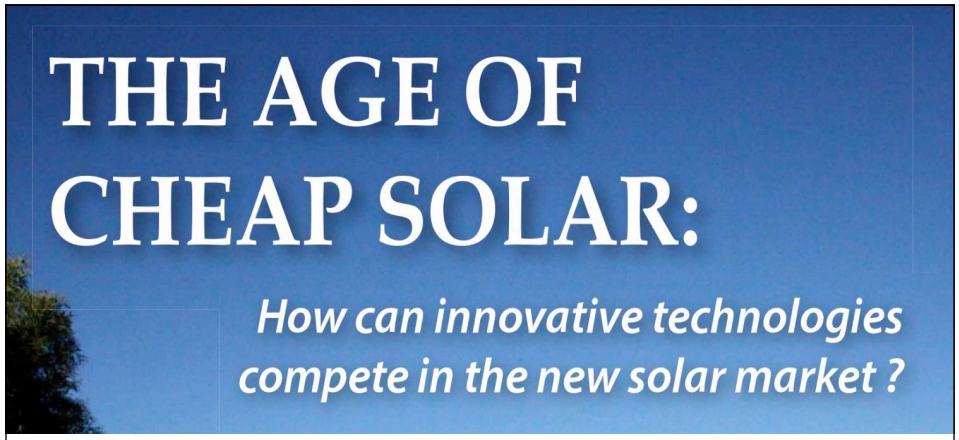
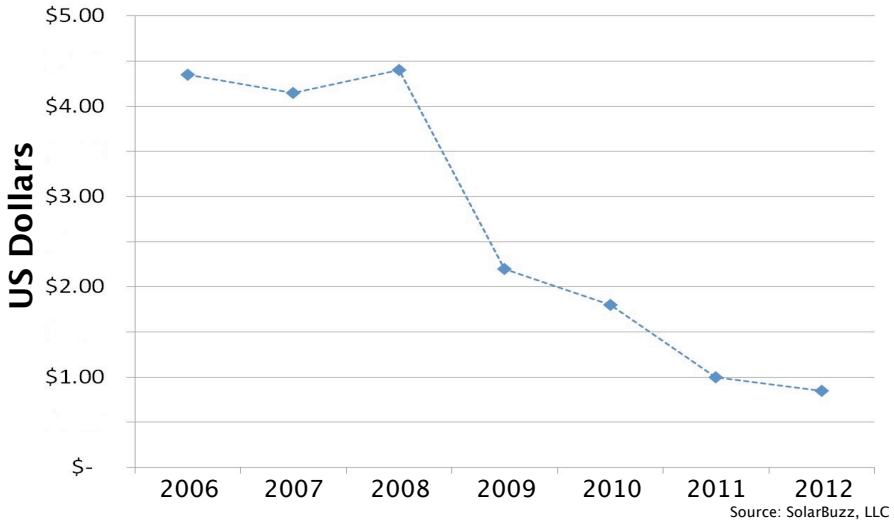



Nicolas Morgan
VP Business Development, Morgan Solar Inc.
n@morgansolar.com / +1-416-203-1655

