APRICUM

THE CLEANTECH ADVISORY.

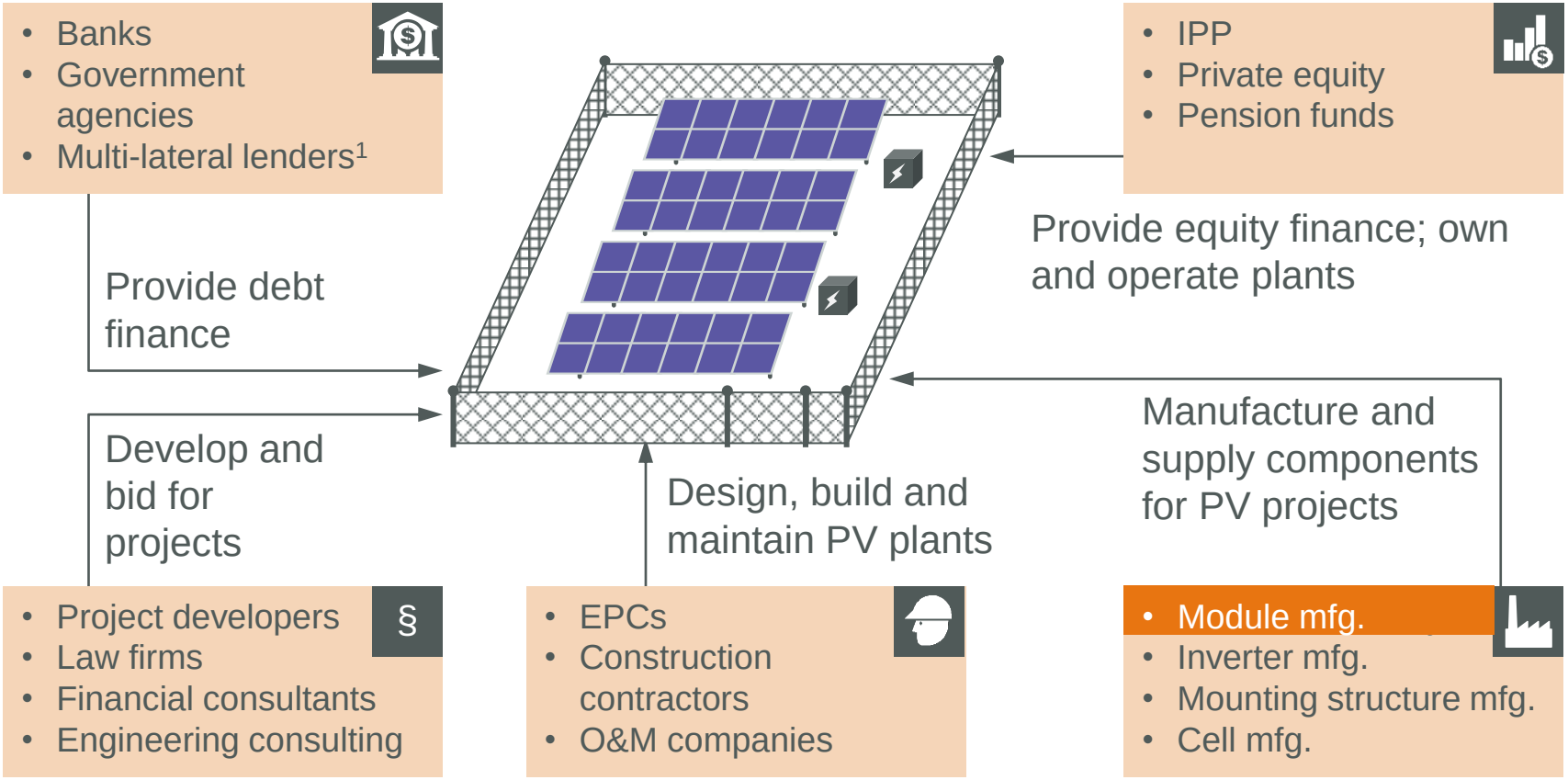
Case Study: PV Module Manufacturing in Saudi Arabia

September 18, 2014

Desert Solar Saudi Arabia, Riyadh

PV power generation provides an array of business opportunities for new entrants, incl. module manufacturing.

