



CHANGING HOW SOLAR CELLS ARE MADE

February, 2017

Forward Looking Statements

This presentation contains certain forward looking statements relating to the company's financial results, business prospects and the development and commercialization of the company's solar technology. These statements are based on management's current expectations and beliefs and are subject to a number of factors which involve known and unknown risks, delays, uncertainties and other factors not under the company's control which may cause actual results, performance or achievements of the company to be materially different from the results, performance or other expectations implied by these forward looking statements.

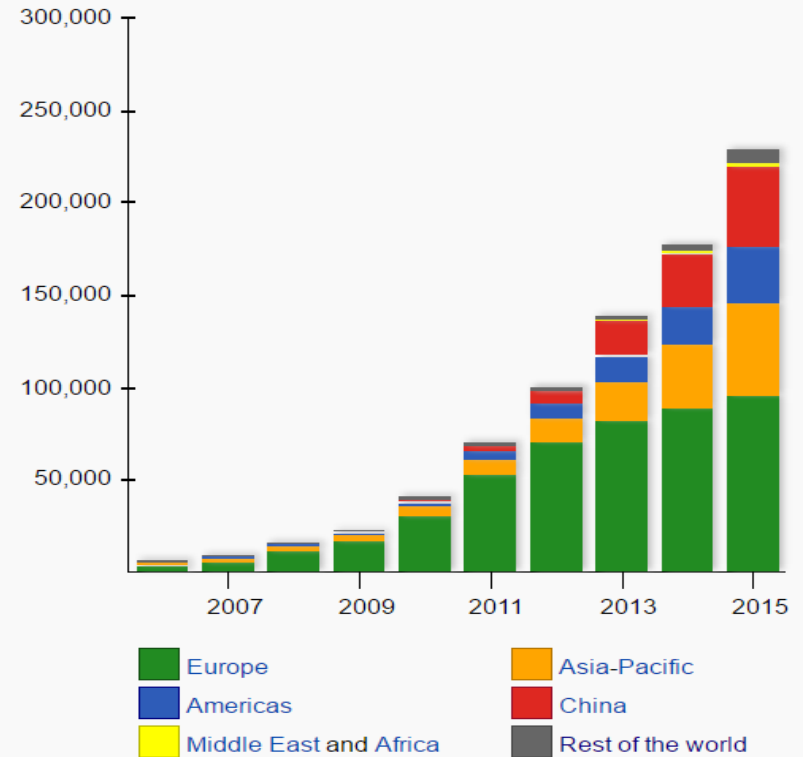
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The Solar Energy Industry is Growing



Worldwide growth of photovoltaics

Cumulative capacity in megawatts [MW_p] grouped by region^{[1][2][3][4]:15:17}



Recent and projected capacity (MW_p)

Year-end	2010	2011	2012	2013	2014e	2015p
Cumulative	40,336	70,469	100,504	138,856	178,391	233,000
Annual new	17,151	30,133	30,011	38,352	40,134	55,000
Growth new p.a.	134%	76%	0%	28%	5%	37%

Natcore's Technologies

Foil Cell

(All Back Contact Solar Cell)

Natcore's Foil Cell uses high-speed, low temperature laser process

INCREASE
efficiency



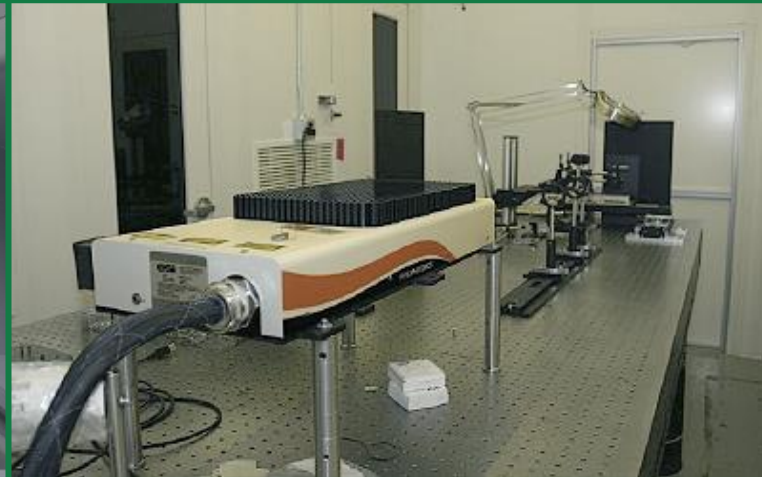
Black Silicon

Natcore's black silicon technology streamlines the path to low solar cell reflectance

REDUCE
costs



Natcore Laboratory – Rochester, N.Y.



