

The Future Development of the Solar Inverter, Power Optimizer & Microinverter Market

- Latest findings from IMS Research

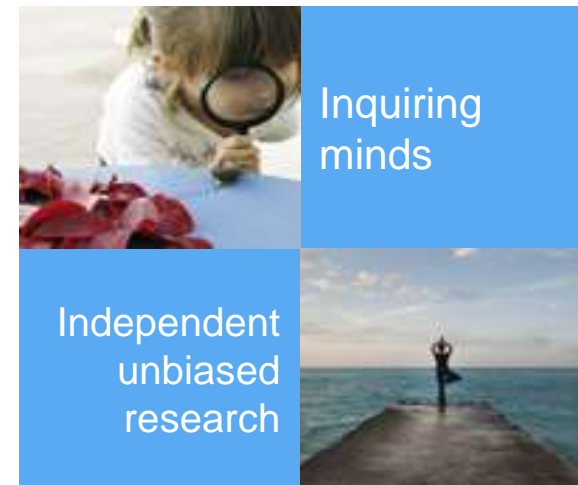
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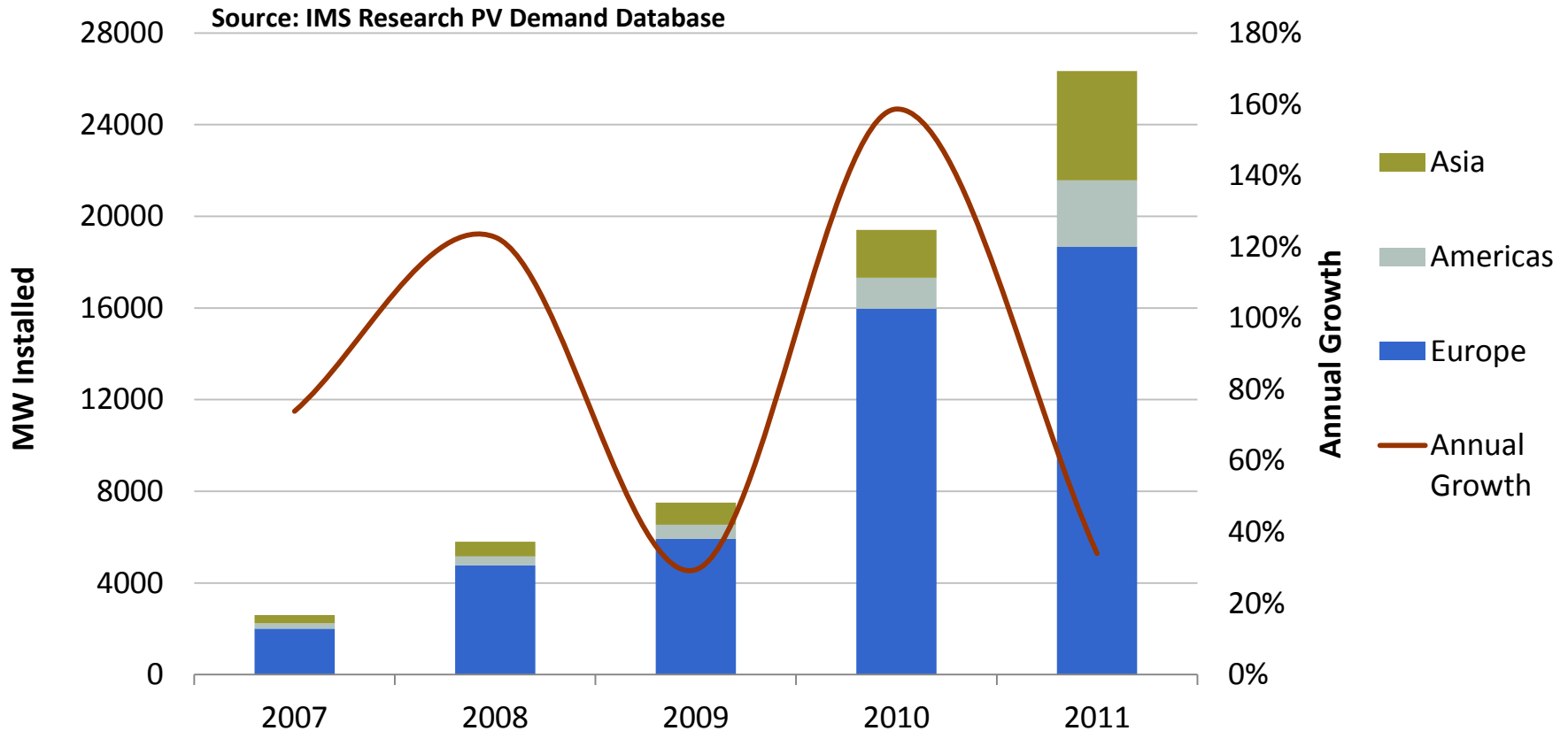