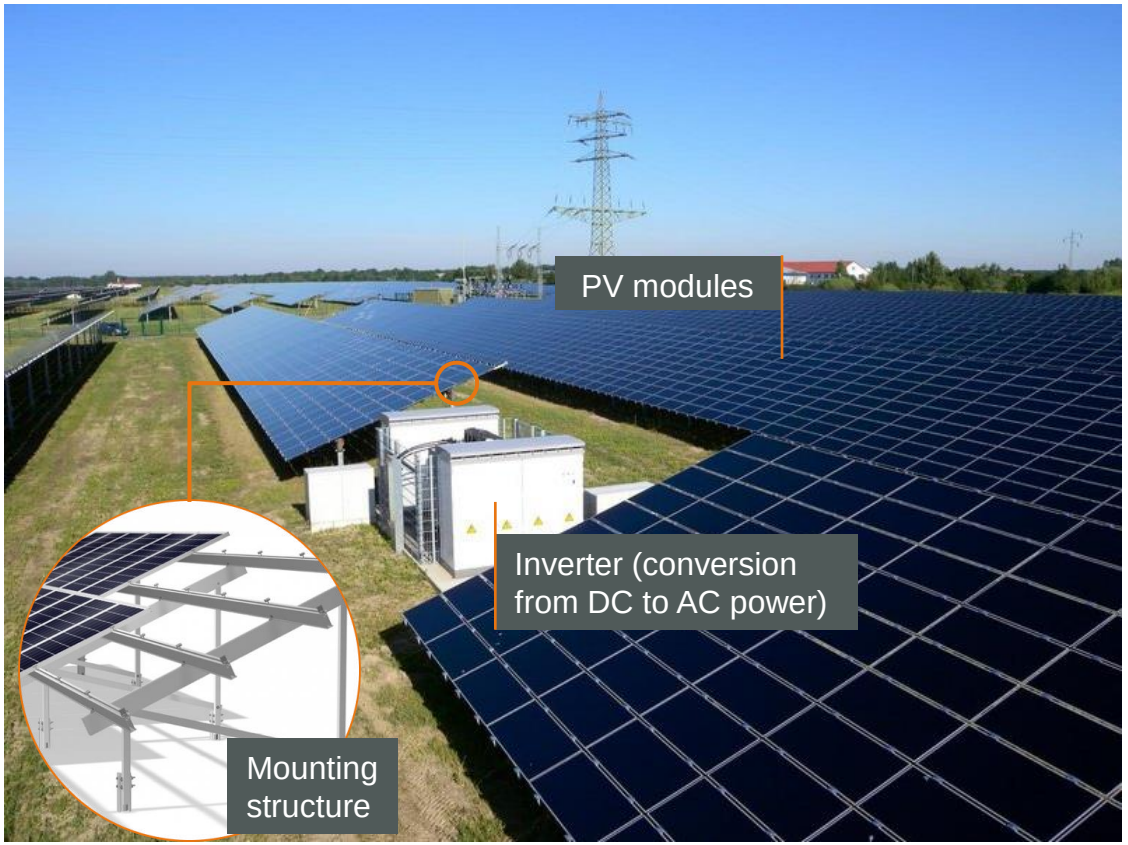
Business opportunities associated with PV power (exemplary)



