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Scenarios for Solar PV Development in Sun-Rich Countries

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PV Power Overview

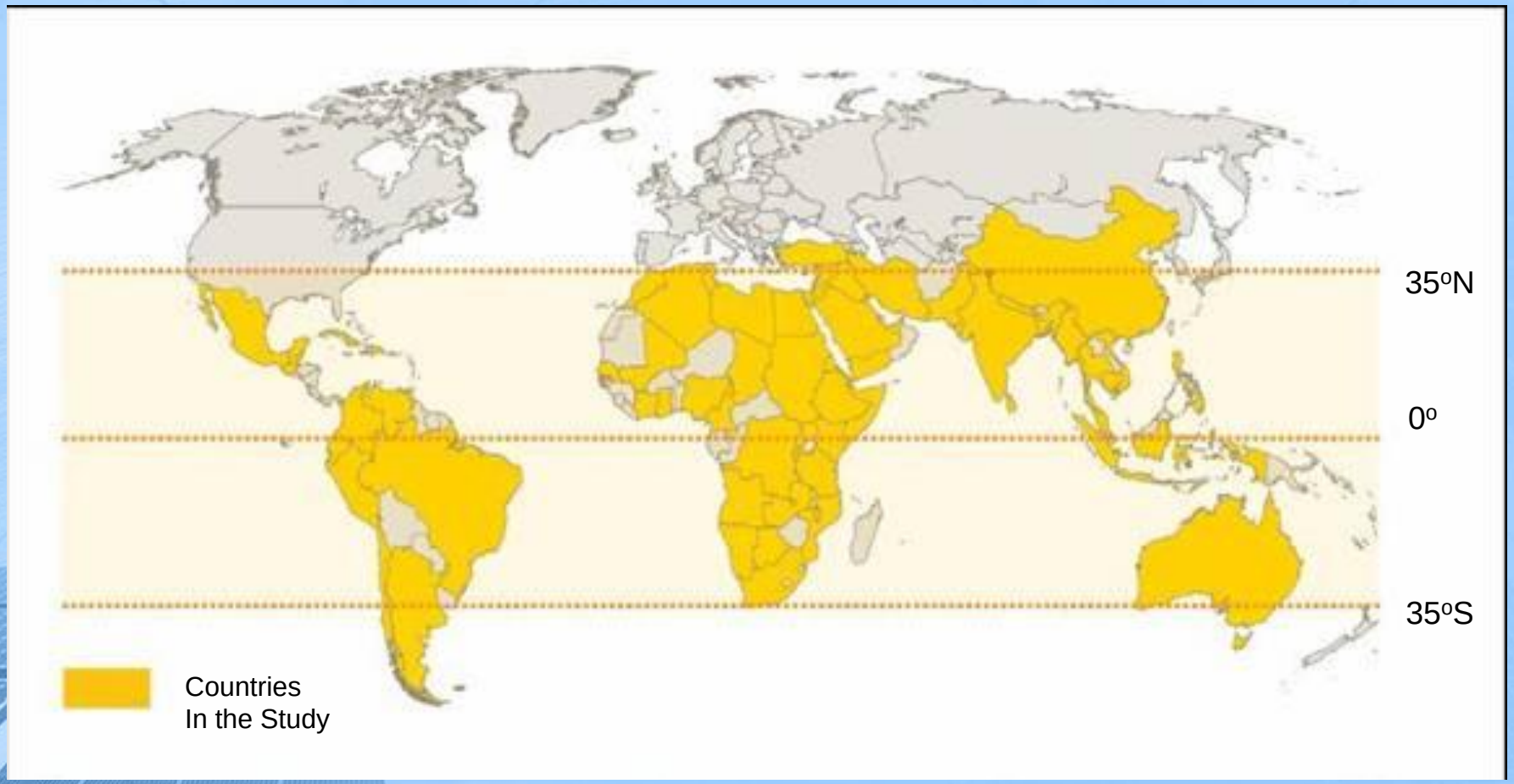
- The European Photovoltaic Industry Association (EPIA) released a study (dated October 2010) on policy scenarios to advance PV power potential around the globe
- Major findings:
  - More than 7,000 MW of photovoltaic (PV) generation were added to the global generation base in 2009
  - Cumulated installed base is now well over 22 GW
- Paradoxically, most of the growth is in countries that are not typically sunny (i.e. ‘Sunbelt’ countries)