Who is IMS Research?

- Market research, business intelligence, consultancy since 1980s. Researching PV market for 6 years+
- Provides market data, forecasts, competitive benchmarking & consulting services
- 120 analysts in Europe, USA, China, Korea & Japan & 9 analysts focused on PV
- Clients include 50 top suppliers of PV inverters & publish 30+ reports each year on PV market:
 - Annual PV Inverter Market Report – Market Sizes, Pricing, Forecasts and Suppliers Shares
 - Microinverters & Power Optimizers
 - Balance of System Equipment
 - PV Inverter Customer Opinions & Requirements Survey
 - PV Demand Database
 - PV Integrators Market Shares, Pipelines & Profiles



Solar PV Demand in 2011



- Solar PV still only 1% of global electricity production
- Market still entirely incentive-driven, hence very volatile growth
- Europe accounts for 70% of installations
- USA and China becoming important demand markets

What does this mean for inverters?

	2010	2011	Change
Installations	19.4 GW	26 GW	+34%
Inverter Shipments	23 GW	26 GW	+12%
Inverter Revenues	\$6.8bn	\$6.7bn	-1%
Inverter Prices	\$0.29/W	\$0.26/W	-12%

Source: IMS Research's PV Inverter Quarterly Supply & Demand Report Q4'11

2010 – the year of inverter shortage:

- Average delivery times were 26 weeks due to component shortages (IGBTs, capacitors, micros)
- Shipments grew 180% year-on-year
- Zero channel inventory up until Q4'10
- Factory-gate prices stable, wholesaler prices massively inflated