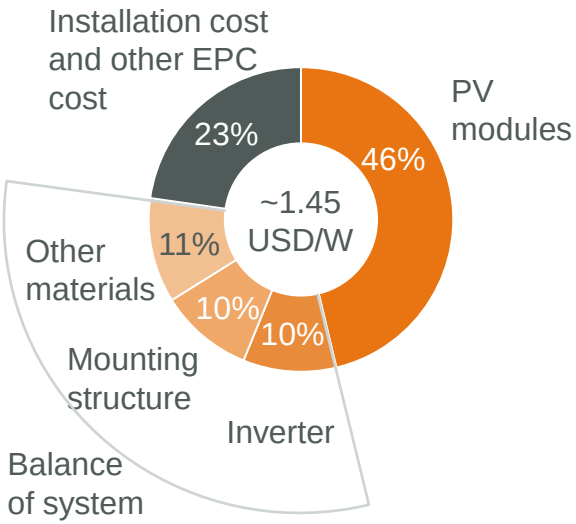
1) E.g., International Monetary Fund, European Bank of Reconstruction Development, etc. (will not be active in high-income countries)

PV modules account for almost 50% of system costs – is module assembly a feasible business in Saudi Arabia?

PV power plant components



Exemplary cost breakdown for utility-scale PV plant[1] in Saudi Arabia



Balance of system (BOS) defines all other components except the module: Inverter, mounting structure, cables, etc.

Source: Apricum cost model Q2/2014, 1) EPC price only, no development cost, land cost etc.

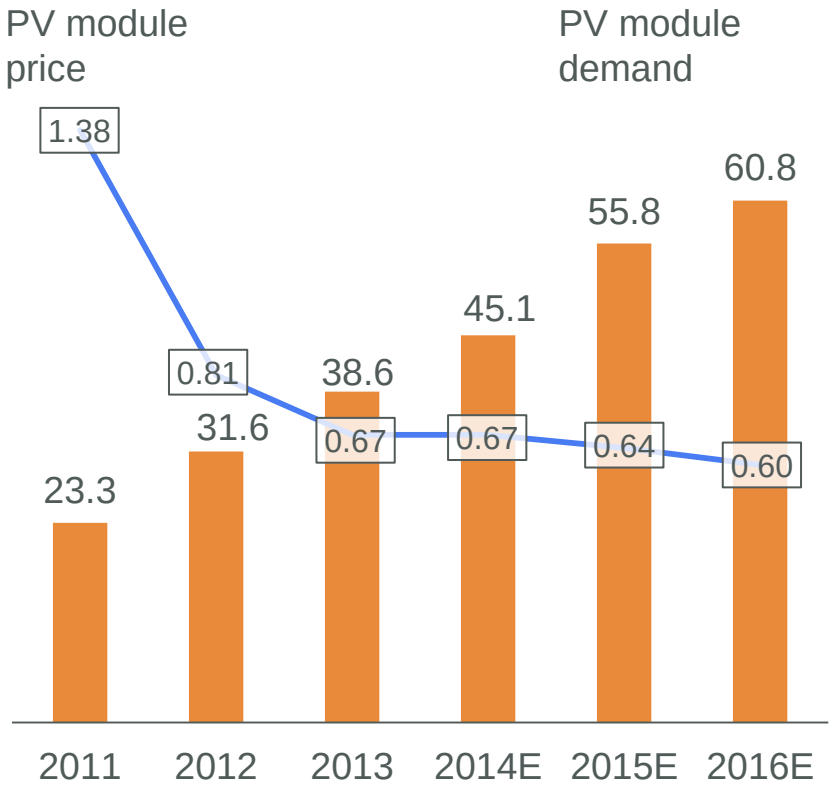
Feasibility of PV module manufacturing in KSA is determined by the market, competition and the entry strategy.

Selected key questions regarding potential entry into PV manufacturing in Saudi Arabia

1. The market	How large will the market be? Is the market sustainable?
2. The competition	Can we achieve a competitive advantage compared with foreign (Asian) manufacturers?
3. The entry strategy	Stand-alone vs. partnering, technology, risk mitigation – what is the most successful entry strategy?

Global PV market will continue to grow due to fast growing energy demand and increasing cost-competitiveness of PV.

