD)**
Cleveland, Ohio

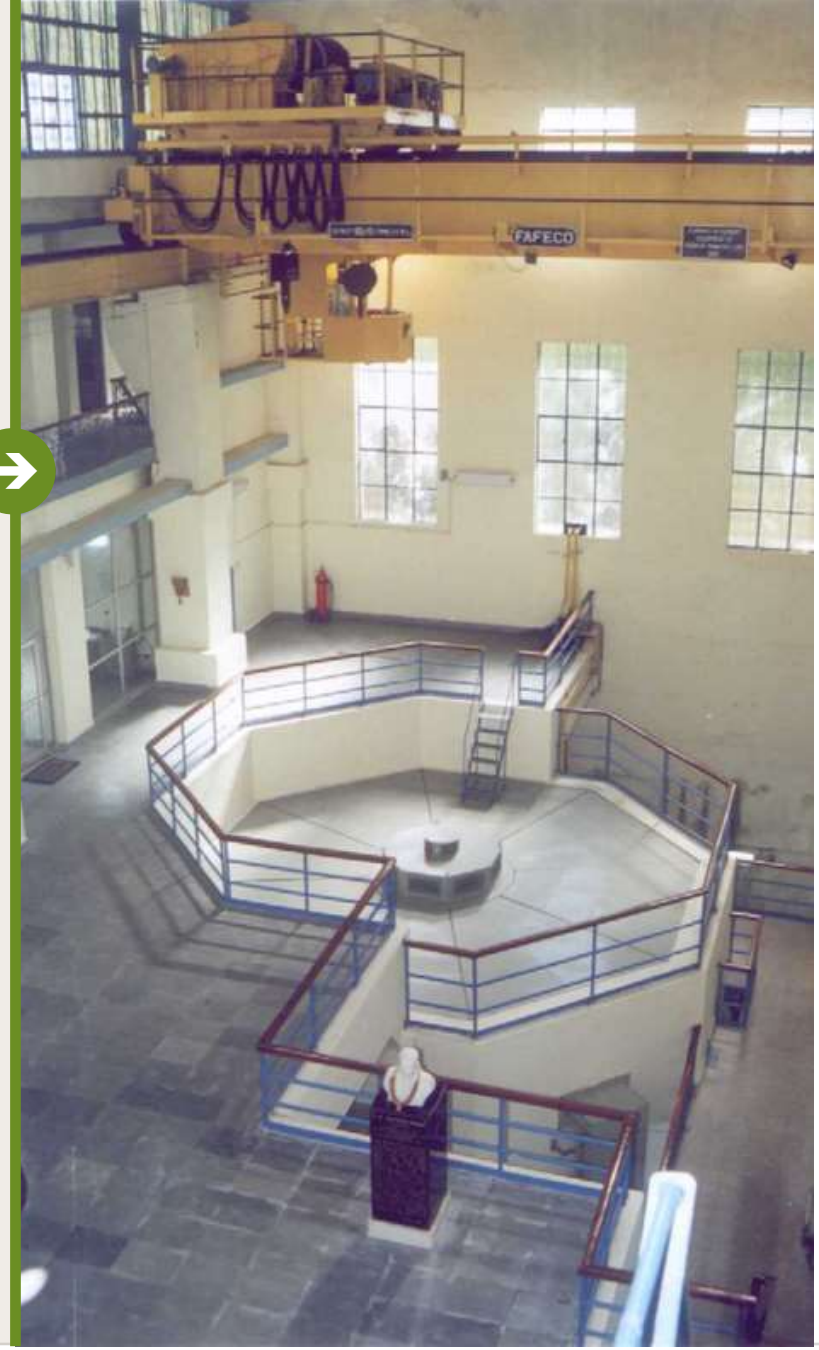
# What we do.