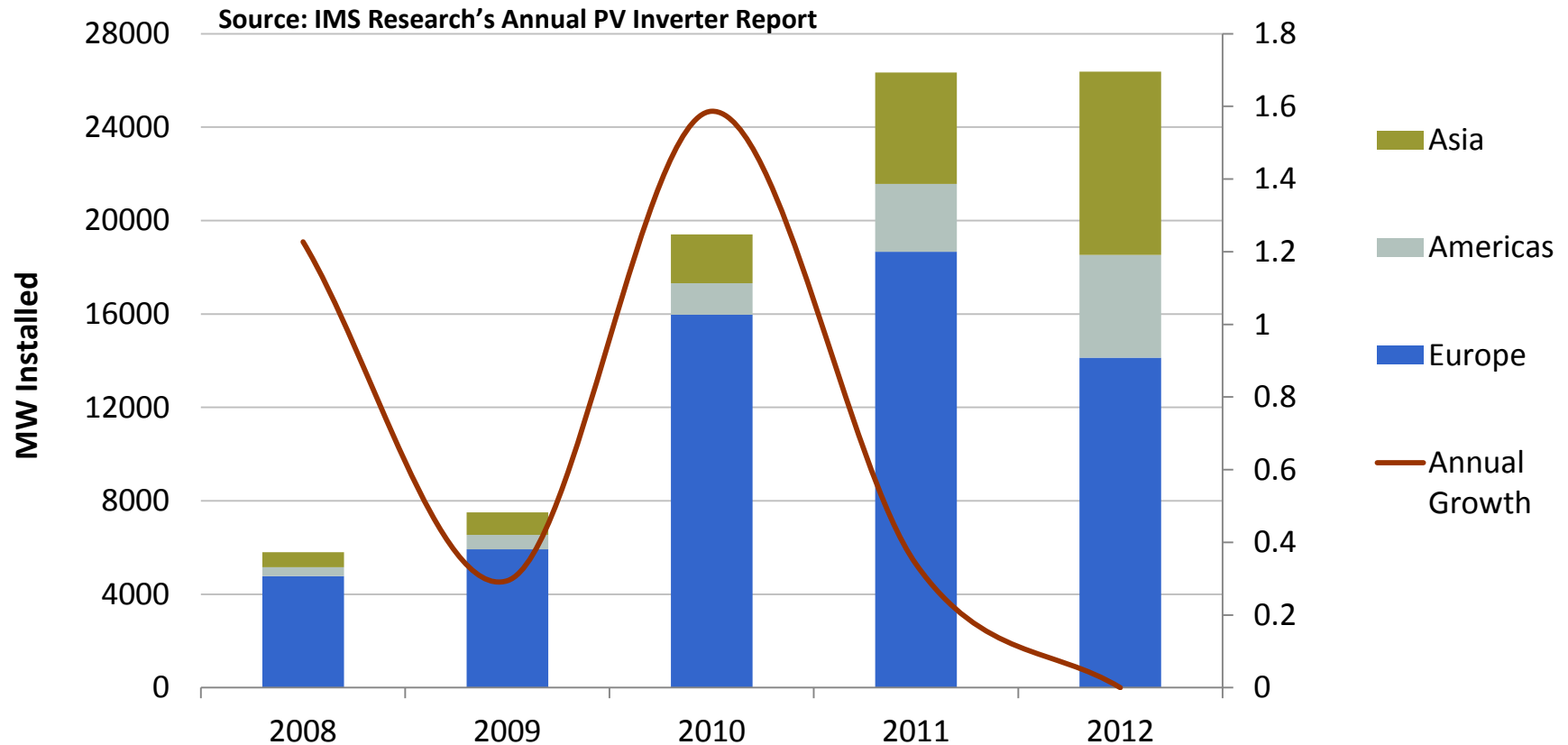
2012 – a year of oversupply or shortage

2011 – the year of inverter oversupply:

- Immediate availability
- Shipments fell by 25% in 1H
- Inventory at start of 2011 was 4 GW!
- Prices slashed throughout supply chain