morgansolar

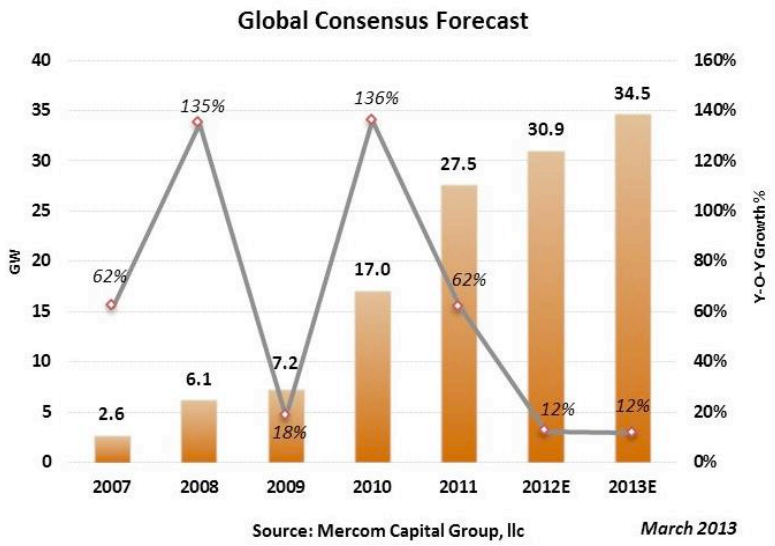
## Solar Panel Prices 2006 to 2012




Source: SolarBuzz, LLC

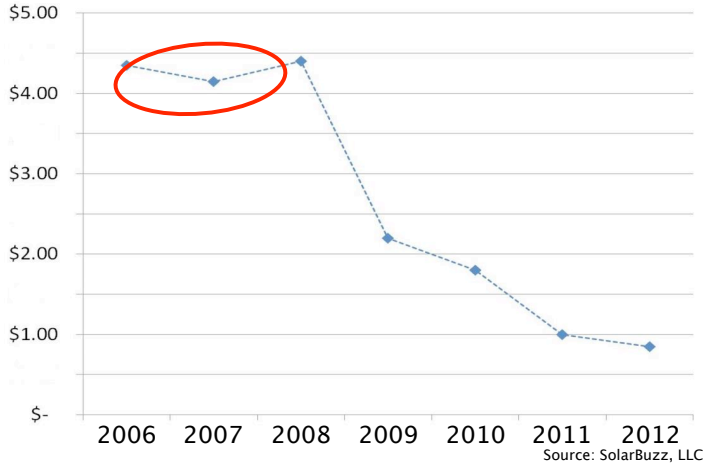
- **Solar prices have dropped 85% since 2008**
- **Panels available today as low as US**

# Solar Market Growth 2007 to 2013




**Market growth – strong, but erratic**

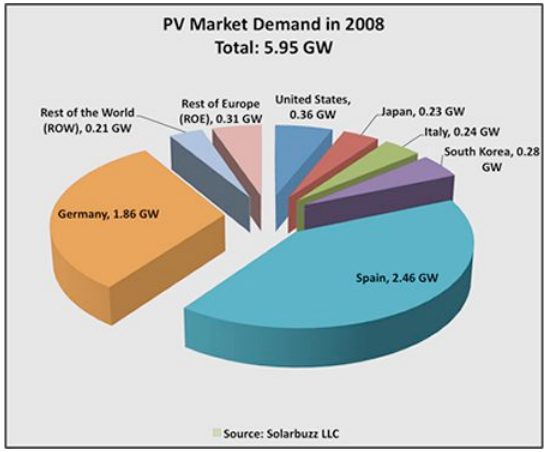
# Up to Early 2008




Source: SolarBuzz, LLC

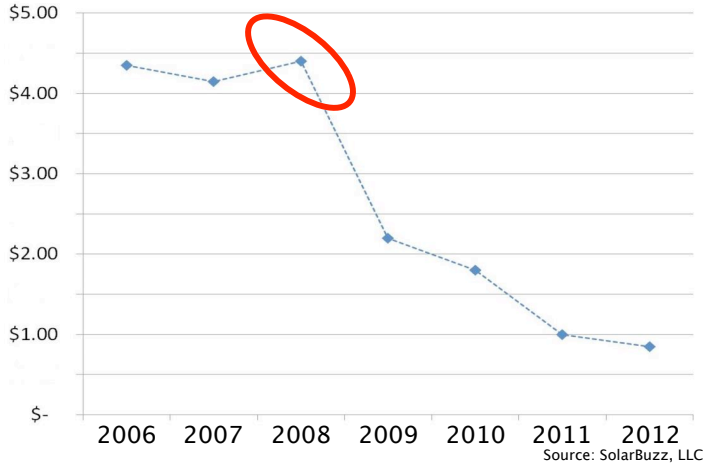
- Supply bottlenecks, prices artificially high
- Incentive driven demand (German & Spanish FIT)

## Early 2008 Big Questions




"Can new supply ramp up fast enough?"

# October 2008 Financial Crisis!




Source: SolarBuzz, LLC

- Project Finance Disappears overnight

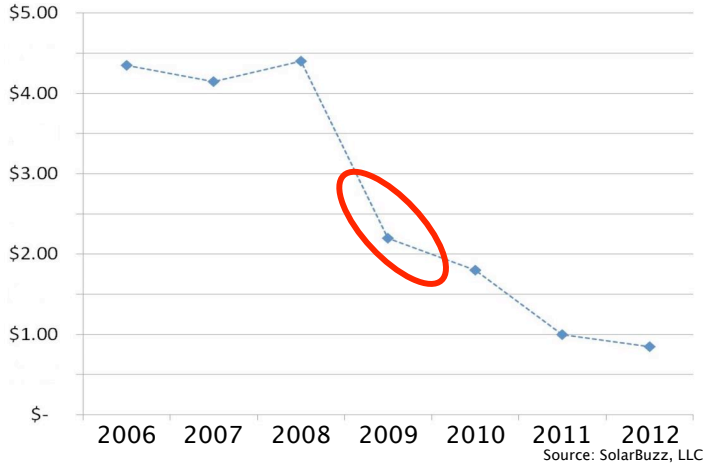
## October 2008 Big Questions

"How long until financing returns?"