Global annual PV demand [GW]



Key global PV demand drivers

- \+ Globally growing energy demand, particularly in emerging countries
- \+ Government pursuit of energy security and depleting fossil fuel reserves
- \+ Targets and incentives for renewable energy aimed at reducing emissions
- \+ Strong module/system price decline, resulting in economical power generating cost

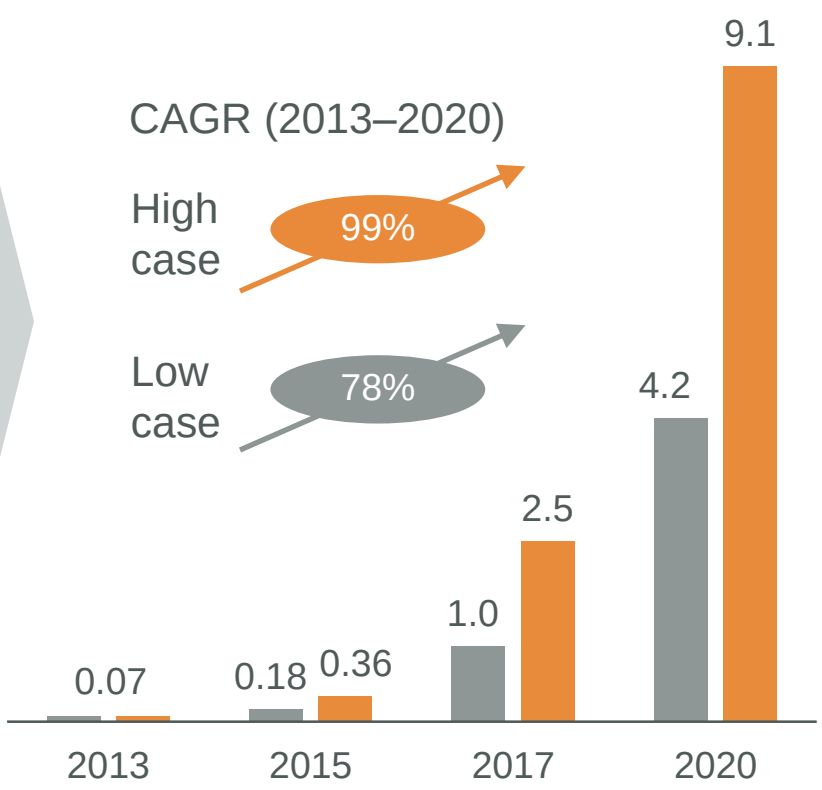
Source: Apricum market model Q2/2014, Apricum analysis

The GCC is ready for a PV boom, driven by enviable solar resources, soaring power demand and diversification goals.

Key GCC PV market drivers

- Costly oil-fired power generation, increasing demand
- Heavily oil & gas dependent economies
- Limited high-tech sector and high unemployment
- High greenhouse gas emissions
- Strong radiation => PV power generation at low cost