EPIA
European Photovoltaic Industry Association

Countries in Scope of Study

- Sixty-six sun-rich (‘Sunbelt’) countries from different regions of the world were analyzed in the study,
- Accounting for about 5 billion inhabitants, representing 95% of the sun-rich countries and 75% of the world population,
- Consuming roughly 6,800 TWh or 38% of the world electricity (total world electricity consumption in 2007 was about 17,900 TWh)

Countries in Scope of Study



Source: EPIA, October 2010

Scenarios Analyzed

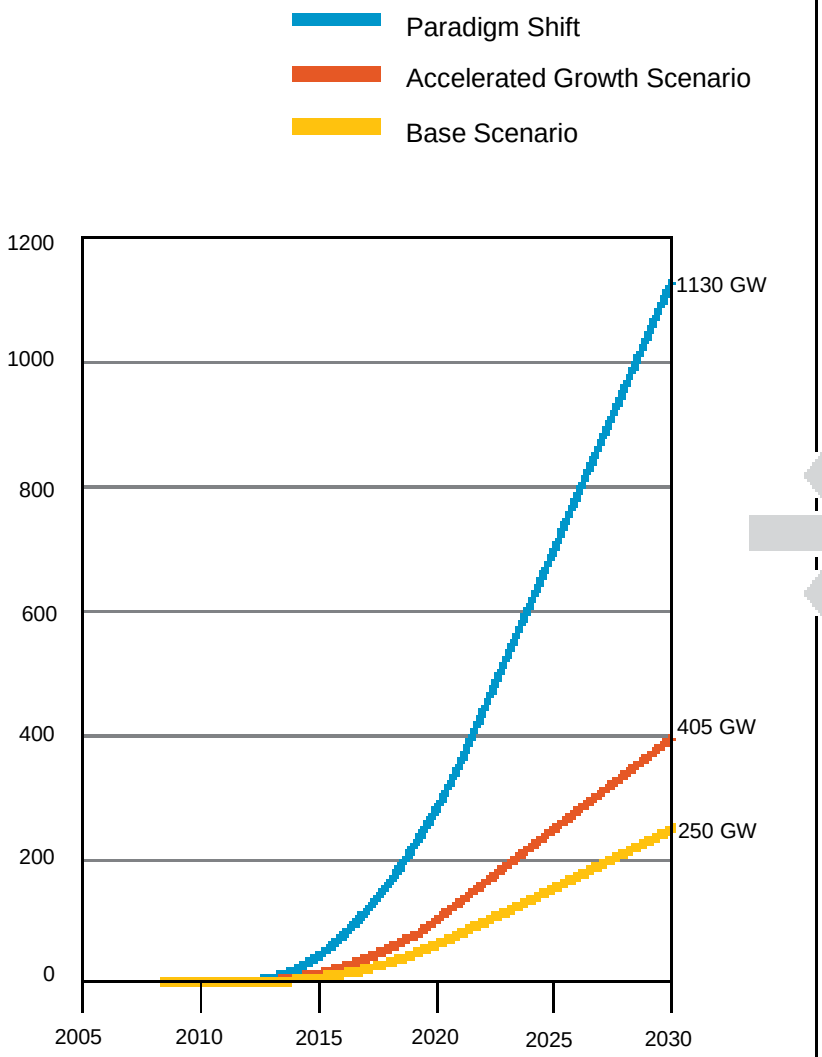
To compare potential actions, and quantify outcomes, three possible scenarios were constructed for Solar PV development:

- A ‘Base’ (Business-as-Usual) scenario,
- An ‘Accelerated’ scenario and,
- A ‘Paradigm Shift’ scenario.