"Can Germany and Spain sustain the market?"

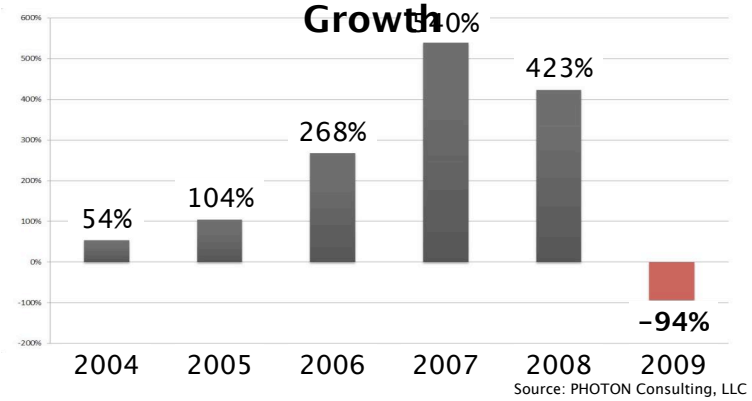
"Is the Spanish FIT too high?"

## 2009: Spain Closes the Floodgates



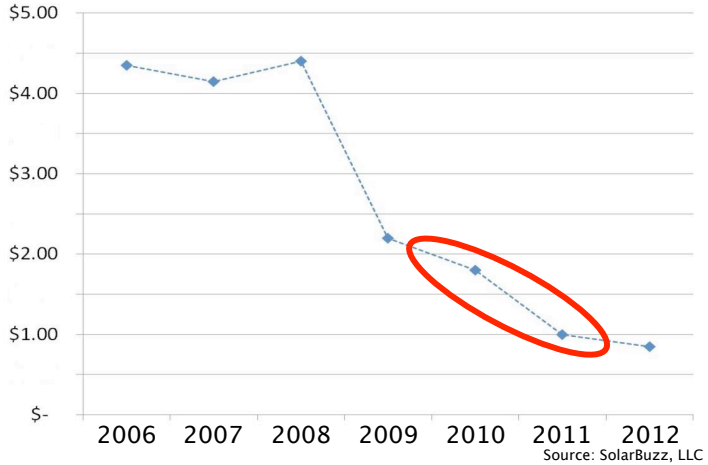

- Spain Reduces FIT
- New Chinese capacity still coming

## 2009 Big Questions



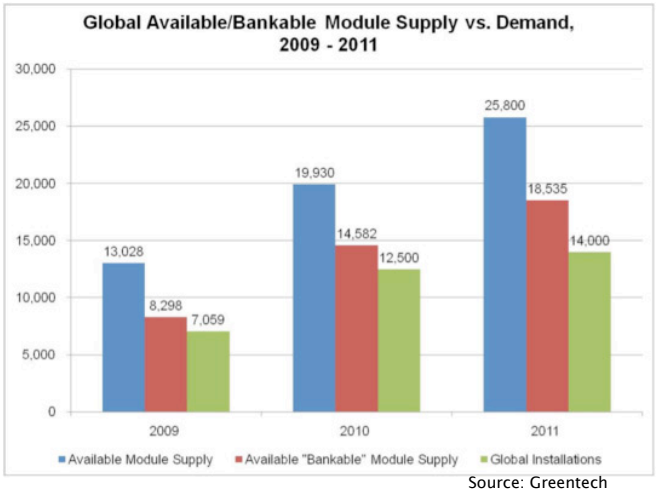

"How low can prices go?"
"Where is the 'next' Spain?"

# 2010 - 2011: The Shakeout




- No “new Spain” emerges

# 2010 & 2011 Big Questions




Source: Greentech Media

"How long can prices stay low?"

"Solyndra raised how much?!?"

