Fjord Perspective on Solar

Challenges in Mainstream vs. Opportunities in Value Chain

Ivan Zyuzin, CFA

Contents

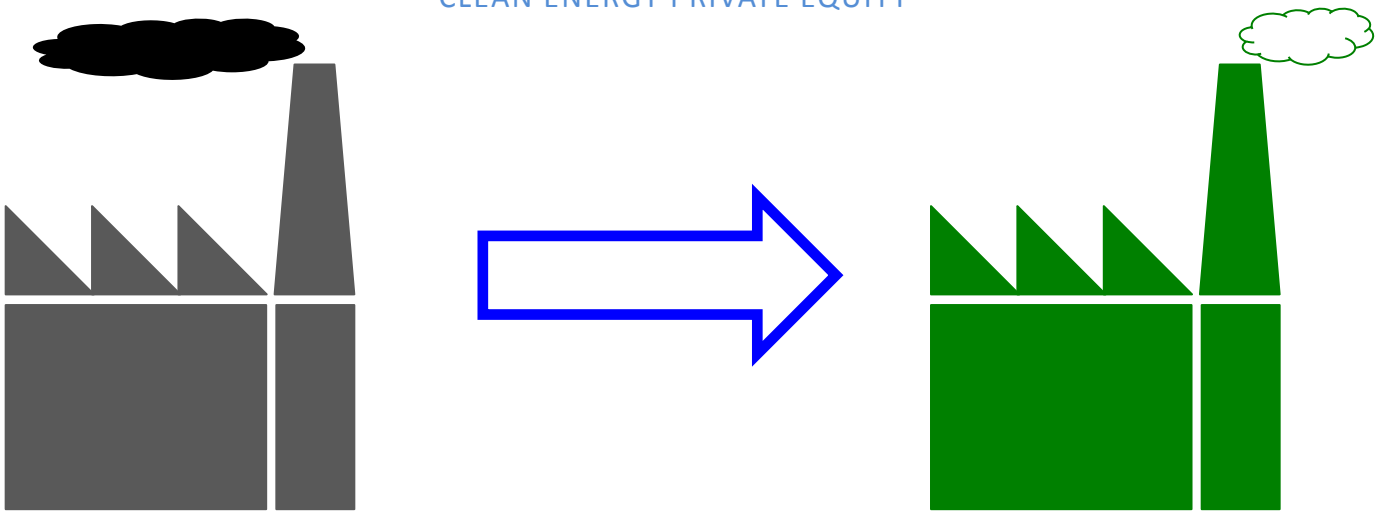
Overview of Fjord

What Fjord Does…

Fjord grows clean technology companies that impact industries

fjord

CLEAN ENERGY PRIVATE EQUITY

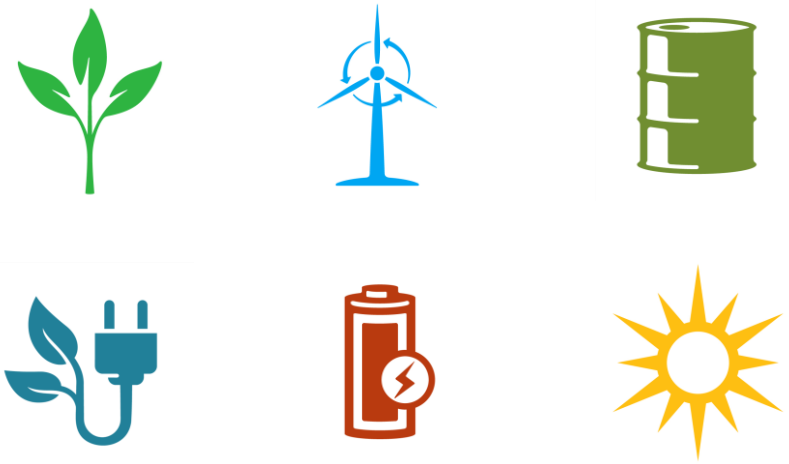


1 Overview of Fjord

Fjord Definitions…

At Fjord "clean energy" means:

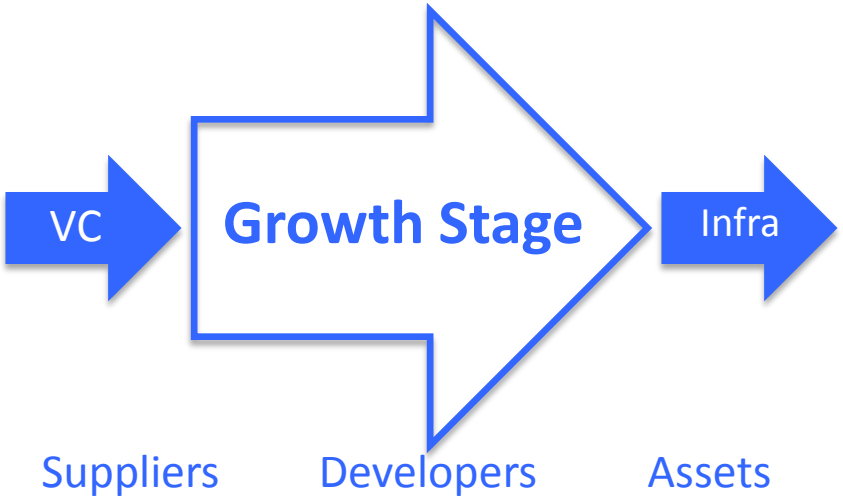
- lower carbon/renewable, i.e. reduced carbon output per unit of energy used/generated
- energy efficiency, i.e. reduced energy usage per unit of output



…and "private equity" means:

- growth stage, i.e. proven technologies ready for commercial expansion

Fjord has the experience to recognize which companies have developed technology to the point that it can be commercialized; the network that enables us to source those deals; and the skills to help those companies grow successfully.



1 Overview of Fjord

What Fjord Does: Examples

Industry	Solution	Investment
Utilities (RWE, EON)	**Renewables**	Iberwind Natural Efficiency
Automotive (Daimler, Toyota)	**Electric vehicles**	Tesla
Chemical, Oil & Gas (DSM, DuPont, Statoil)	**Biorefinery**	BioGasol
Utilities (EGP, A2A)	**Integrated CHPs**	Futuris
Oil & Gas (Gazprom, Saudi Aramco)	**Biorefinery**	Joule™
Turbines (Siemens, Air Liquide)	**Efficiency**	Fluitec
Engines (Bosch, Honeywell)	**Efficiency**	Bowman Energy Recovery Systems

2 Fjord Perspective on Solar

Pipeline overview

	Lead	Active	BackBurn	Closed	Invested	Exited	Total
Battery	1	1		7			9
Bio - gas	1		1	7			9
Bio - h&p	2	1		11	1		15
Bio - pellets				12			12
Bio - refinery	1		1	9	2		13
Carbon				13		1	14
Efficiency	2	1	1	9	2		15
EV	1		1	6		1	9
Geothermal				6			6
Hydro				12			12
Marine - Tide	2			6			8
Marine - Wave				4			4
Nuclear				1			1
Other		2	2	10			14
SmartGrid			2	8			10
Solar - Cryst			2	42			44
Solar - CSP				10			10
Solar - ThFi			1	25			26
Solar - Therm			1	1			2
Waste	3	1		11			15
Water				7			7
Wind - Off	1		1	8			10
Wind - On			2	49	1		53
Grand Total	14	6	15	274	6	2	317

- 82 opportunities out of 317 over 2009-2011. ~26% of piepline
- Majority in “growth capital” situation, not venture or infrastructure
- During the same period, a lot of investors lost money in solar, but the market has grown impressively!
- A lot of growth driven by decreasing module prices
- How professional investor could support this growth story?