## *Clean* and *Green Energy* have been integral to DLZ's mission for decades.

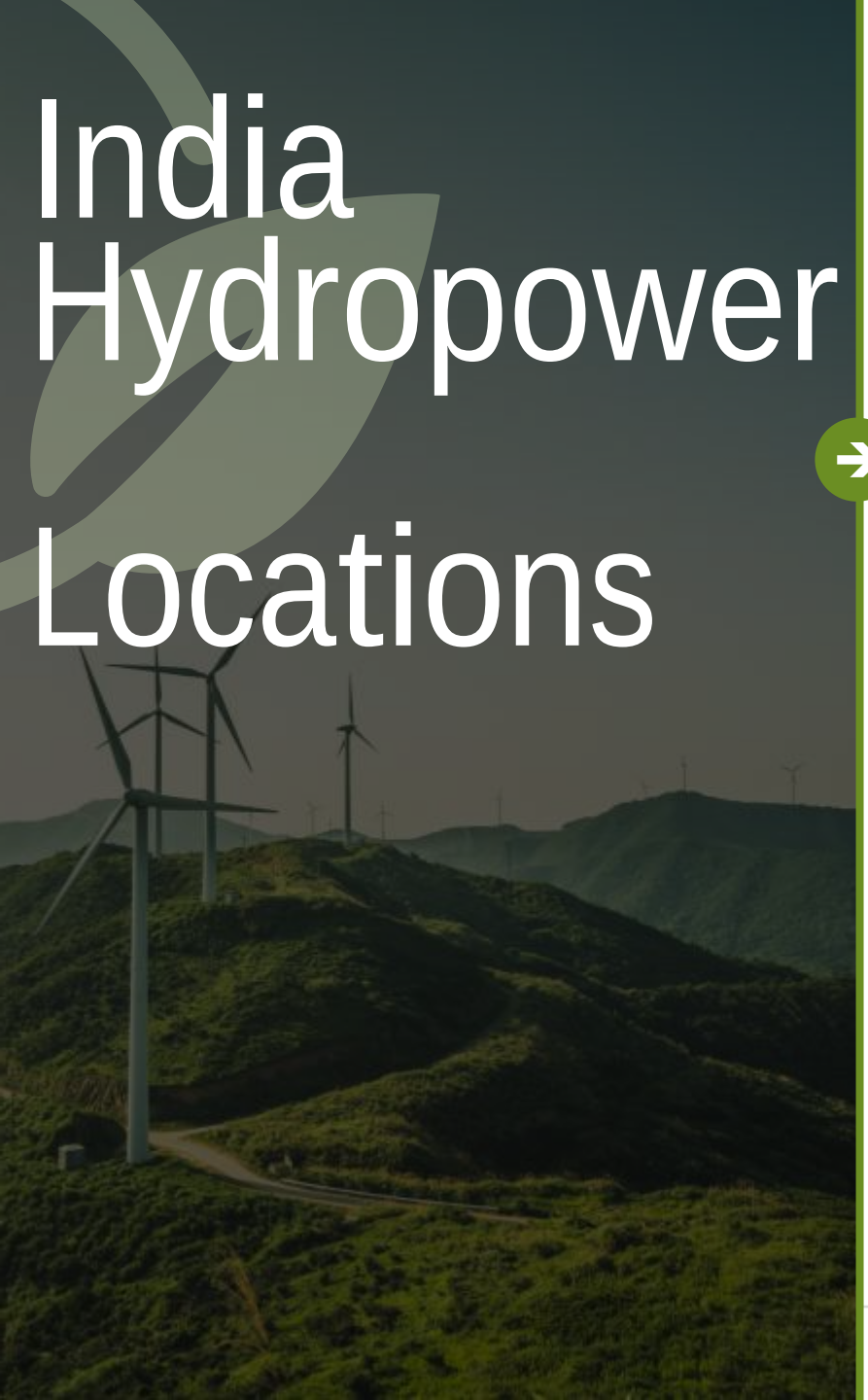
We have heavily invested in renewable energy and consider this a key area of expertise. With a growing demand for sustainable and renewable energy sources, our team of experts can assist you in transitioning to clean, green energy sources.