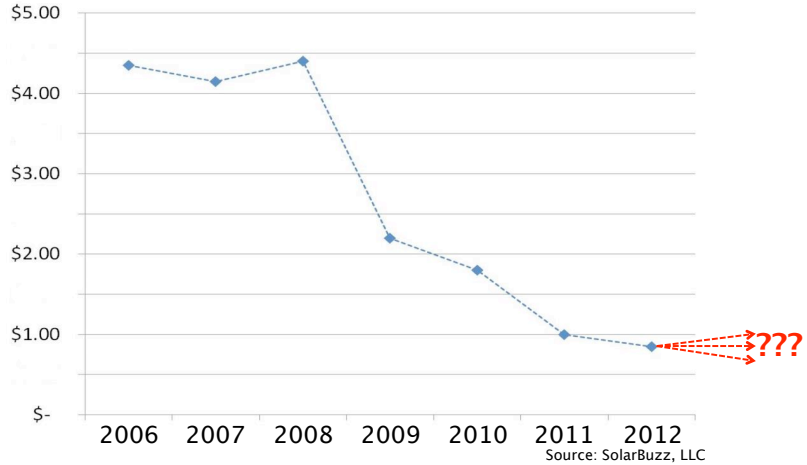
## Solyndra Digression

- Over $1.5 billion in equity and government funding
- They did have an amazing technology, but maybe not amazing enough.
- Raised too much money, and bad timing

**Solyndra's $1.5 billion < China's $18**


Before they collapsed: VC's told me it was one of the best investor pitches they'd ever seen. Lots of VCs were frustrated that they didn't get a chance to invest.
After: VC's LPs said absolutely no more solar investing! You didn't see Solyndra coming, so you clearly don't understand the market.

# 2012 and beyond: Light at the end of the tunnel?




- Are prices going to level off, continue down, or rise slightly?

## Today

- Prices leveling in the short term
- Current supply 48 GW, 2013 demand forecast 32 to 36 GW
- China will continue to dominate silicon PV manufacturing

## Reflections on China

Image removed:

SunTech Solar Panel

- 10X increase in manufacturing since 2008
- $18 billion in operating capital loans
- Production costs increase with "stop and start" production
- Selling inventory for cash
- $1 in losses for every $3 in sales

"State-owned banks have provided $18 billion in loans on easy terms to Chinese solar panel manufacturers, financing **an increase of more than tenfold in production capacity from 2008 to 2012.** This set off a 75 percent drop in panel prices during that period, which resulted in **losses to Chinese companies of as much as $1 for every $3 in sales** last year."

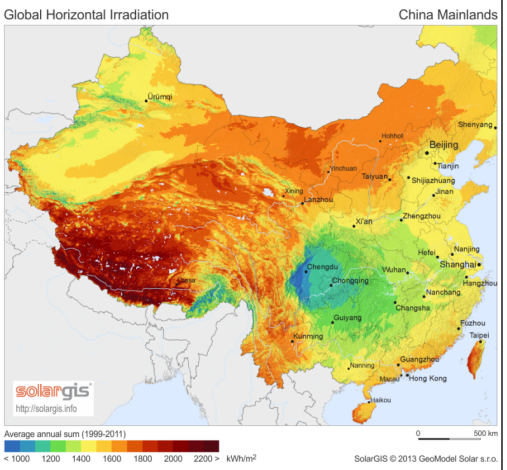
# China Conclusion

Bet big on Si-PV.