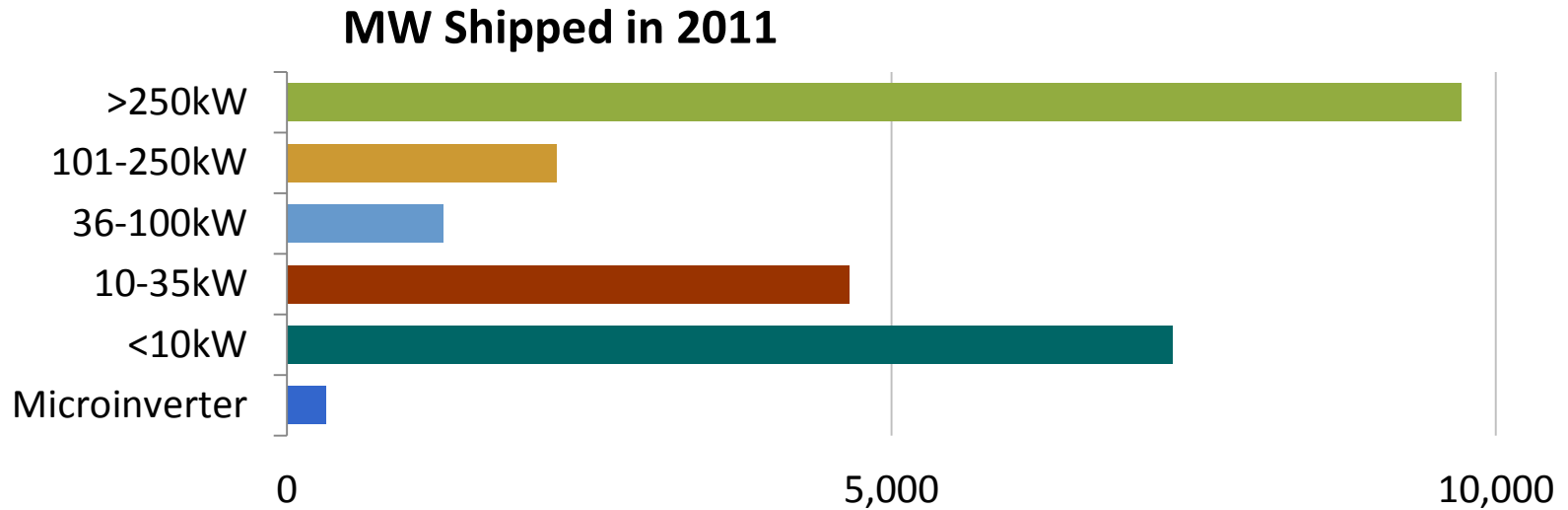


PV Inverter Demand in 2012



- Global installations stagnate in 2012; fall in Europe compensated in US/Asia
- Flat inverter shipments in 2012. Revenues 5% lower than 2011 ~ \$6.4bn
- Large quarterly fluctuations
- Upside potential still exists

Which inverters are preferred?



Source: IMS Research's 2011 PV Inverter Report – Premium Edition



String – 46%

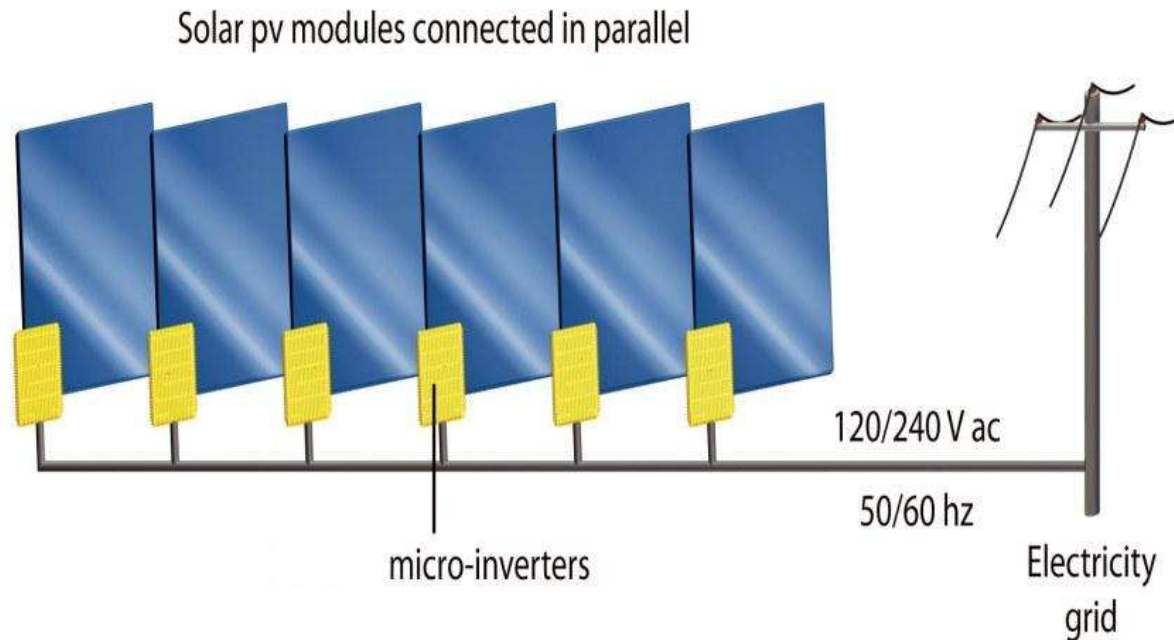


Central – 53%



Microinverter – 1%

- Convert DC>AC at panel level, using ~200W inverters
- Combat shading & panel degradation as poor performance of one panel doesn't bring down whole system performance