# Renewable Projects: 1995-2011

- DLZ developed 7 small hydropower plants
- 75 MW generation
- Design/Build/Operate/Maintain Procurement




# India Hydropower Locations

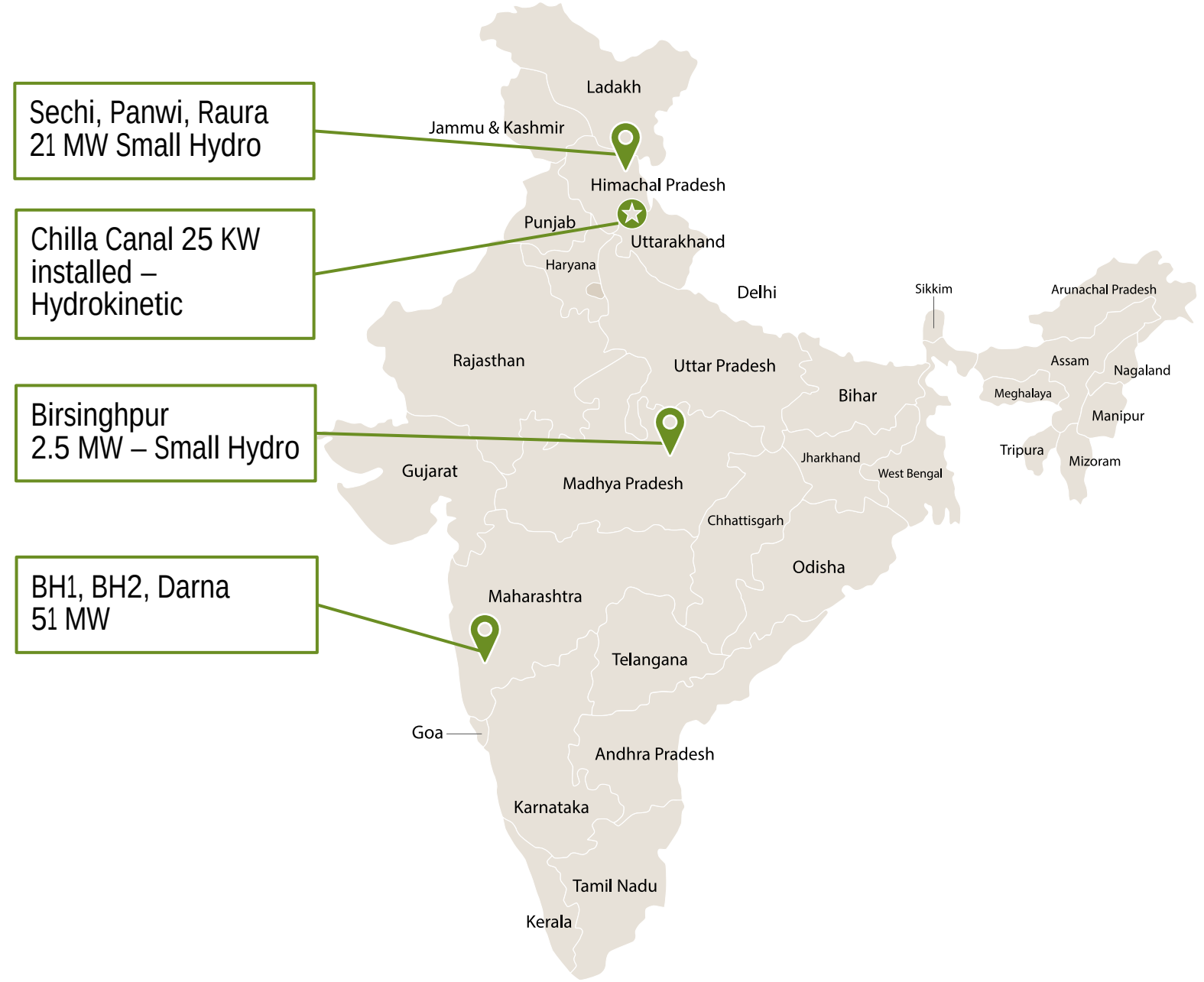


Sechi, Panwi, Raura
21 MW Small Hydro

Chilla Canal 25 KW
installed –
Hydrokinetic

Birsinghpur
2.5 MW – Small Hydro

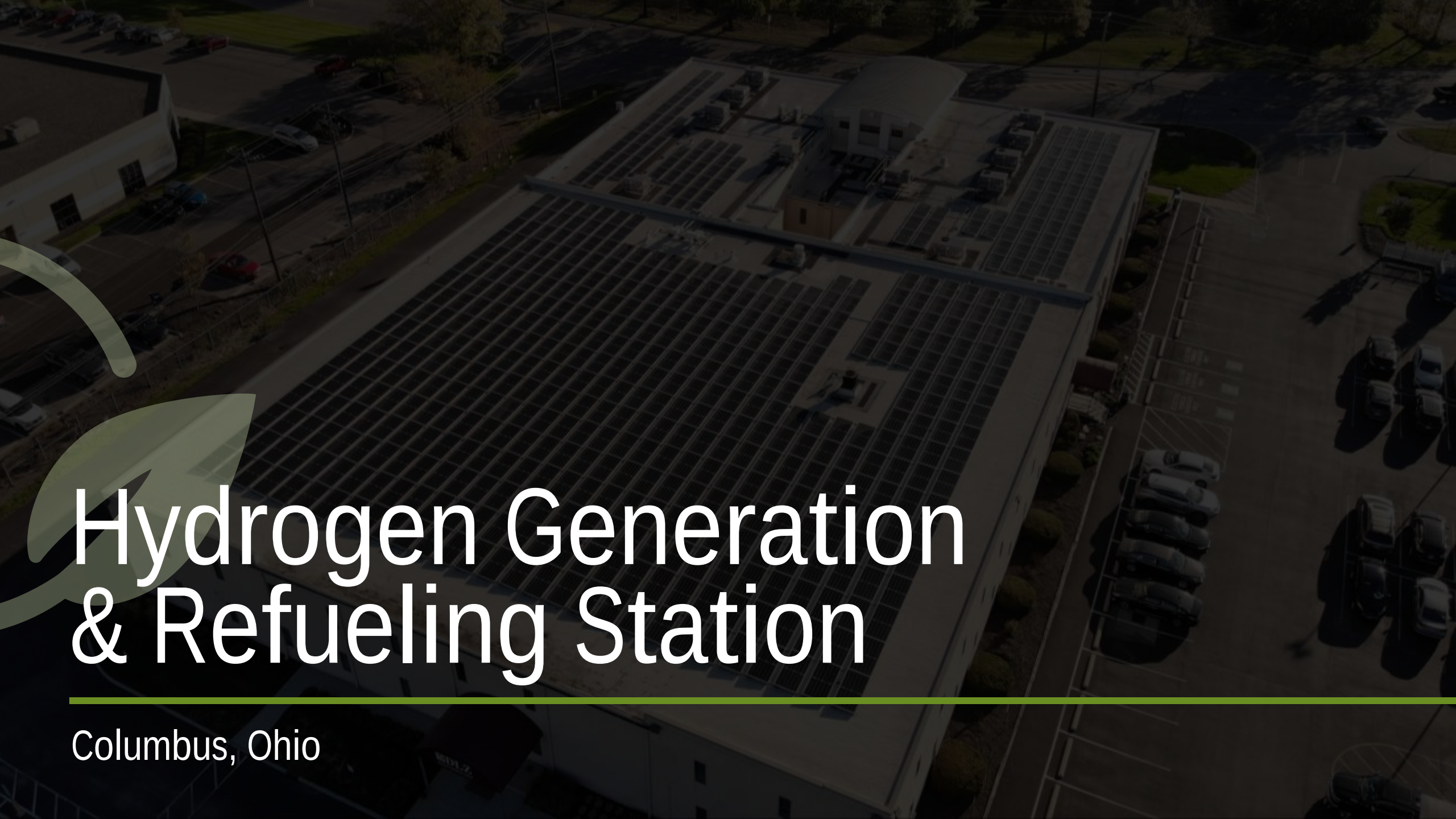
BH1, BH2, Darna
51 MW



# Hydrokinetic: 2011-2016

- 1st commercially viable hydrokinetic turbine in United States for use in inland waterways.
- Evolution based on laboratory and field testing
- Three US patents issued

# Costa Rica Renewable Projects: 2021-Present



# Hydrogen Generation & Refueling Station

Columbus, Ohio

# Hydrogen Generation & Refueling Station

Installed solar panels to produce green electricity

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Hydrogen refueling station for vehicles

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- Hydrogen storage up to 18 kg

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- Installed solar panels to produce green electricity
- Hydrogen refueling station for vehicles
- Hydrogen storage up to 18 kg
- Can support 15-20 vehicles

# Project Challenges

# Project Challenges

1

Supply Chain

- Delays in pumps, compressors
- Contractual issues w/Solar Installation

# Project Challenges

1

Supply Chain

2

Local Permitting

- Collaboration with local building code
- Fire Protection
- Structural Engineering (canopy, solar)
- Signage