19,000
sq ft facility

8,000
sq ft of
'class 10,000'
clean room



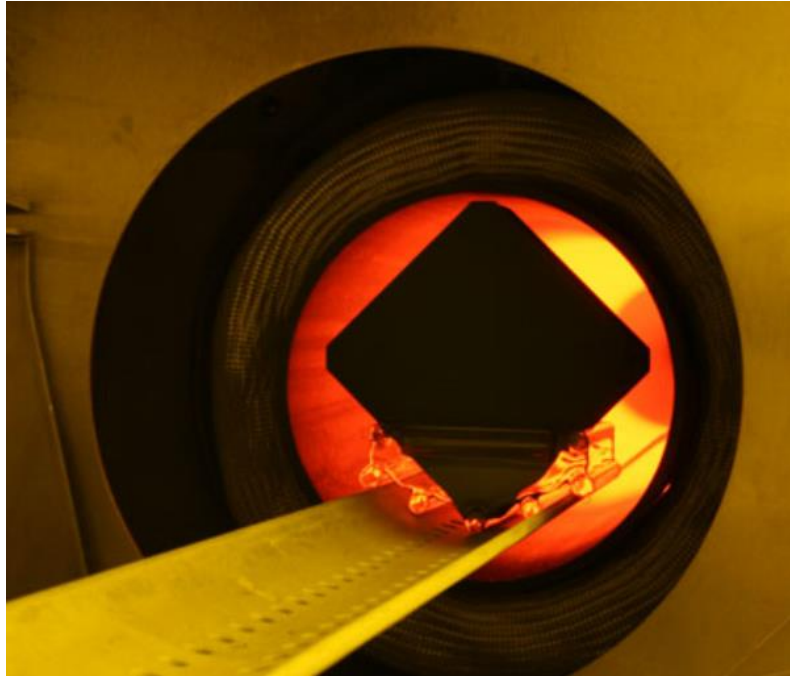
Full solar cell process from bare silicon wafer to working cells

Natcore R&D Center – Rochester, N.Y.



Technician working at one of several clean room wet benches.

Natcore R&D Center – Rochester, N.Y.



(Left) Solar wafers entering the diffusion furnace. (Right) Work performed using customized R&D equipment.

A Versatile, Customizable System

Traditional silicon hetero-junction cells hold the record for efficiency, **but high costs make them impractical**

25.6%

Output

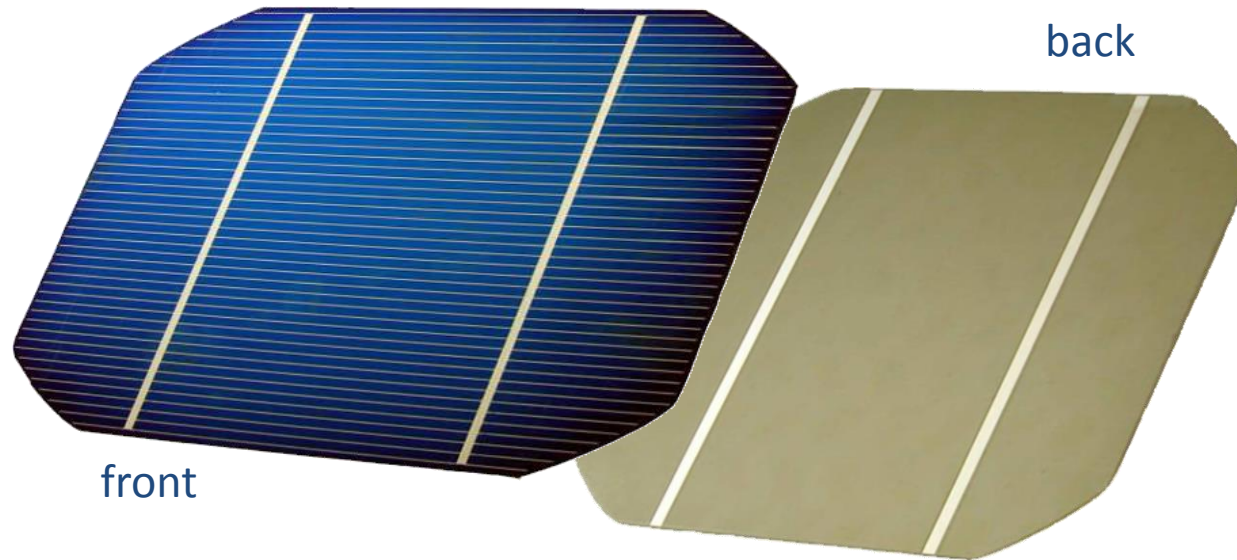
The current world leader in efficiency



FOIL CELL TECHNOLOGY

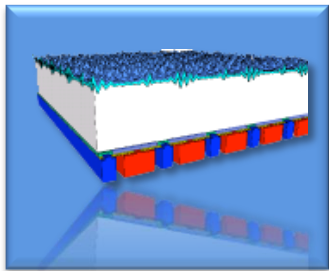
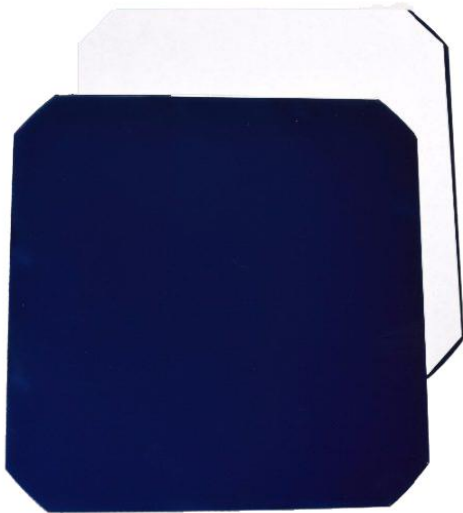