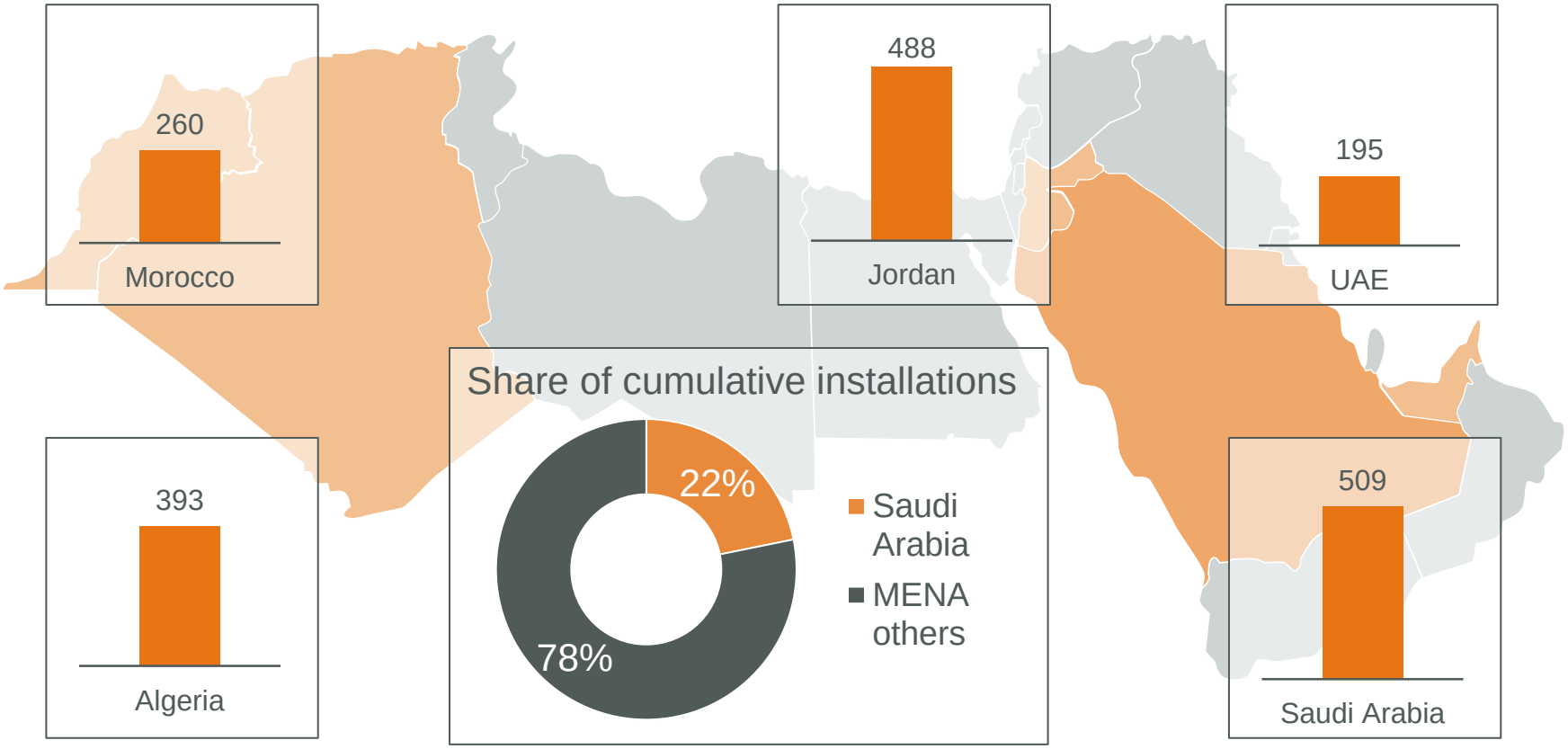
Cumulative PV installations in GCC [GW]



GCC includes Saudi Arabia, UAE, Kuwait, Qatar, Oman and Bahrain. Sources: Apricum analysis, Apricum Market Model Q2/2014

In a currently unclear Saudi market environment, numerous opportunities in the GCC and MENA should also be targeted.

Expected cumulative PV installations for selected countries in MENA region by 2016 [MW]



Source: Apricum market model Q2/2014 center scenario, MENA excluding Turkey

Cost and bankability will eventually determine the success of a PV module manufacturer.

PV module manufacturing key success factors (KSFs)

KSF 1: Cost

PV modules are commodities; therefore lower cost means higher margins

- Ability to source raw materials at low price (cells, glass, backsheets, encapsulants, etc.)
- Low utilities/labor cost
- Adequate scale of production