# Project Challenges

1. Supply Chain
2. Local Permitting
3. Grid Interconnection

- **Net Metering Agreement with Local Utility**

# Project Challenges

1. Supply Chain
2. Local Permitting
3. Grid Interconnection
4. Vehicle Procurement

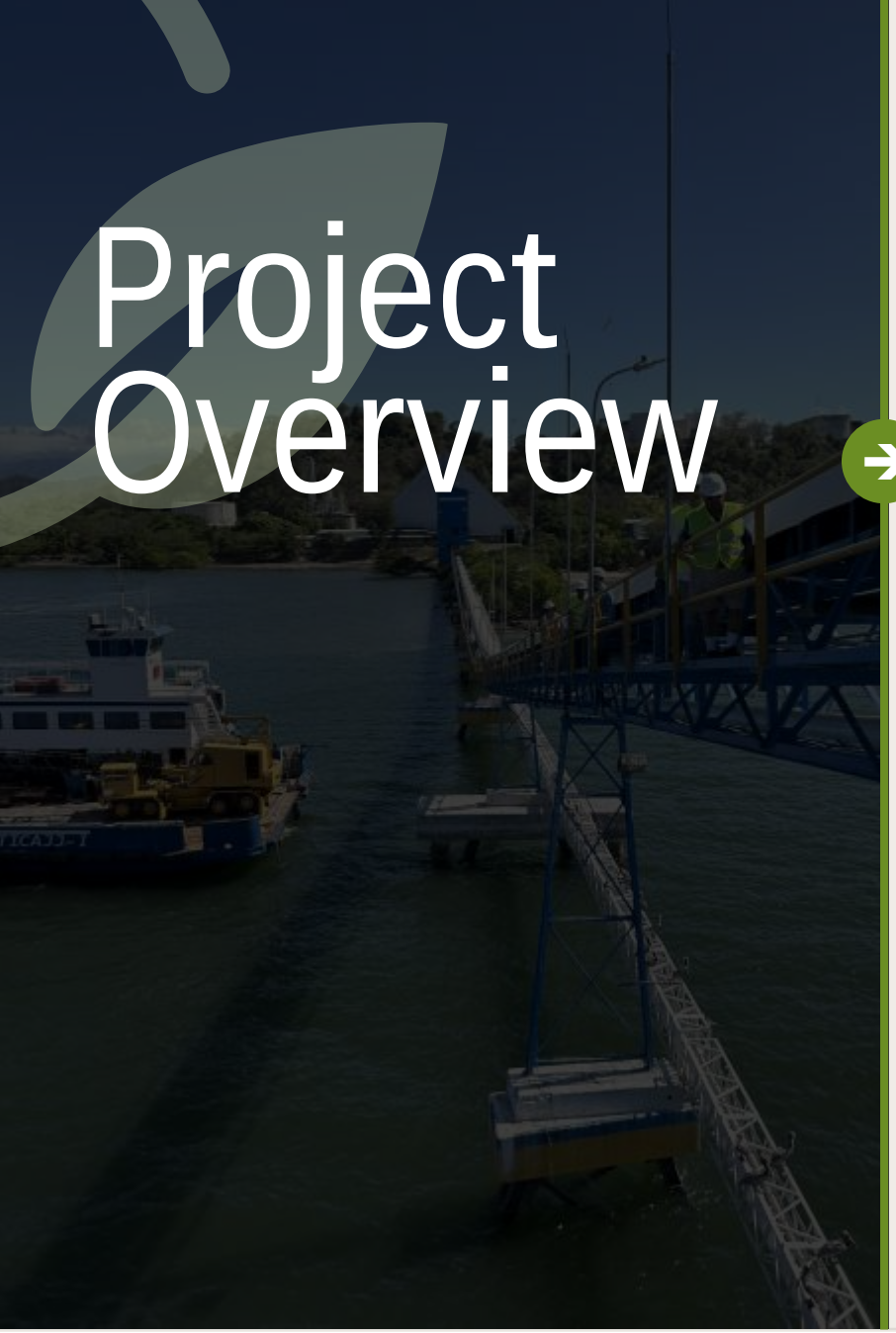
- **California-only Retail**
- **Limited inventory**