Industry Standard: Front/Back Contact



- The mature current technology
- Reaching its limit in efficiency
- Requires a fair amount of silver

Back Contact Solar cells

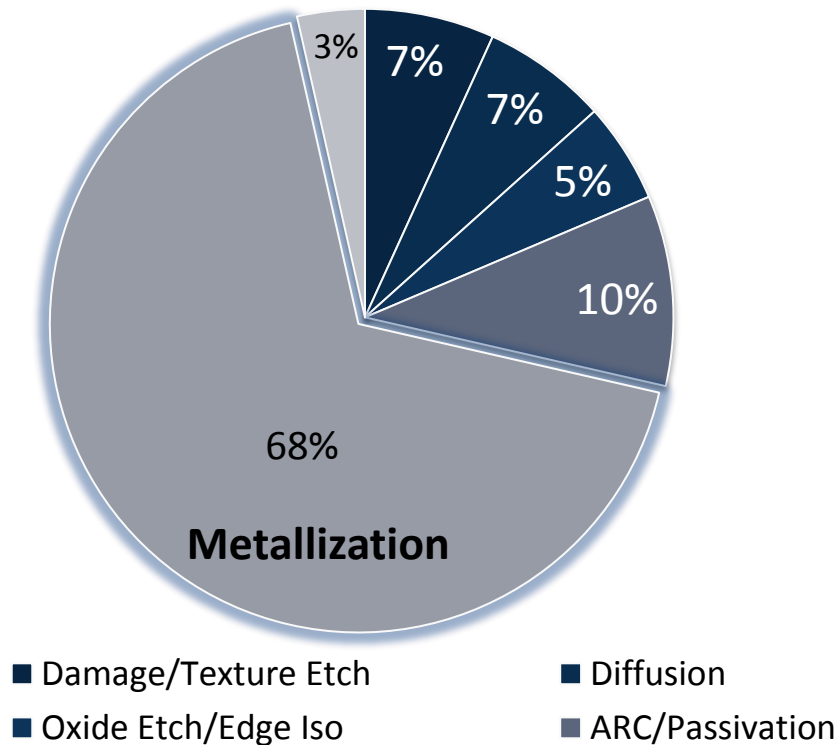


- Back contact cells have the highest potential:
 - Currently hold the world record for silicon (>25%)
 - Will always be advantaged due to lack of front grid shadowing
- Currently difficult to make
- Natcore process
 - Simplified fabrication
 - Aluminum

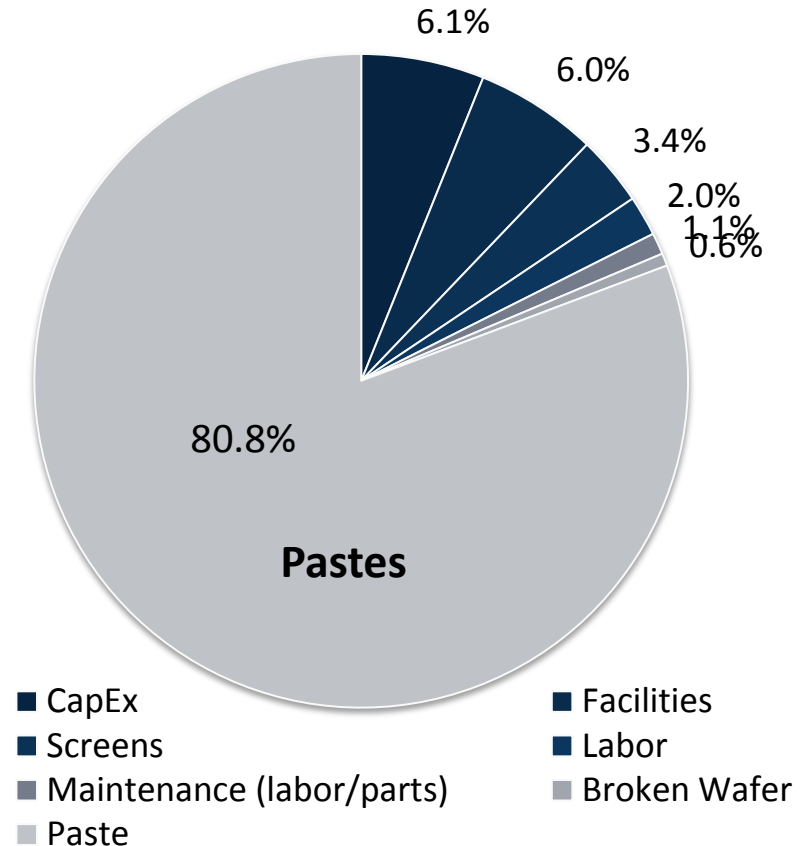
Current Cells: Cost Dominated by Silver

- Metallization steps comprises >60% of cost
- Ag and Ag/Al pastes are >80% of metallization cost