3 Fjord Perspective on Solar

Case #1

Integrated Solar – Thermal developer

Project
- Solar – Thermal Developer
- Management Change

Key Elements
- Full integration from design to deployment
- Specific issues with interim management change

Conclusion
- **Solar Thermal is becoming less competitive as PV cost drops**
- **Limited to niche applications**
- **Gigantic project – difficult financing**

Investment Case
• Exeprienced provider (development, engineering, construction) of solar thermal plants (CSP) with technology and execution experience as well as a significant pipeline of projects globally • Operational problems have caused significant disruption and company requires management support (CEO resigned, new management announced, currently de facto no leadership) • New management interested in taking in a strong cornerstone shareholder through a private capital increase with certain agreed level of operational control. • Assuming realisation of part of the pipeline and return to profitability, the company is valued at attractive multiples of 4-6x 2011 EBIT and <1x Sales and are a reflection of the public market's frustration of the company's erratic performance
Business Overview
Fully integrated provider of solar thermal plants. The company has developed and is specialised in parabolic technology incl salt. storage. The business is split into: • Development and financing: Company has successfully developed sites , but given the size of plants , funding is crucial and has built up certain competence (eg. tapping retail) • Technology and construction: owns parabolic trough technology and acts as EPC for projects • Power plant investments: management of resulting minorities in power plants

3 Fjord Perspective on Solar

Case #2

European PV cell manufacturer

Project
- European PV cell manufacturer
- Looking for expansion capital

Key Elements
- EBITDA-positive
- Squeezed margins
- Strategic change

Conclusion
- Getting outbid by competition from Asia
- Risky strategic repositioning maneuver

Investment Case
• Cost-leader EU-producer marginally more expensive that Chinese competitors • Plan is to acquire fully permitted projects and then hire an EPC to construct the plant. Once constructed aim would be to sell fully constructed projects to investors. • Strategic goal to move into the construction portion of the solar value chain. Source fully permitted projects and use own modules from the plant to construct projects and then once fully constructed sell them onto investors. They would outsource the EPC portion of the work.
Business Overview
• Significant European PV manufacturer successfully competing for cost-leadership in commoditized sectors and considering downstream integration and expansion plans • Availability of project finance Facility, which provides guarantee for 80% of order as payment from customer. Thus 20% is then obtained directly from customers. Financing is provided for a period of 2 years. Discussions to them to extend this for 18 years. The premium charged is based on counter party risk, business sector risk and customer risk.

3 Fjord Perspective on Solar

Case #3

PV-process recycling solution provider

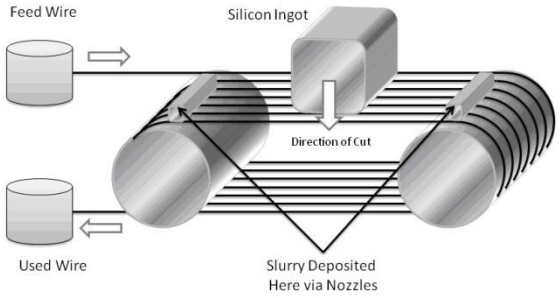
Project
- European PV-process by-product recycling
- Expansion capital needed

Key Elements
- Triple-digit revenue growth
- In-house patented technology
- Asia expansion

Conclusion
- Undermining effect of technology from another unrelated sector
- Unrealistic expectations

Investment Case
• Restructuring case for industrial and fast-growing application of value-enhancing supplemental technology in solar PV value-chain • Opportunity to drive strategic change and leverage on Fjord network to support growth in Asia

Business Overview
• Industrial process recycling, processing silicon carbide and glycol from spent slurry during ingot cutting • In-house development combination of mechanical and chemical treatment processes, offering higher yields



4 Opportunities in Value Chain

Defendable solution to a critical industry component

Integrated Inverters provider

Name	[Integrated Inverters]
Status	Investment Review
Industry	Solar Inverters
Geography	North America
Stage	Growth Capital (Operating business with revenues)
Investment Thesis	• Parallel solar technology is an attractive market segment • Invest in proven parallel inverter company to support operational growth phase • Exit envisaged via a trade sale (short term) or ramp-up

Business	• Parallel technology provides the following benefits:
	  ○ Ability to connect solar panels in 'Parallel' vs 'Serial' helps draw more power from panels
	  ○ Increased safety due to lower voltage.
	• Micro-inverters are the current alternative, but at a much higher cost
	• As a result, focus is on smaller systems ie. roof, building-integrated etc. which is generally less affected by FiT cuts
	• Offer same-cost alternative to existing inverters with a different wiring method:
	  ○ Technology developed for advanced fuel cell technology, now being applied for solar market; barriers to entry are higher (protected by IP)
	• Suffered due to supply chain issues that prevented them from fulfilling orders. These have been worked out (critical ones solved), and they require additional funding to strengthen balance sheet
	• Capital light model - as production is outsourced to various companies