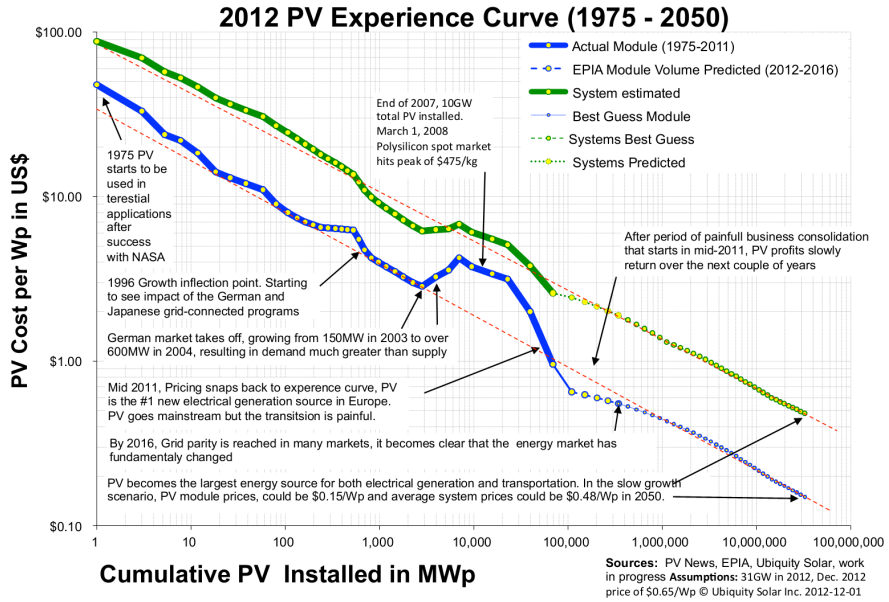
Consolidation needs to happen

Local municipalities fighting to keep plants open

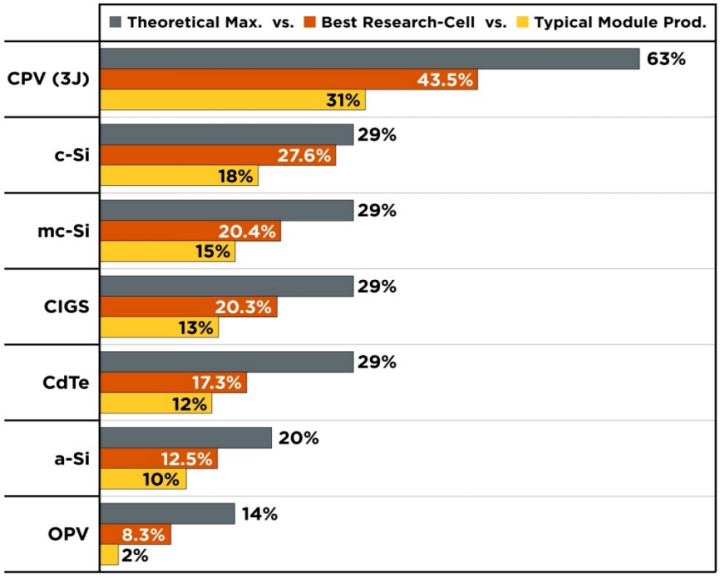
Low prices are here to stay



# Cheap Solar – The New Normal



# Alternatives to Conventional PV

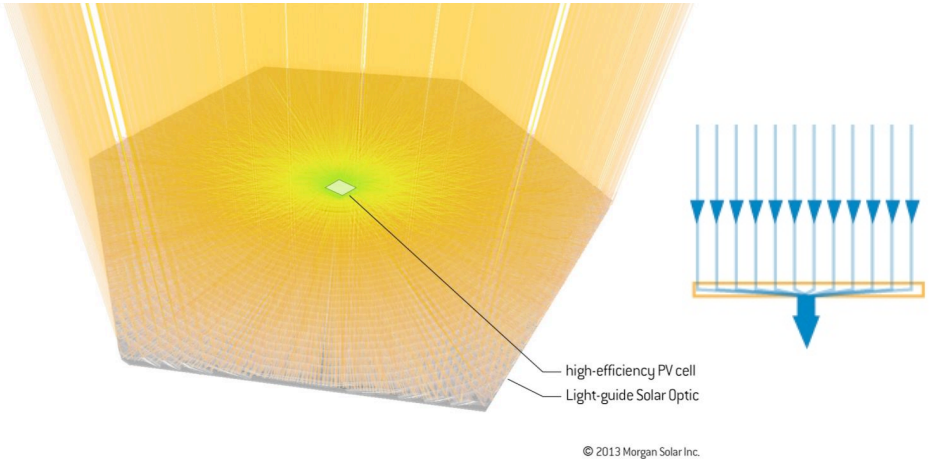



Source: NREL

sunsimba™

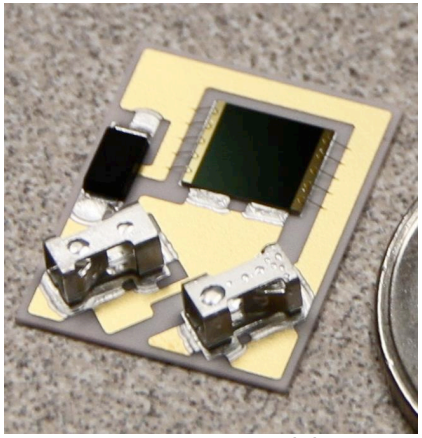
# Sun Simba™

## *How it works*




The Light-guide based Sun Simba™: a thin, low cost plastic disc, 230 mm in diameter, that captures sunlight and funnels it to a 5 mm sq. PV cell.