Cell Processing Cost Breakdown



Metallization Cost Breakdown



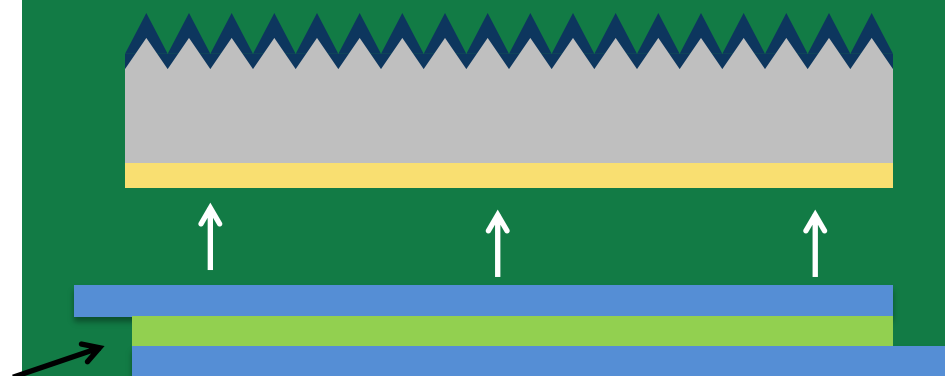
*For 19% std multi cell; raw Ag \$15.00/oz.

Natcore Foil Cell Structure

- **Multilayer foil metallization**

- Low cost metal: Aluminum
- Atmospheric & low cost process
- Laser based processing

REVOLUTIONARY PROCESS



Key Features / Properties

- Low cost contact metals
- Simplified manufacture
 - Low capital equipment cost
 - Small factory footprint
 - Low temperature processing

Cost: Foils & Laminates

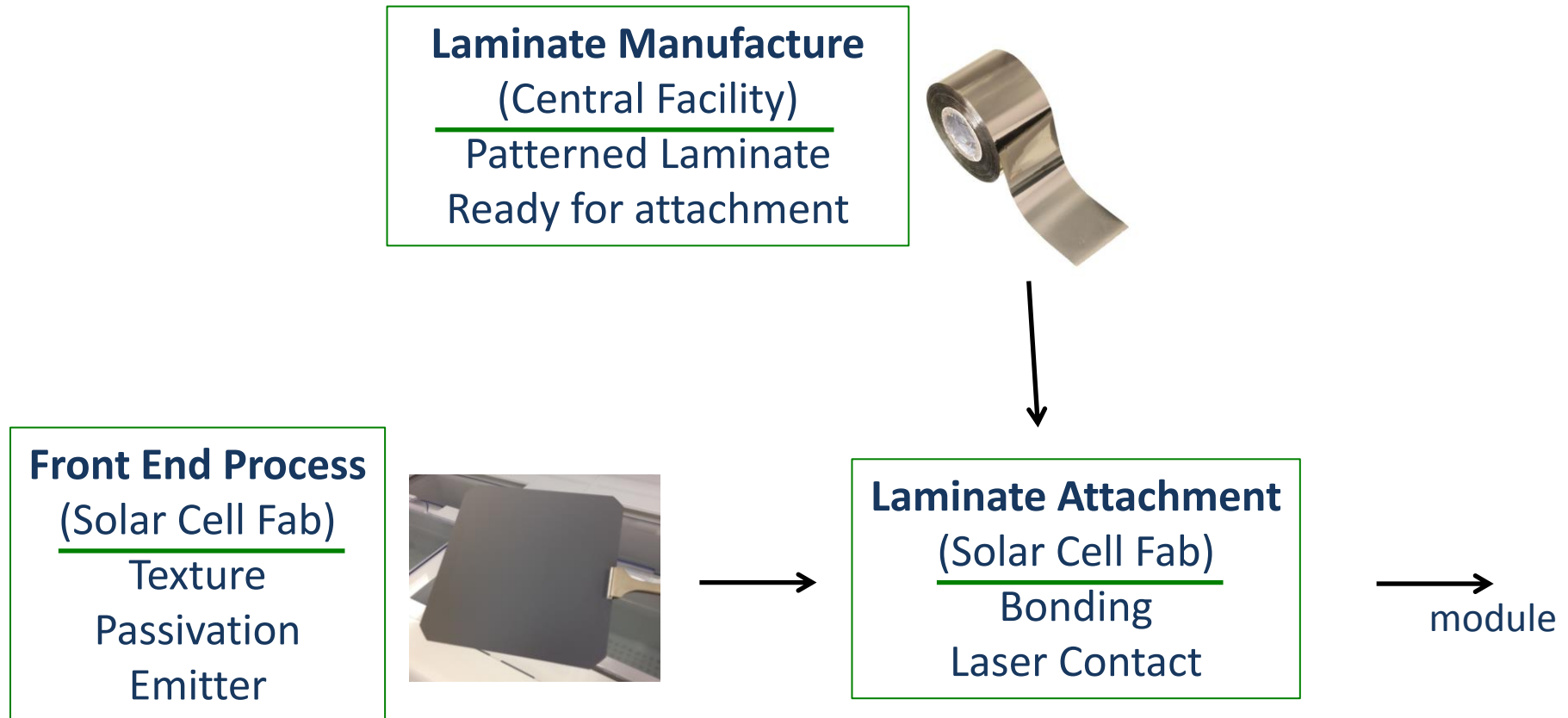
Leveraging an existing industry

- Worldwide Aluminum foil production: $\sim 100,000\text{M m}^2$ per year
- The entire solar industry: Requires $\sim 400\text{M m}^2$
- Low cost driven by **existing** high volume