PV Potential in Sunbelt Countries

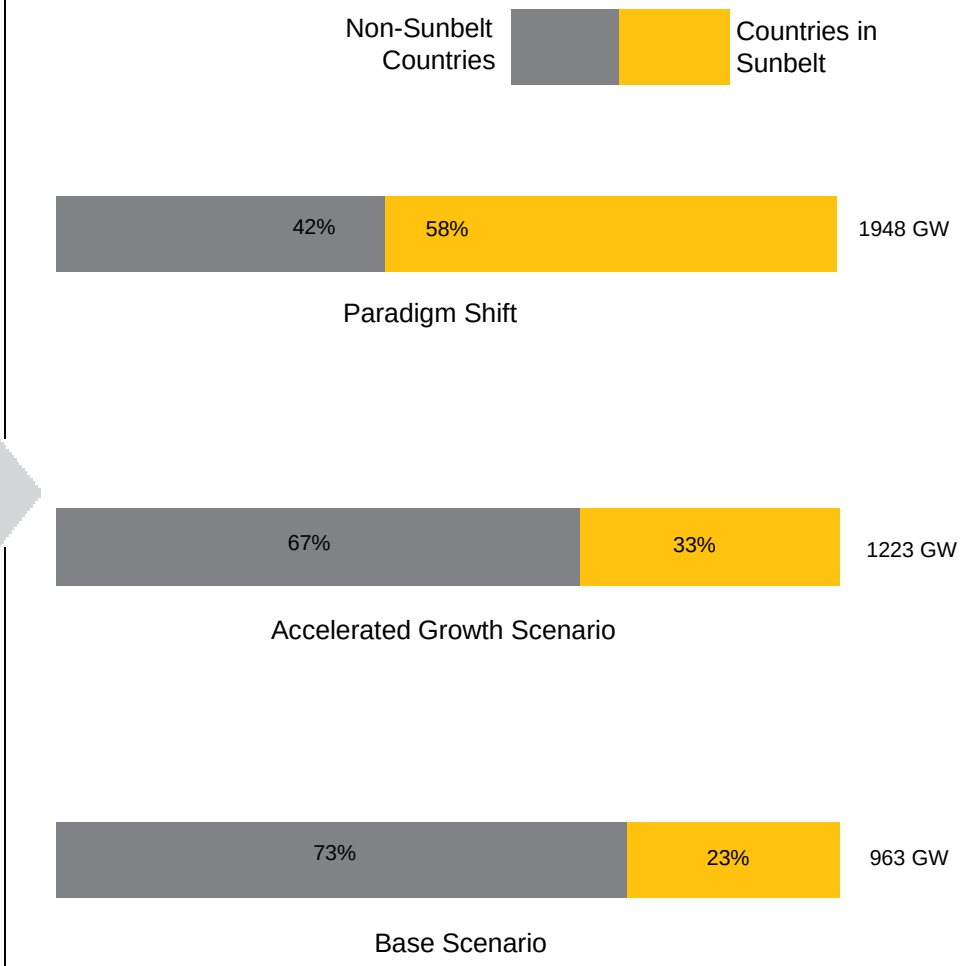
- Depending on the development scenario, PV potential in Sunbelt countries could range from 60 to 250 GWp by 2020, and from 260 to as much as 1.100 GWp by 2030
- Sunbelt countries would then represent 27% to 58% of the forecasted global PV installed capacity by 2030

Scenario's Installed PV Capacity In Sunbelt Countries until 2030 (GWp)



Source: Greenpeace Solar Generation. IEA Technology Roadmap Solar Photovoltaic Energy, A.T. Kearney Analysis