## High Efficiency Multi-junction Cells



5 mm Boeing-Spectrolab III-V Cell

- Multi-junction (III-V cells), developed in 1980's for space applications
- Made using standard LED manufacturing equipment
- Much better thermal performance than silicon or thin films
- Potential efficiency of 60%, in clear development path
- Multiple high quality vendors including Boeing-Spectrolab

**III-V Cells > 41% efficiency**
**Proven, reliable technology**

MOCVD = **metalorganic chemical vapour deposition**

**30% Efficient Panels**

**Costs up to 50% lower than sum-of-best practice Si-PV**

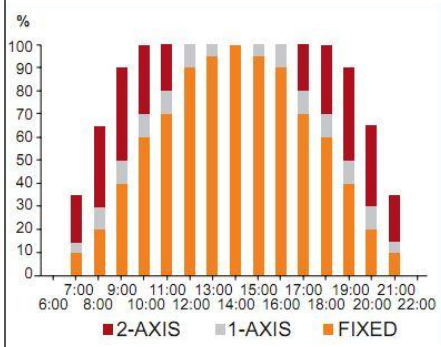
**10X Lower Manufacturing Capex**

**Much Higher Performance in High DNI Locations**

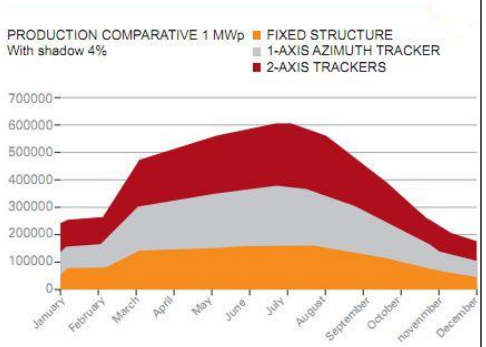

- A good CPV panel is only the beginning. You have to have a successful system and that includes a low cost tracker that can also help you reduce the balance of system costs
- Morgan Solar developed the Savanna tracker after buying and testing various commercially available tracker which prove to be, costly, inaccurate, mechanically unreliable and expensive to install and maintain.
- The patented Savanna tracker was designed to be:
    - The lowest installed and operating cost tracker on the market. To have low costs it is imperative to eliminate expensive EPC costs from solar installations, and the works associated with foundations or piling, and field installed wiring.
    - The Savanna tracker uses highly-reliable motors and gear boxes that have millions of hours of accumulated field life, widely employed in heliostat tracking. We have the supply chain and contract manufacturers in China already in place and are starting to manufacture trackers in large quantities.
    - The trackers come pre-wired from the factory, reducing expensive field electrical work and as such reducing the BOS costs.
    - The tracker is self-ballasted, as I said, it requires no concrete foundations, ground screws or any form of civil construction for its installation.
    - It is human heights – a person standing on the ground can install the tracker, clean the panels and do any maintenance that could be eventually needed.
    - Spacers between trackers provide strength for the network of trackers to mutually ballast each other and these interconnection arms also act as conduit for cabling, reducing the BOS costs.
    - The system is design to perform in 35 mph winds but it has been field tested in winds gusting up to 50 mph while it continues to operate. In stow mode it can sustain hurricane winds of 120 mph.

# Why Tracking Matters

## Daily Production




## Annual




Source: Meca Solar

**Dual-axis tracking generates 25 – 40% more power per year depending on location. (*Source*: NREL)**

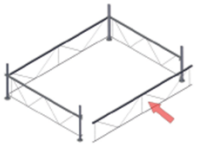
# The Savanna Tracker



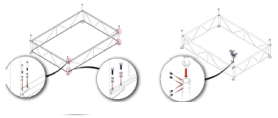

- A self-ballasted tracker that can compete with the cost of fixed racks PV installations.
- Uses low cost stepper motors and gear boxes.
- Trackers are light enough to be installed in minutes by 4 people using simple hand tools.

# Simple, Low Cost, Rapid Deployment

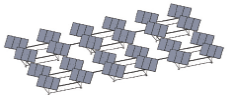
1. UNCRATE AND UNFOLD BOX FRAME:
Packed tightly for shipment, the tracker frame arrives in a crate and is quickly unfolded into a self-ballasted rectangular box frame. No concrete foundations required.



2. ASSEMBLE THE BOX FRAME:
The pre-wired, assembled box frame is bolted together and fixed in place using simple hand tools.