Minimized Material Cost

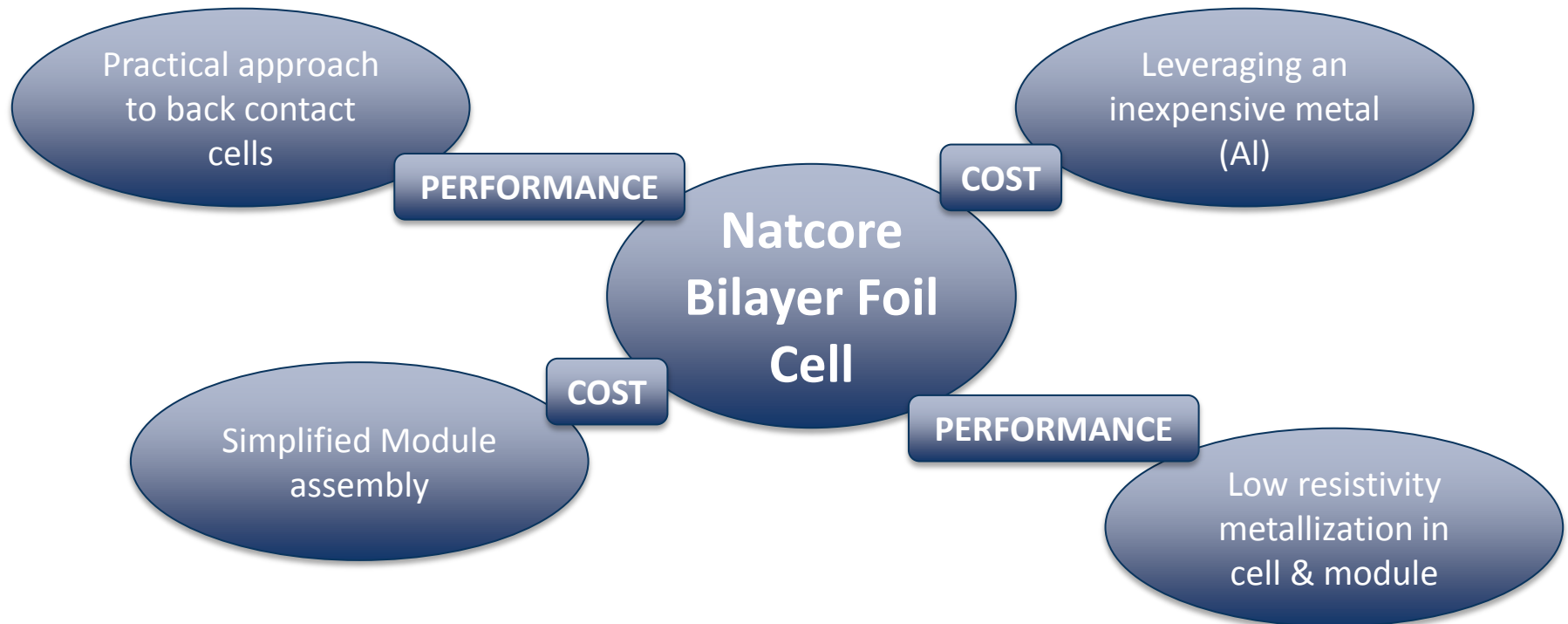
- Current cells use about 190mg of Ag per cell:
 - Raw metal cost: $\sim 10\text{¢/cell}$
- Replaced with $\sim 1.5\text{g Al}$:
 - Raw metal cost $\sim 0.2\text{¢/cell}$
- Planning to work with NREL for accurate cost model