Share of Sunbelt Countries In Global Cumulative Installed PV Capacity by 2030 (GWp)



Levelized Cost of Energy (LCOE)

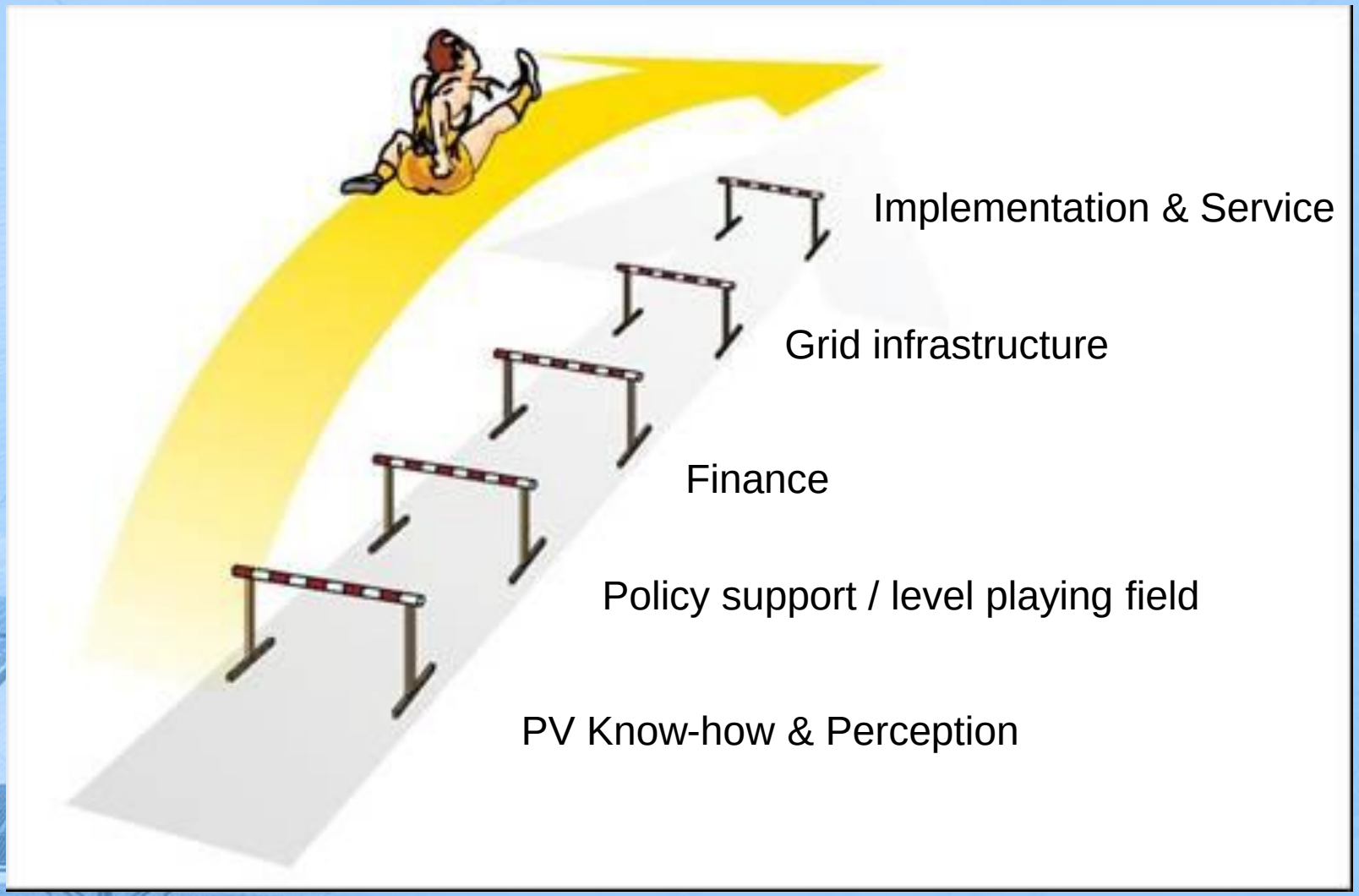
- Current LCOE ranges between 12-20€cts/kWh
  - PV can today compete with diesel generators for peak power generation without policy support
- An analysis of the cost curve demonstrates that the LCOE of PV for large systems could:
  - Reduce cost to 5-12€cts/kWh by 2020
  - Reach 4-8 €cts/kWh by 2030 in sun-rich locations
- It is still more expensive than the majority of grid-connected power generation capacity
  - Policy support is still needed in many markets for PV to compete during coming years
- By 2020, PV can be competitive with all peak load electricity generation sources in Sunbelt countries