Pros

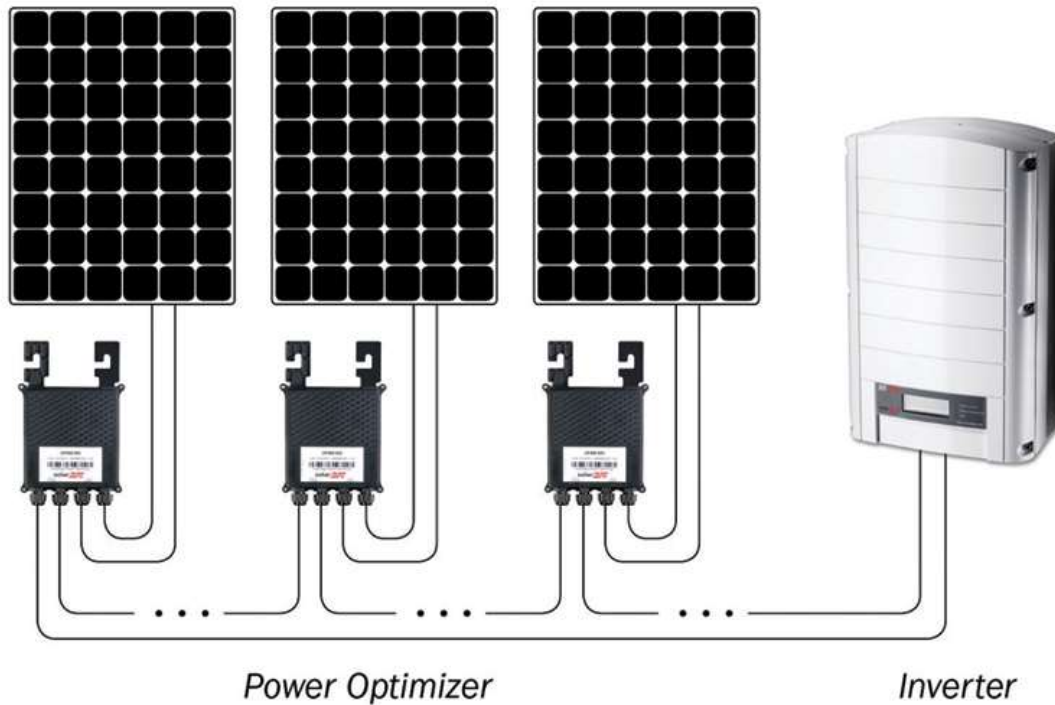
- Higher energy yields – one poor panel doesn't reduce whole system performance
- Provides enhanced monitoring (at a panel level)
- Remove single point of failure of central inverter
- Better safety and remote shutdown



Cons

- But... comes at a higher price (more than 2x)
- Good uptake in USA, but installers in Europe reluctant to use. Concerns over reliability.
- No single point of failure – but more electronics that could fail
- To date only sold by start-ups (e.g. Enphase) inhibited adoption. But market leader, SMA has released a microinverter...

- DC-DC optimization of each panel (or string), but still uses a central inverter
- Similar benefits to microinverters, but more traditional architecture means potentially easier adoption