KSF 2: Bankability

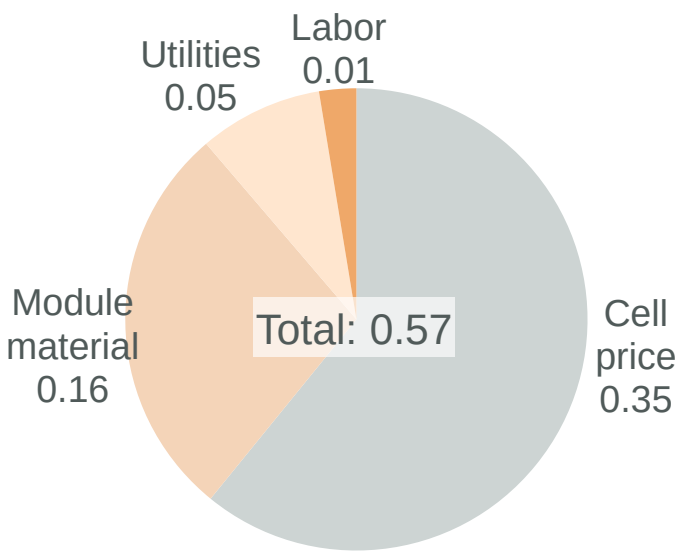
Bankability means access to large scale projects and ability to sell

- Track record
- Certifications and guarantees/warrantees
- Perceived financial stability of module manufacturer

If a manufacturer does not fully satisfy these two KSFs, it must find a reliable offtake (e.g., through internal sales, government sales, etc.) for its products while it improves its processes and seeks bankability

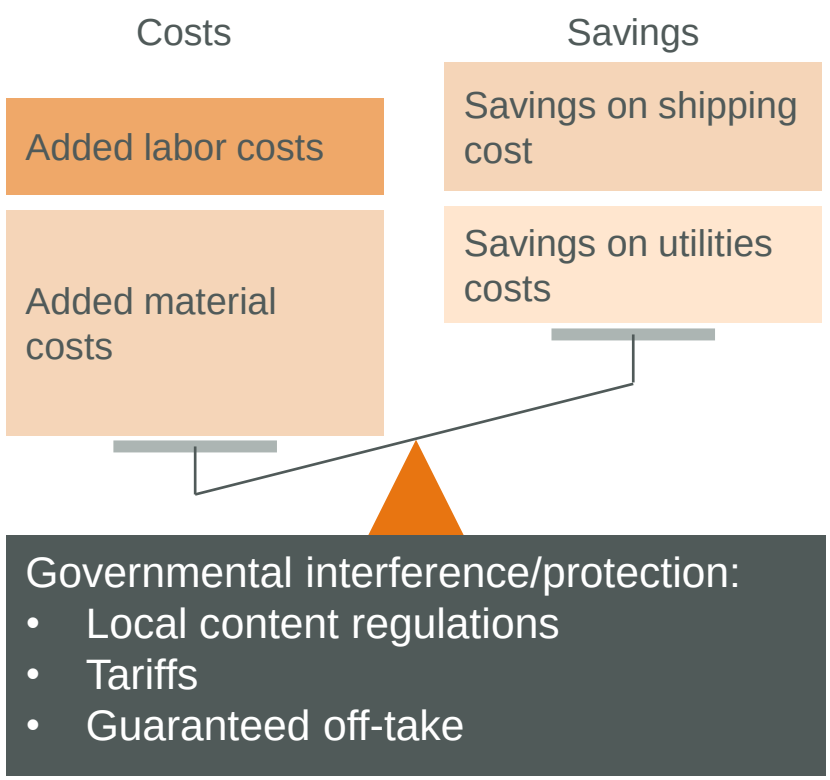
KSF 1 – Cost: Saudi government can offset cost disadvantage compared with Asian strongholds.

PV module production cost for integrated Chinese player[1] [USD/Wp]



Note: orange tones represent factors that are significantly location dependent

How does production cost stack up in KSA compared to Asia?



Source: Apricum PV price model Q2/2014; 1) Overhead, depreciation not included

KSF 2 – bankability: For utility-scale projects, banks require bankability, which needs up to three years to develop.