Increased Competitiveness of Large PV Systems

Technological optimization and volume effects are leading to LCOE reductions for large PV systems

- In 2010, PV is already competitive with peak power generation from diesel generators
- By 2020, even in a low fuel price scenario, PV is likely to be more competitive than diesel or gas fuelled peak power capacity, or when compared with Combined Cycle Gas Turbines for parts of the mid-load market
- By 2030, also in a low fuel price scenario, PV will be more competitive than all other power generation technologies

Key Barriers to PV Deployment



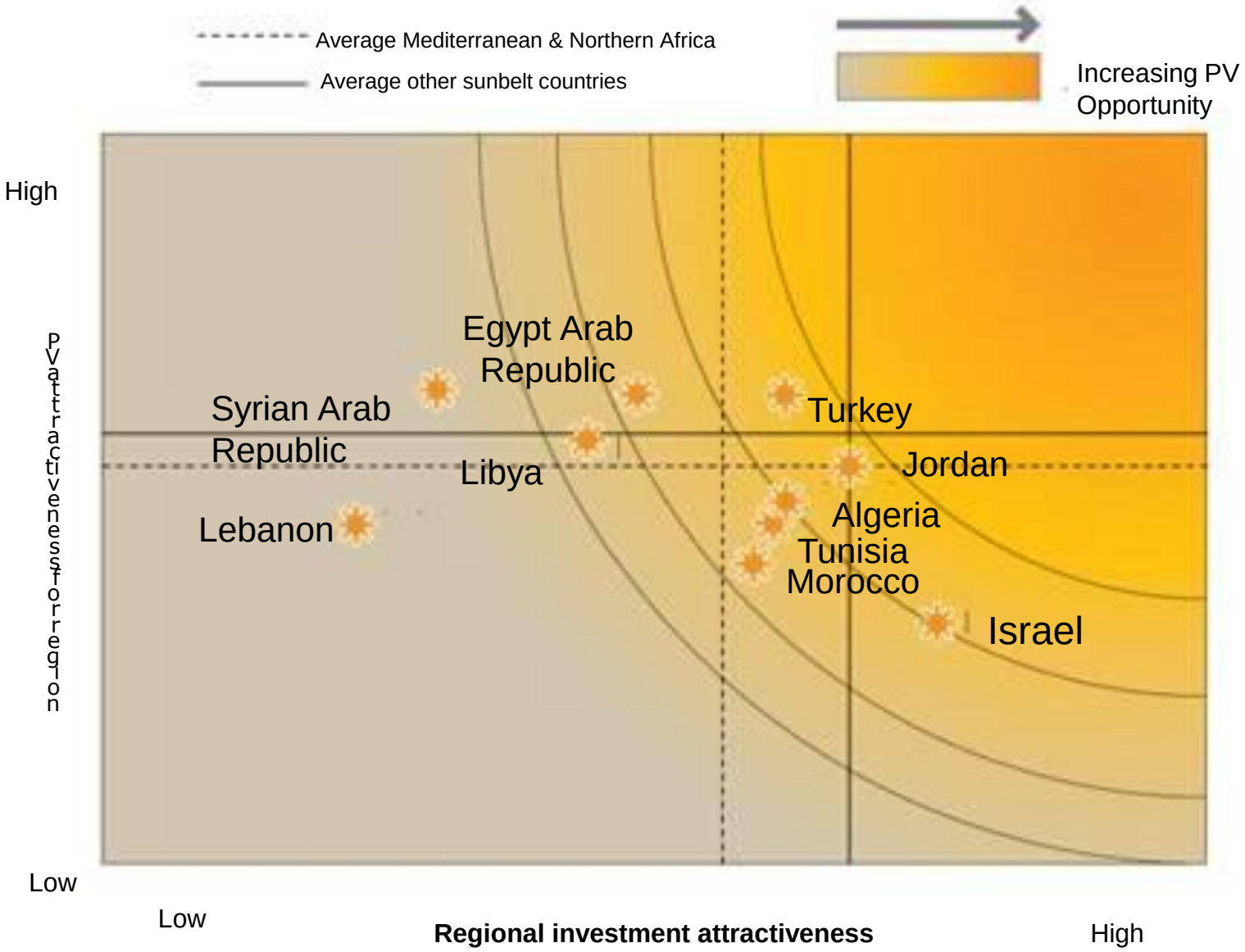
Source: EPIA, October 2010
Analysis: A.T. Kearny