Pros

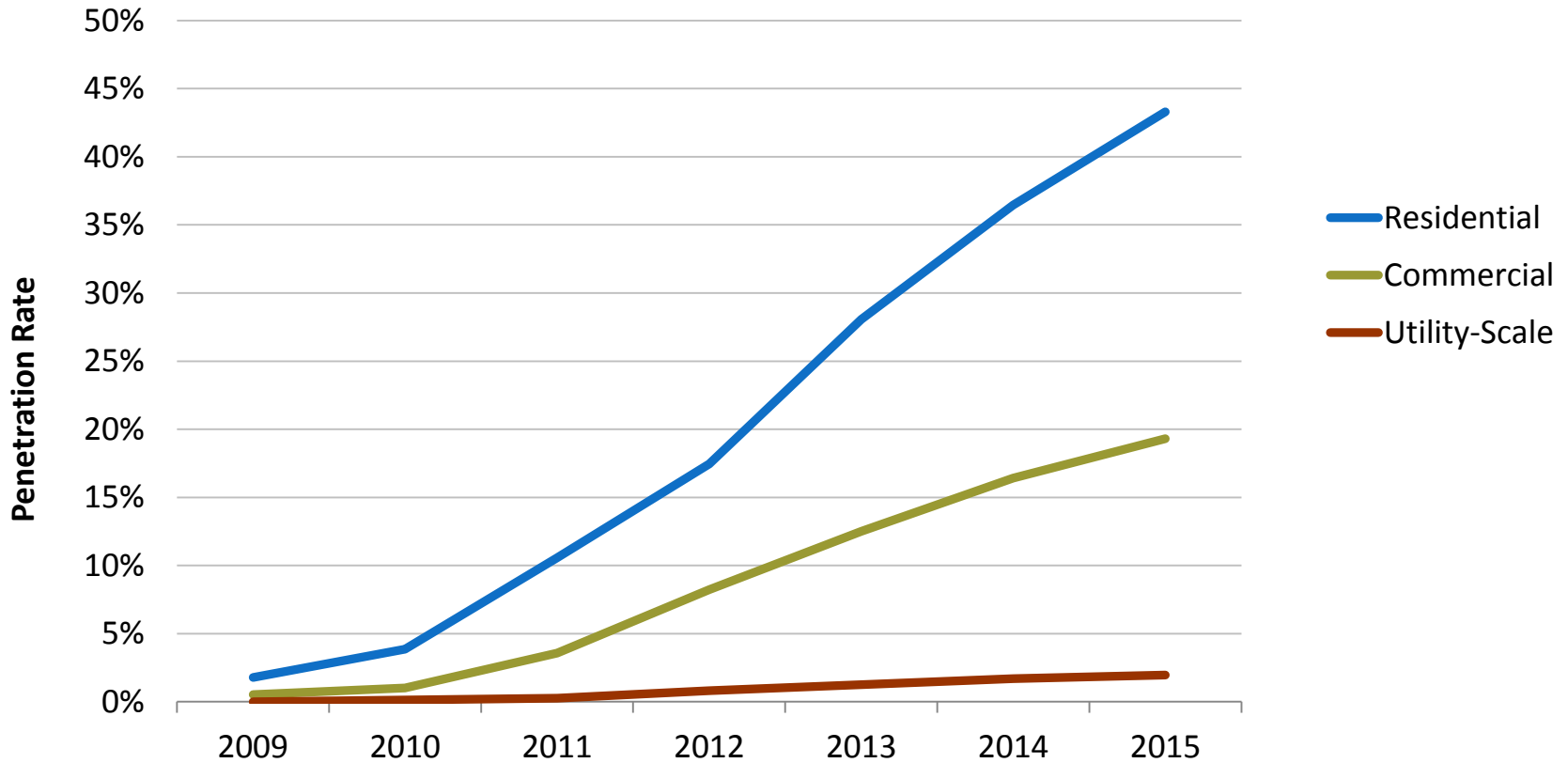
- Higher energy yields – each panel boosted to optimum DC voltage then inverted to AC centrally
- Provides enhanced monitoring (at a panel level)
- Better safety and remote shutdown
- Can still use a traditional central inverter



Cons

- But... comes at a slightly higher price (less of a premium than microinverters)
- Not appropriate/economical for all installation types
- More electronics in the field that could fail
- To date only sold by start-ups (e.g. Tigo, SolarEdge) which inhibited adoption (previously offered by National Semiconductor, but now withdrawn)