Foil Cell Process Flow



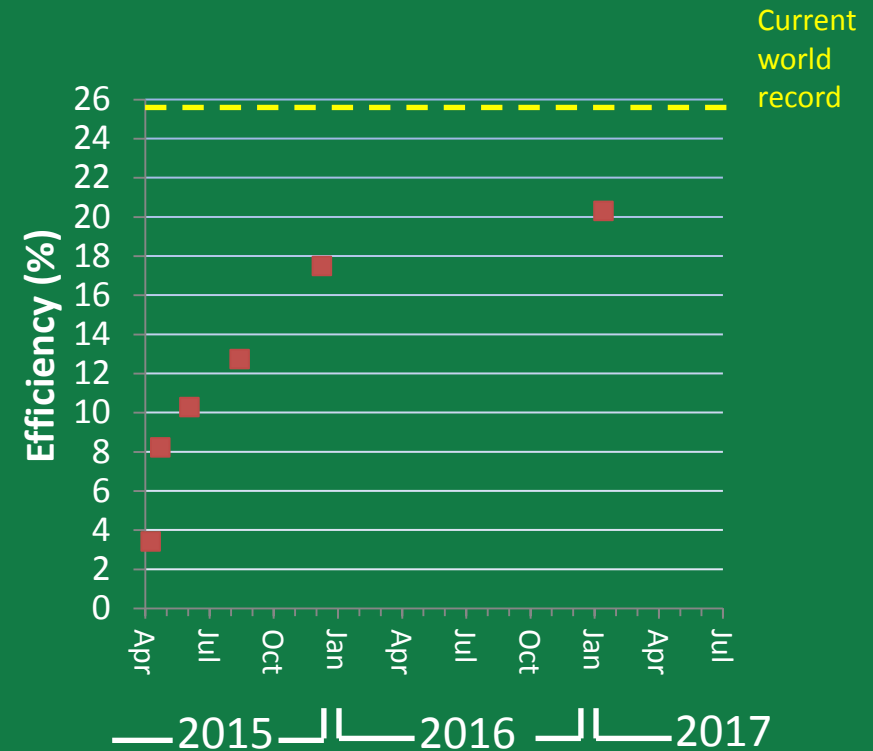
Vectors of Improvement

- Technology and cost benefits sum to yield an improved system



Prototype Development at Natcore

- Multilayer structure:
First versions achieved
April 2015
- Steady progress in
efficiency



Efficiency: Today & Projection

Laboratory

(current status, small test cells using a perforated emitter laminate foil & deposited base metal)

- Efficiency: 20.3%
- $V_{oc} = 0.66V$
- $I_{sc} = 41.3 \text{ mA/cm}^2$
- FF = 74.3%
- Short term target: >20%

Production Estimates

- Early phase: 22%
 - Existing I_{sc}
 - $V_{oc} = 0.72V$ (typical implied V_{oc})
 - FF = 76% (conservative)
- Long Term: 24 - 26%
 - Within the range of the highest performing back contact cells

IP Position and Strategy

- Natcore has strong patent expertise
- US and International filings in various technologies
 - 31 granted patents
 - 34 applications
- Laser / Back contact cell & module IP: Comprehensive filings
- Coverage areas:
 - Novel cell structure
 - Module integration
 - Processing methods

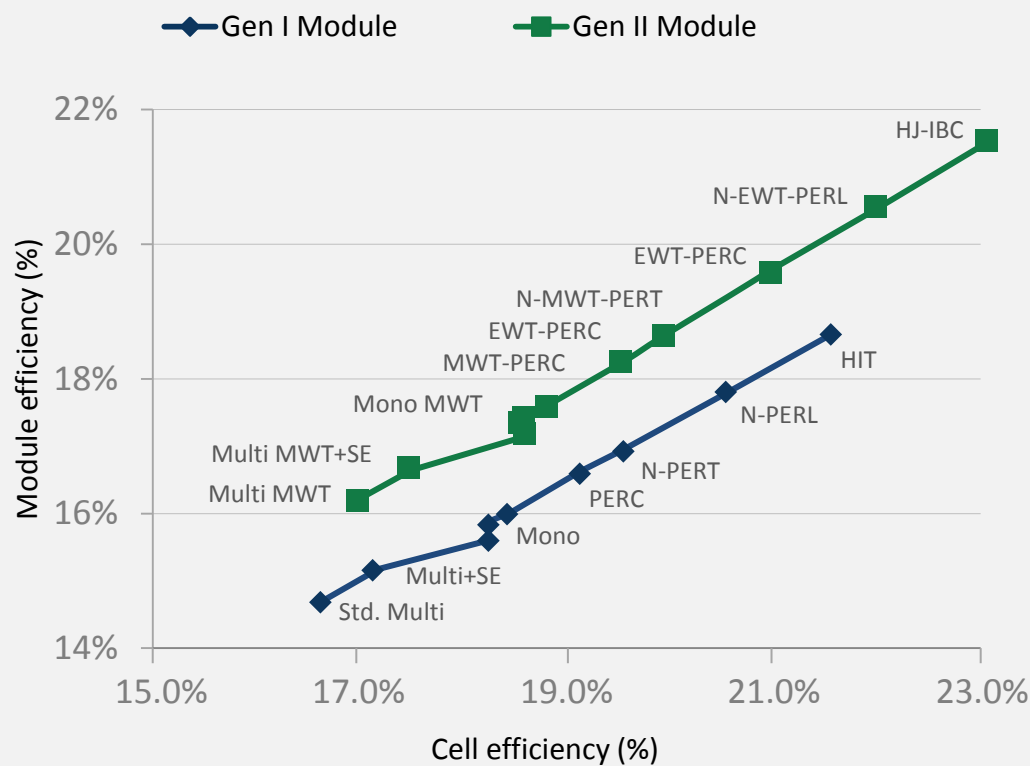
CTM Energy Loss

Less electrical resistance

Less wasted space

The best structure for eliminating CTM loss

Sometimes a CTM *gain* if surface area isn't wasted



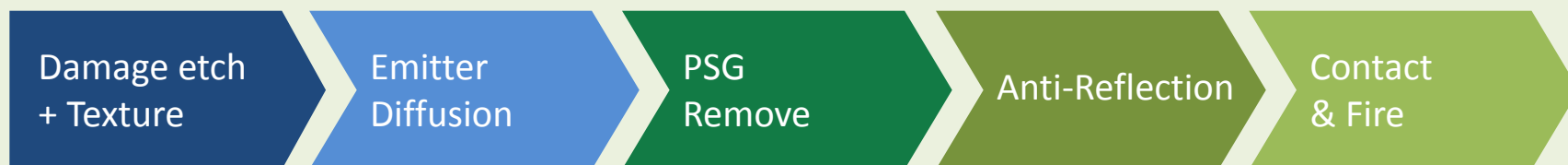
Natcore Back Contact: Better efficiency and Better CTM