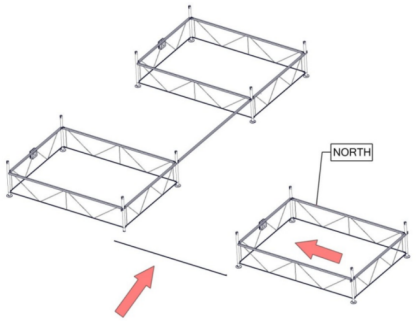
3. MOUNT THE TRACKING ARMATURES:
Armatures are inserted by hand into a post at each corner. The entire Savanna™ tracker can be set up by two installers in approximately 15 minutes.



4. POPULATE THE FIELD:
Savanna™ is a simple, repeatable unit that is easily scaled to any field size. Additional box frames are positioned parallel to existing trackers, and an interconnecting member placed between the two northernmost frame walls.

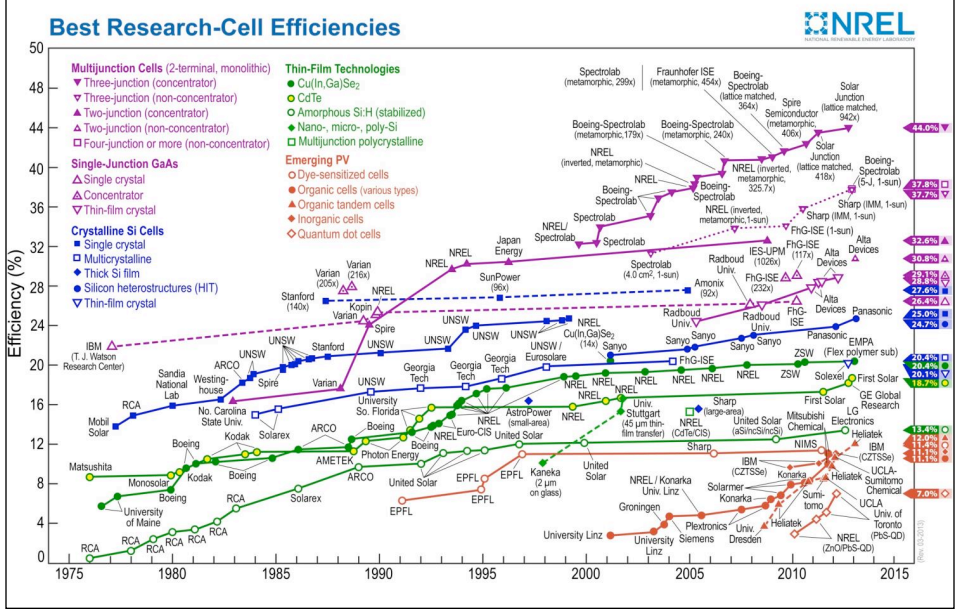

- Self-ballasted – no concrete foundations or ground screws.
- Pre-wired.
- Can be installed using mostly non-skilled labor.
- No heavy equipment or specialized tools.
- Can be quickly re-deployed at low cost.
- Minimal site preparation required.

# Stable and Wind Resistant




- Spacers between trackers ensure proper spacing and simple installation.
- Trackers are interconnected to mutually ballast each other.
- System is design to perform in 35 mph winds, tested in stronger winds with gusts up to 50 mph.
- Additional wind resistance features easily added in field where needed.

# Innovation in PV



## Solar Innovation

Images removed: Manually wirebonding cells at a SunTech vs automated processes


**BOS Components**

Queen Street SOLAR Co-operative

**Innovative Financing**

# CanSIA Innovation Advisory Council

**CanSIA Solar Electricity Innovation Steering Committee (SEISC)**

| | |
|---|---|
| **Ian MacLellan (Chairman)** | President and CEO, Ubiquity Solar Inc. Waterloo |
| **Wes Johnston, (Secretary)** | Director of Policy and Research, CanSIA, Ottawa |
| **Jan Dressal** | President and CEO, Sparq Systems Inc., Kingston |
| **John Gorman (ex officio)** | President of CanSIA, Ottawa |
| **Milfred Hammerbacher** | President and CEO, s2e Technologies Inc., Waterloo |
| **Rafael Kleiman** | Professor, McMaster University, Scientific Director, NSERC PV Innovation Network, Hamilton |
| **Kathrin Ohle** | Principal, twig energy inc., Toronto |
| **Andrew Parkes** | KPMG, LLP, Global Infrastructure Advisory, Toronto Office |
| **Siva Sivoththaman** | Professor, University of Waterloo, Director of the Centre for PV Systems and Devices, Waterloo |

**CanSIA Solar Electricity Innovation Advisor Group (IAG)**

## Challenges to Solar Innovation

- Price expectations are being set companies dumping inventory below cost.
  - **But prices will stay low and get lower!**
- Start up & operating capital funding is scarce and expensive .