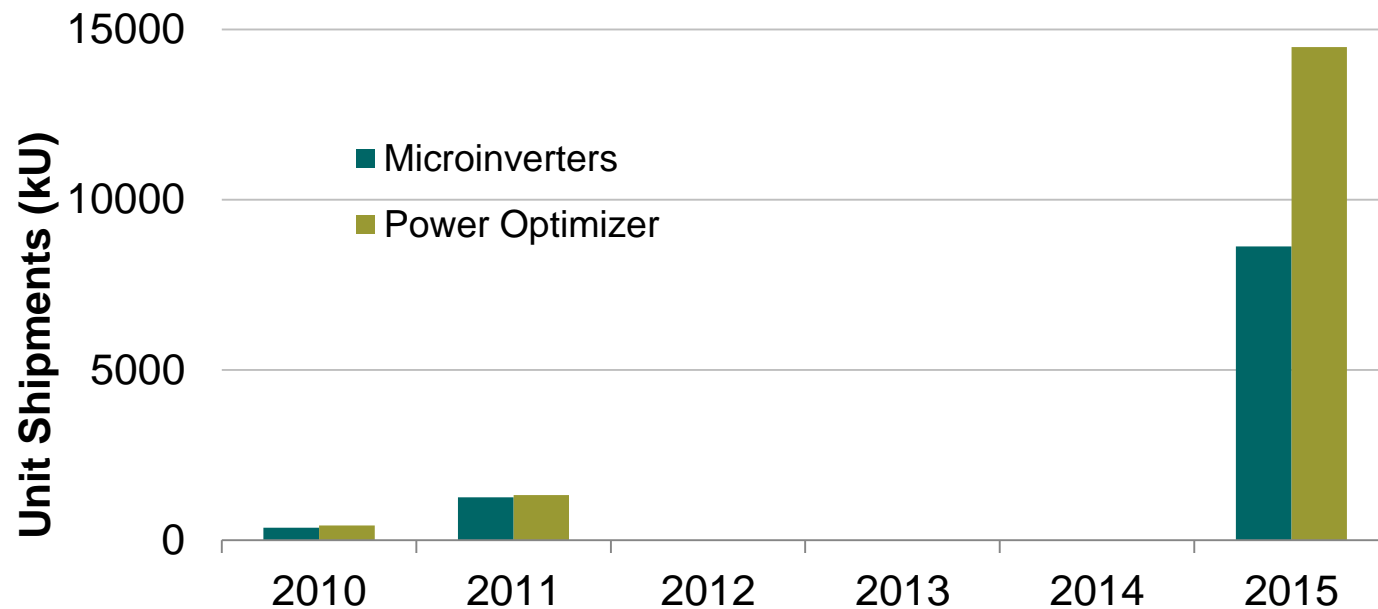
Penetration Forecast



Source: IMS Research's 2011 Microinverters & Power Optimizers Market Report











Microinverters & Optimizer Forecast

- Microinverters & Optimizers just 4% of total market in 2011
- Will capture 15% of total market by 2015 = >6GW shipments
- Attractive to semiconductor vendors due to high volumes. 8MU microinverter, 14MU power optimizers in 2015



Source: IMS Research's 2011 Microinverters & Power Optimizers Market Report

Inverter Market Rankings - 2011

Q1-Q3 Rank	Company	Change in 2011
1		-
2		-
3		1 ↑
4		2 ↑
5		2 ↓
6		8 ↑
7		2 ↓
8		8 ↑
9		1 ↓
10		-

Source: IMS Research's
Q3'11 PV Inverter
Market Tracker

Chinese Inverter Suppliers



VS.



- Asian suppliers failed to penetrate market in 2011. (<10% share)
- IMS Research identified more than 60 Chinese inverter suppliers; however only one (Sungrow) in top 15 global rankings
- Chinese suppliers can compete on price, but product quality perceived too low and lack service capabilities
- ‘Only’ 30% of customers think Chinese products have “acceptable quality”
- Chinese products mainly limited to low-power inverters, but will change now domestic market is booming