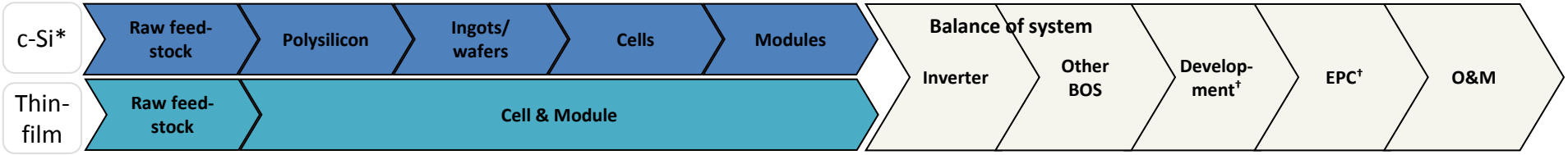
Name	[Integrated Inverters]
Exit Options	• Trade Sale to electrical component manufacturer (Schneider, GE, Siemens) ; or other solar value chain player (Enphase, SMA)
Target Return	2.0 – 2.5x in 2 years
Competitive Advantage	• Technical and cost advantage present (conversations with installers and partners) and defendable
Execution considerations	• Board is strengthened by top-tier venture investors • Favorable investment terms, due to clear Fjord value added and alignment of interests
Angle for Fjord	• Proven technology with a visible competitive advantage • Company requires growth support to achieve the next level of development (capital and operational roll-out) • Fjord can help with strategy, management and operational support as well as access to EU markets. • Company is facing a ramp up, and has faltered in the past. Help will be welcomed to support current team that is in place
Risks	Operating / Execution Risks • Continued operational problems and inability to fill orders due to long lead times • Potential reputational problems with distributors as a result Business Model Risks • Fully outsourced production subject to supply chain management issues Market Risks • European market harder to break into due to incumbent players and required distribution power

Strong investment case:

- Clear product offering: solution for industrial application
- Defendable proposition, clear value added and reasonable expectations

4 Opportunities in value chain

Missing link – reviewing the value chain



#	<10	~200	>150	>200 c-Si, >200 TF	>500	<100	200	>1000	~200	??
Common themes	Commoditised, supplied by large diversified metallurgical groups and gas suppliers.	Only 5 Tier 1 companies with significant cost-advantages over new entrants. Bottleneck of the PV industry between 2004 and 2008.	Most wafers are cut by integrated PV companies, but there exist a small number of specialised wafer manufacturers. Tolling agreements are a common practise in this part of the value chain.	Strong margin pressure is driving consolidation and increasing scale in this segment of the value chain. Becoming more and more a commodity product.	Module manufacturing is still very fragmented with many small manufacturers. There is a case to be made for locally produced modules, but generally, facing the same commoditisation trend than cells.	Strongly tiered, with a few number of manufacturers supplying the great majority of the PV industry. Either specialists or diversified electronic companies.	Either commoditised electronic products such as cables and charge controllers or mounting systems requiring no IP. Trackers/ mounting often done in-house by EPC	VERY fragmented as PV projects are small and require little initial capital outlay. Biggest value added are local contacts, difficulties in accessing finance is driving consolidation.	PV is still too small for big EPC companies to show strong commitment. Great variety of business models. Very fragmented, in residential sector (>1000 companies)	Represents a fraction of project cost (1-1.5% of capex/year) – mostly related to the cost of replacing the inverter. Mostly done in-house by EPC company/ inverter manufacturer

Consider

- Continuous decline in PV silicon and PV module costs
- Overcapacity
- Shift in supply (already) and demand (soon) to Asia

Question

- Who can protect margins?
- Right and wrong period of the cycle?

Source: Bloomberg New Energy Finance

Contact

Thank you!

Please do not hesitate to contact us to discuss further:

Ivan Zyuzin
Associate
+44.79.08558825, +7.916.8276521
Ivan.Zyuzin@fjordcap.com

info@fjordcap.com
www.fjordcap.com