# Project Summary

- Ivys Simple Fuel HRS generates 20 kg / day H70 hydrogen gas
- HRS demand supported with private Solar installation
- Fleet of 6 Hyundai Nexo Vehicles

# $GH_2$ - Costa Rica

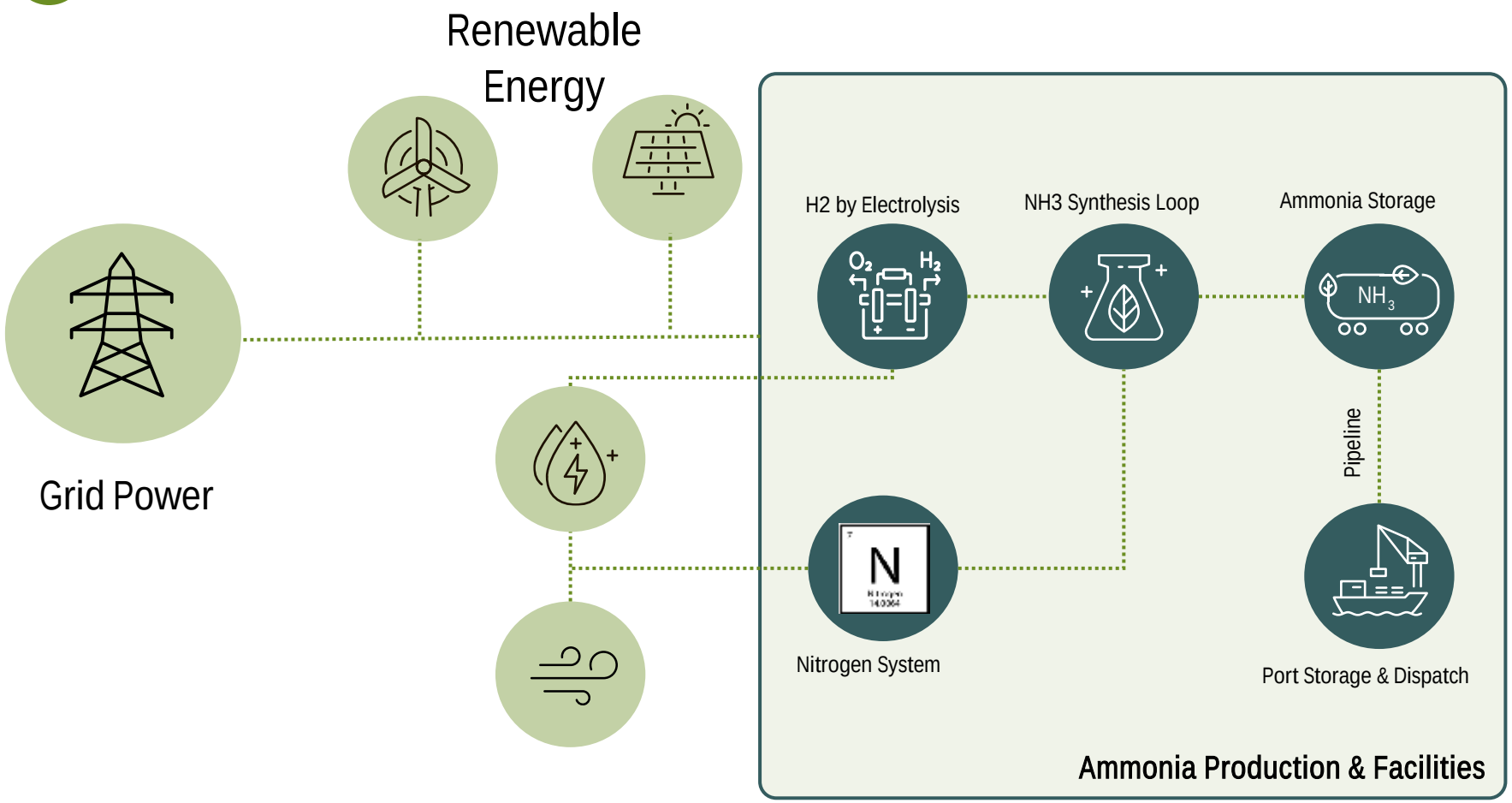
# Project Overview

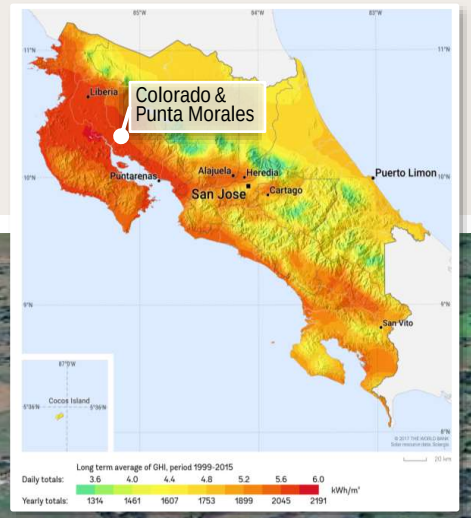


- GH2 is a proposed green ammonia plant in Costa Rica
- Target production of approximately 1,200 metric tons per day of green ammonia, aimed at both local and international markets.
- Green hydrogen will be produced via water electrolysis in 500 MW alkaline electrolyzers. Nitrogen, extracted from air through an air separation unit, will combine with hydrogen in an ammonia loop to create anhydrous ammonia.
- 1.3 GW of solar energy and 250 MW of wind energy will power the electrolyzers and ammonia production.
- Any additional power requirements will be met through a PPA with the national utility, which sources 98% of its energy from renewable resources.
- The solar facility will be co-located with the ammonia loop, while the wind farm, situated 80 km north due to optimal wind conditions, will connect to the site via an existing transmission line. This solar-wind mix optimizes capital costs, energy generation, and tariff efficiency.
- Ammonia will be transported through a 6-kilometer pipeline alongside a national road to the nearby Punta Morales port for export, including access to the Atlantic via the Panama Canal.