Q. Inverter market faced major oversupply in 2011 – why haven't prices fallen like panels?

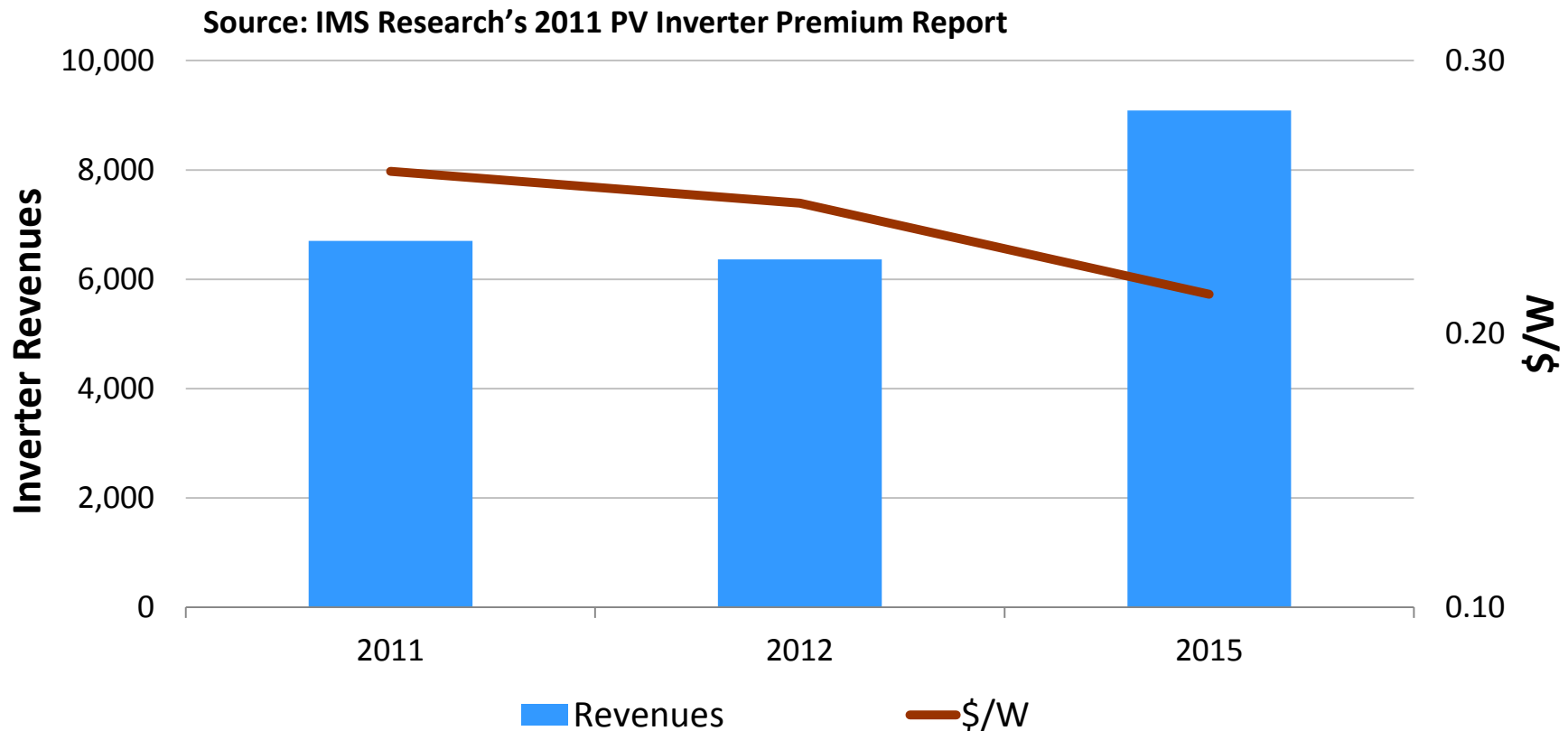


1. Major product differentiation – CEC efficiency not only indicator of good inverter
2. Concerns about low-cost Chinese products
3. High production capacity does not mean high production
4. Suppliers provide new models with enhanced features, better system monitoring and better MPPT
5. Requirements for improved grid integration (e.g. Low-Voltage Directive) force use of more costly inverter

What do customers expect in future from inverter manufacturers?

- 70% of customers want *at least* string-level monitoring. 15% want panel-level
- Higher input voltages. A clear move away from 600V to 1000V+
- Lower prices. Nearly half of all customers expect inverter prices to fall more than 20% in 3 years
- More features but not willing to pay more
- Energy Storage. 25% of customers expect most of their PV systems to use storage in 2 years' time
- Better after-sales servicing. 50% of customers say this is critical when selecting inverter vendor

Long-Term Forecast for PV Inverters



- Inverter market revenues to fall in 2012
- Longer-term prospects much more positive ~ \$9bn in 2015 & 40 GW market – 40% growth
- Average prices to fall to \$0.21/W in 2015 (50% reduction over 7 years)

- 2012 again extremely challenging for inverter suppliers – stagnating market
- Greater monitoring and more intelligent grid interaction needed
- Microinverters will not transform the market but will capture significant portion of residential market
- Despite oversupply, inverter prices will NOT collapse like panels. ASPs may in fact *increase* on average
- Supplier base consolidation to continue. Chinese suppliers will start to make major inroads now they have a domestic market
- Long-term demand for inverters very positive – revenues ~\$9bn in 2015

Any Questions?

- All data shown based on primary research from IMS Research, for more details please visit:
- www.PVMarketResearch.com or www.IMSResearch.com, or contact me by email:
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