**Bankability! Financing 20 year projects with 2-3 years of test data.**

Thought about just having the word “Bankability” in the middle of the page.
India example of the impacts of dumping on domestic manufacturing market.

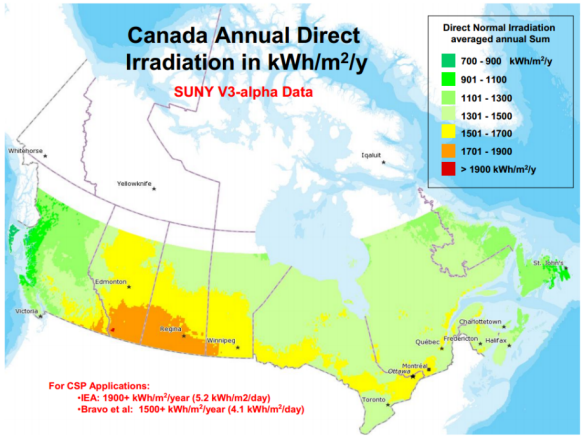
## What is Canada doing right?

**Federal**

- IRAP
- SR&ED
- MITACS
- SDTC
- EDC

**Ontario**

- IDF
- OCE
- MaRS DD




Source: NR CAN

Plus the Ontario FIT program, and university level research funding.

NRCan Sci & Tech Internship Program
DFAIT Going Global Innovation
ECO Canada Youth Internship Program

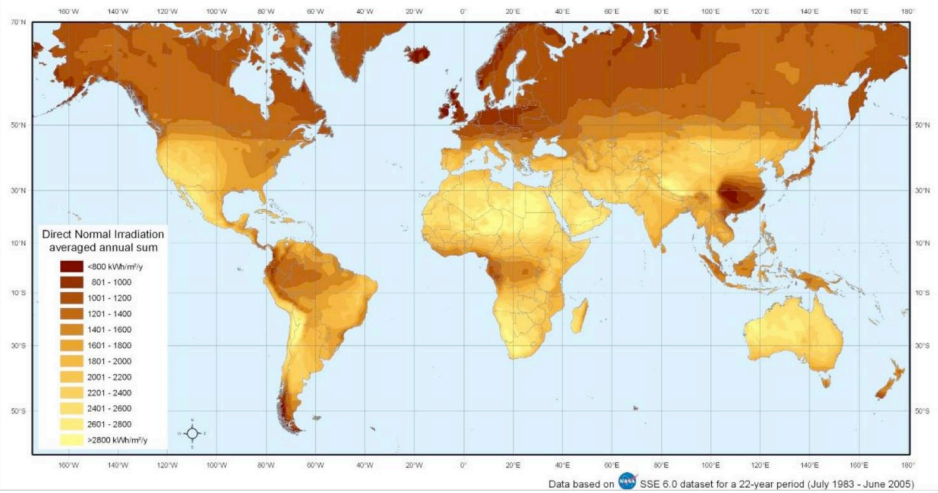
## Where is Canada getting it wrong?

- Ontario FIT: Innovation need not apply!
- Other provinces not following Ontario's lead
- Where is Canada's National Solar Energy Policy?
- Canadian Banks not getting involved (**at all!**)
- Canadian investment community is under-developed.
- People think too locally

**"Canadians don't know how to scale**

Ontario FIT: Carve out for local innovation? Local content was designed to promote Ontario jobs, but ended up hindering Ontario innovation.

## Solar MUST BE an Export Market




- Germany is still dominates the global solar market.
- Emerging markets are an untapped, rapidly growing market

- India has less power generation than Canada.
- Saudi Arabia developing 40 GW!
- Diesel electricity is 3 times more expensive than solar.
- MENA to develop 1 GW in 2013 – 625% increase from 2012nt was designed to promote Ontario jobs, but ended up hindering Ontario innovation.

## What's needed?

- **National Solar Energy Strategy**
  - Strong innovation focus
  - Other Provinces need to get involved
  - CanSIA Solar Electricity Innovation Steering Committee (SEISC) showing leadership
  - Strong export focus
- Canadian banks to start taking renewable energy seriously; funding projects
- Continued and expanded support for entrepreneurs and researchers

# Thanks

Nicolas Morgan
VP Business Development, Morgan Solar Inc.
n@morgansolar.com / +1-416-203-1655

morgansolar