# Costa Rica Location

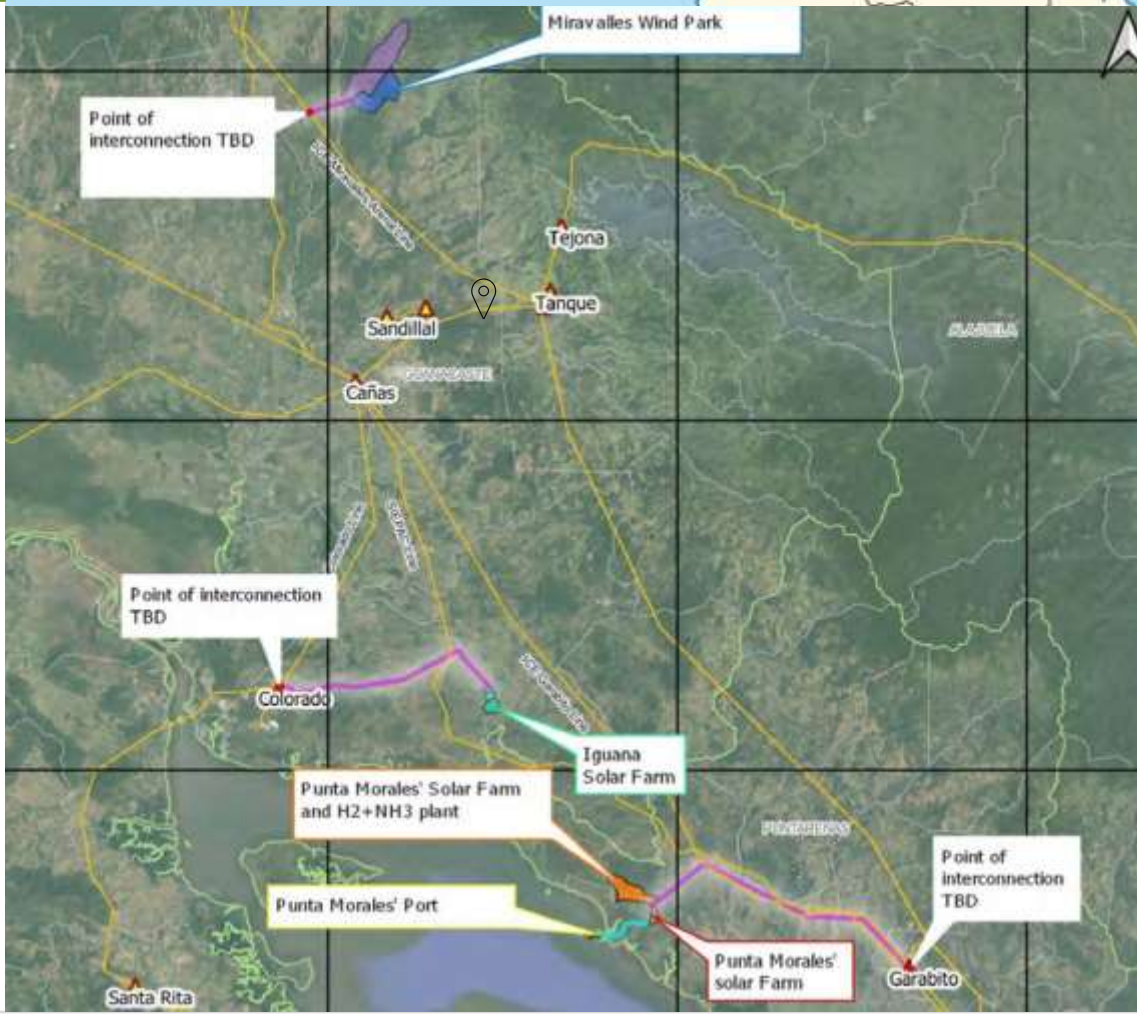
# Process


Renewable Energy
Grid Power
H2 by Electrolysis
NH3 Synthesis Loop
Ammonia Storage
Pipeline
Nitrogen System
Port Storage & Dispatch
Ammonia Production & Facilities


Colorado &
Punta Morales
Liberia
Puntarenas
Alajuela
Heredia
San Jose
Cartago
Puerto Limon
San Vito
Cocos Island
Long term average of GHI, period 1999-2015
Daily totals: 3.6 4.0 4.4 4.8 5.2 5.6 6.0 kWh/m²
Yearly totals: 1314 1461 1607 1753 1899 2045 2191


DLZ - H2 Costa Rica

# Project(s) Location




## Ammonia

The ammonia production facility will be strategically located in Punta Morales, within the Puntarenas region, providing an advantageous position for efficient dispatch of ammonia to the international market.

| 1,200 | 546 MW | 95% |
|---|---|---|
| Metric tons of daily production | of required power | Capacity factor operation |

## Solar (1.3GW)

The site is in Punta Morales, Chomes, in the Puntarenas region, approximately 6 km from the port of Punta Morales and adjacent to the proposed facility's site.

**2,044 – 2,083 kWh/m2**
Of potential global horizontal irradiation

## Wind (250MW)

The wind resource consultant has identified the Miravalles Estate as an ideal location for the wind farm, with close proximity to the Miravalles substation and Miravalles-Arenal transmission line, offering convenient grid connection options.

| 10+ | 200MW | Additional 50MW |
|---|---|---|
| Years of wind data | To be developed in a 750 ha property readily available | To be developed in a neighboring property (negotiations ongoing) |