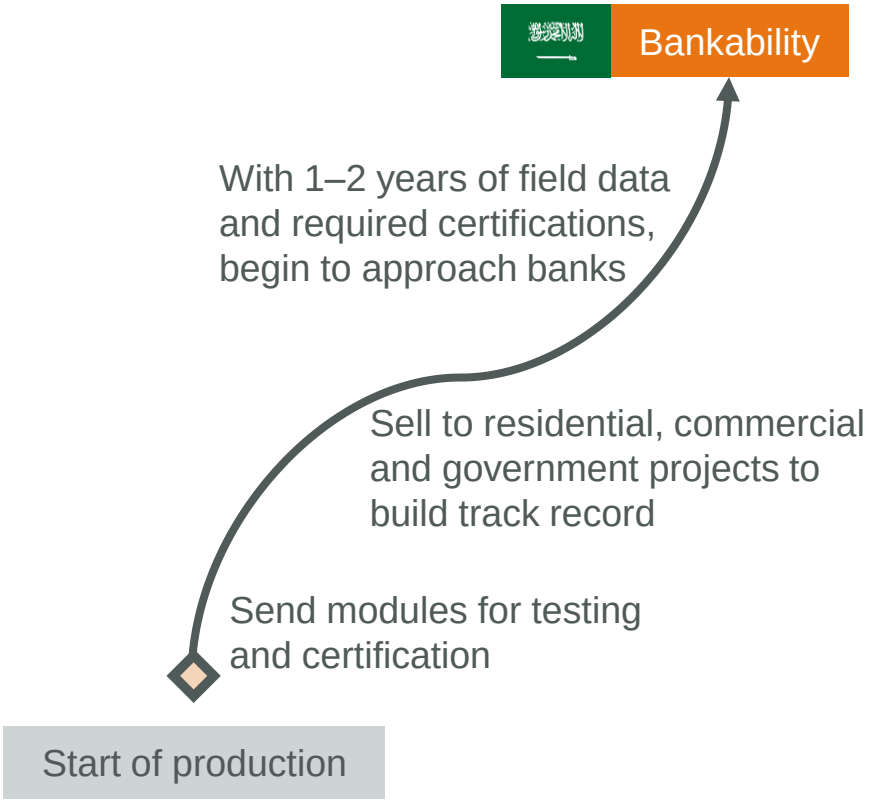
Bankability explained

Utility-scale project funding

Equity (20–30%)	Debt (70–80%)

- Banks maintain a list of PV modules for which they will provide debt financing
- To be on these lists, PV manufacturers must:
  1. have a track record of modules in the field
  2. have general (e.g., TÜV) and sometimes local certifications
  3. be perceived as financially stable

How can a Saudi PV module manufacturer achieve bankability?



Partnering with a bankable, global PV manufacturer is a quick path to the market.

Entering PV module manufacturing in Saudi Arabia

Realization on stand-alone basis

Purchase new or used PV module manufacturing equipment and begin operations independently

Pros

- Maintain complete control over business
- Create a completely independent brand

Cons

- Difficult and time-consuming to achieve bankability
- Complete reliance on manufacturing equipment supplier
- Lack of track record

Realization with a partner

Partner with a mainstream PV module manufacturer and approach the market or region together

Pros

- Bankability
- Access to partner's deep know-how
- Track record
- Access to partner's supply network (better prices)
- Access to global client base

Cons

- Reduced control over business
- Potential lack of balance between partners
- Must share in profits

Source: Apricum analysis

Apricum: Strategy consulting in the solar and wind industry.

Business	Strategy consulting and transaction advisory services
Industry focus	Renewable energy technologies, focus on solar and wind
Team	>40 experts with decade-long industry experience
Clients	Companies, investors and public institutions

Services	• Strategy development, e.g.,
	  • Value chain screening
	  • Feasibility analysis, business plan design
	• Partner/target search (MOU, JV)
	• Due diligence (comm., technical)

Locations	• HQ in Berlin, Germany • Representative offices in Brazil, China, India, Japan, Mexico, Saudi Arabia, Turkey, UK, USA

Apricum's clients comprise industrial companies, investors and public institutions from around the world.

Selected recent references

APRICUM

THE CLEANTECH ADVISORY.

Apricum GmbH
Spittelmarkt 12 | 10117 Berlin | Germany

T. +49.30.308 77 62 - 0 | F. +49.30.308 77 62 - 25
info@apricum-group.com

www.apricum-group.com