BLACK SILICON TECHNOLOGY



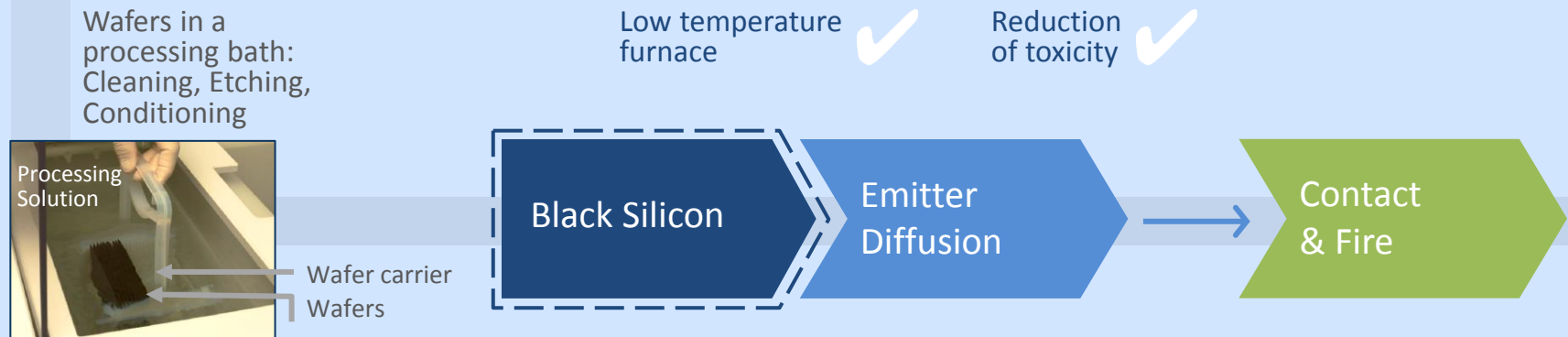
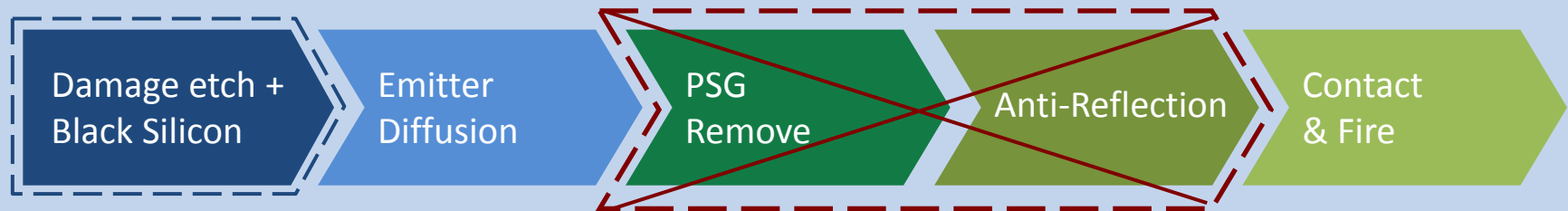
Solar Cell Manufacturing Process

STANDARD PROCESS



Our Process

BLACK SILICON PROCESS



Low temperature reduces toxicity and produces the best condition for uniform, single-sided black silicon application

BUSINESS MODEL & COMMERCIALIZATION

Business Path

- Natcore has demonstrated proof of concept of a revolutionary new solar cell structure and process.
- Now focused on improving the performance of prototype devices
- Seeking a partner that can assist in the commercialization process

3 Revenue Streams

Licensing

- Laser Processing
- Black Silicon
- Equipment manufacturing

Royalties

- Laser Processing
- Black Silicon
- Equipment

Material sales

- Built/shipped by others, but unit sales to Natcore
- Chemicals, foils, etc.

Best-of-Breed

*Choosing
the Best*

Best-of-Breed



ROTH & RAU
CELL & COATING SYSTEMS



Phono[®] Solar
SHARE THE SUN. POWER THE FUTURE!



SUMEC

centrotherm



ALFA TAU ENGINEERING S. r. l.

Best-of-Breed

- ① Wafer Inspection
- ② Saw Damage & Texturing
- ③ Diffusion Furnace
- ④ Selective Emitter Process
- ⑤ PSG Removal & Junction Isolation

- ⑥ Anti-Reflective Coating
- ⑦ Screen Printing
- ⑧ Fast Firing
- ⑨ Testing & Order

Natcore & Synergistic Partners



Consulting

We have been retained by United Energy Ltd. to develop a 75 MW facility in Vietnam. This [video](#) shows some of the details (power station, point of delivery, anti-intrusion system).

- Provide project financing and technology;
- Design, develop, implement and bring solar plants to the turnkey phase;
- Serve as supplier and promoter of the project;
- Select suppliers, PV plant locations and EPC company.