# Project Highlights

## Resource Abundance

Strategically positioned solar and wind projects will supply the majority of the project's power needs.

## Green Energy Matrix

Costa Rica's energy matrix is predominantly renewable, led by hydroelectric power

## Governmental Support

Costa Rica's government has endorsed the green $H_2$ and ammonia production sector, with only two companies, including DLZ, developing such projects

## Strong Market Demand

The global ammonia market, valued at USD 205.34B in 2022, is projected to grow at a CAGR of 5.4% through 2030. The green ammonia market, estimated at USD 300M, is expected to reach USD 17.9B by 2030, with a CAGR of 72.9%, driven by eco-friendly fertilizer demand and maritime decarbonization.

## Job Creation

The project will generate construction jobs & highly skilled operational jobs.
Follow up expansion phases are expected to generate additional construction jobs

## Proximity to Off-takers

Costa Rica's location provides strategic access for exporting green hydrogen and ammonia to Europe and Asia.

## Free Trade Zone

DLZ is securing a free trade zone status in Costa Rica, granting substantial tax benefits for an initial 15-year period, renewable. The free trade zone regime represents 15% of Costa Rica's GDP.

## Existing Infrastructure

DLZ will leverage the existing port facility at Punta Morales. This established infrastructure minimizes the need for significant upgrades, enabling a streamlined adaptation for green ammonia export.


# Questions?