Best-of-Breed Turnkey Projects

- We serve on these projects as a Consultant or General Contractor.
- Hire subcontractors and vet every component of the project.
- Currently working on these Best of Breed projects:

Belize: 10 MW



Australia: 100 MW

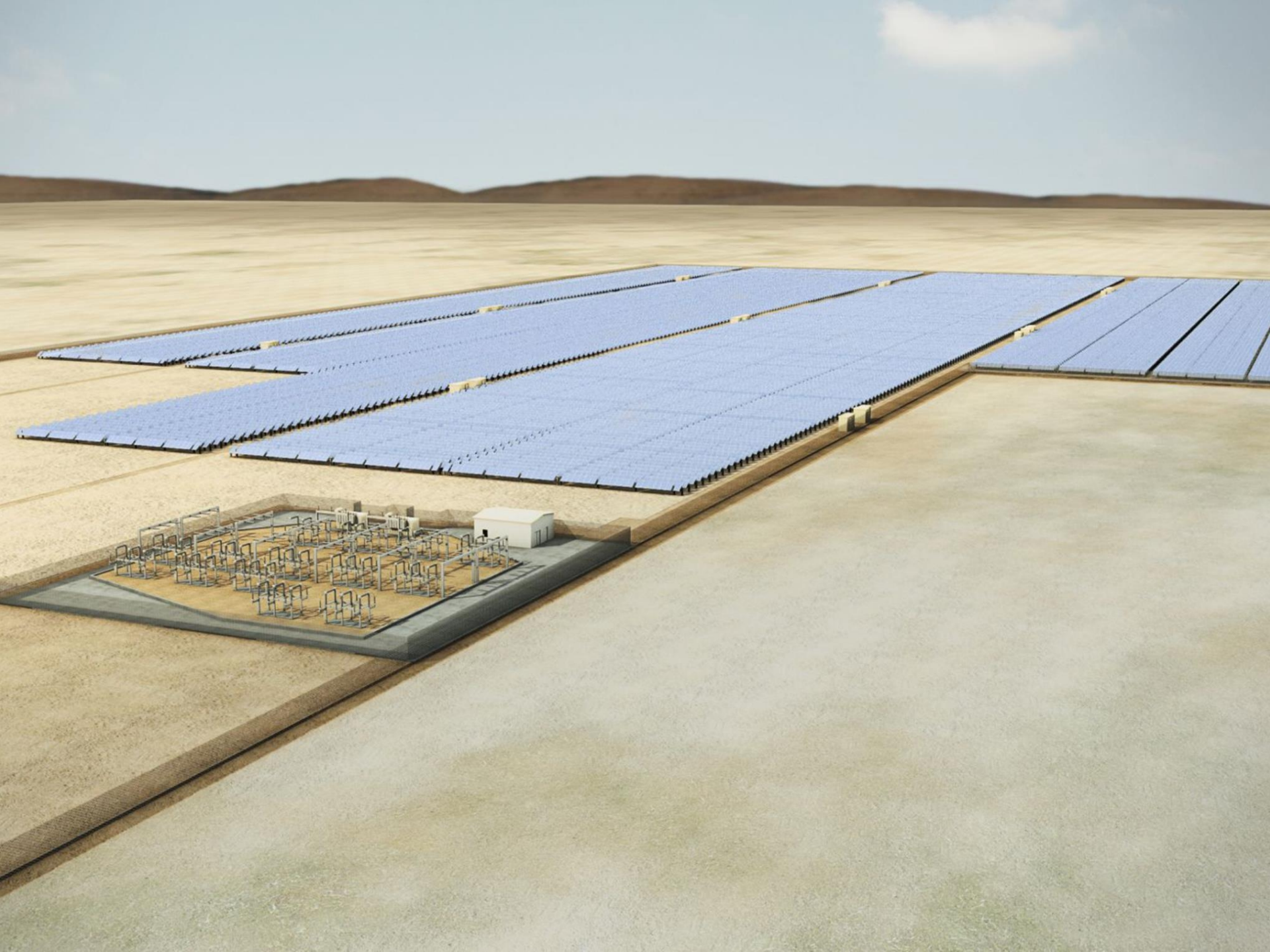


Vietnam: 200 MW



Middle East: 1,000 MW





Best of Breed Process

PROCESS

- Identify In-Country Partner
- Find and Control Suitable Land
- Obtain Government Permits for Project
- Confirm Engineering Feasibility Study
- Negotiate Power Purchase Agreement
- Source and Bid Equipment (Modules, Frames, Inverters, etc.)
- Engage Engineering Procurement Company

Best-of-Breed - Vietnam

Vietnam Project - 200 MW
Drone aerial image of land.



Pipeline Projects

Vietnam

Australia

Belize

Middle East

South Africa

Ukraine/Moldova

Philippines

Vietnamese Project

- **Vietnamese Project** - 56.18 MW PV Plant

- Total Investment \$65.5 M
- PPA: \$0.112 kWh
 - Average Yearly Revenue - \$9.3 M (20 years)
 - Monthly Revenue - \$774,000

Vietnamese Project – 56.18 MW

Revenue

- Engagement fee - \$1.5 M
- Cost Plus (\$65 M x 5) - \$3.25 M
- Annual Partnership Participation (10%) - \$930,000
- 20 Year Term - \$18.6 M

Vietnamese Project – 200 MW

Revenue

- Engagement fee - \$6 M
- Cost Plus - \$13 M
- Annual Partnership Participation (10%) - \$3.72 M
- 20 Year term \$74.4 M