Regional Perspective: Mediterranean & Northern Africa

- In the Mediterranean & Northern African region, the solar potential is only beginning to be tapped into
- PV still needs to be positioned much more strongly by local policy makers and financing institutions
- Under an ‘accelerated’ scenario the region could develop a PV potential of:
  - 7 GW by 2020
  - 27 GW by 2030
- Large scale solar projects have already been announced
- Increased openness for PV systems is being evidenced

Mediterranean Energy Future

- The region has a combined GDP of over $1.5 trillion, and is growing, on average, about 3% per annum
- Currently identified over 40 MW of installed or declared PV systems:
  - Morocco – 6 MW
  - Algeria – 2.3 MW
  - Tunisia – 1.4 MW
  - Egypt – 3 MW
  - Turkey – 5 MW
  - Jordan – 0.2 MW
  - Israel – 25 MW
- Regional energy development is key for the continued dynamic economic growth in the region
- The European Union is promoting the idea of an integrated EU / Northern African energy grid with strong solar energy components



Source: EPIA, October 2010
Analysis: A.T. Kearny

Solar Energy Developments in the U.S.A

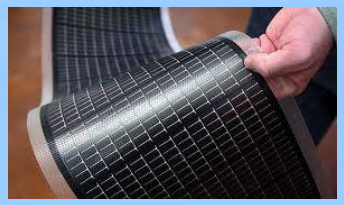
- Over the past decade the U.S. DOE invested over 1 billion in R&D to advance solar energy in general and PV in particular
- Innovations in science & technology helped reduce solar energy costs by more than 60% since 1995
- DOE is partnering with universities, the private sector and national laboratories to advance game changing breakthroughs in solar PV performance and cost
- 'SunShot' initiative - a new government initiative intended to lead to massive growth in America's use of solar power by the next decade

DOE will continue to support innovations in the ways that solar cells are conceived, designed, installed and manufactured, aiming to bring down the price of large scale solar electricity by about 75% (to a $1 a watt, corresponding to roughly 6 cents per kilowatt-hour) by the end of the decade, making it cost-competitive with fossil fuel-based electricity sources

DOE News Release, Feb.4, 2011

Examples of Early-Stage Solar Technologies Supported by U.S. DOE

- ***Solexant, San Jose, Calif***., is developing a new thin film material comprised entirely of materials that are non-toxic and abundant on Earth, including copper, zinc, tin, selenide, and/or sulfer. These devices will be constructed with a non-particle ink that can be printed and will result in commercially viable efficiencies using scalable, low-cost processes
- ***Stion, San Jose, Calif***., is developing a thin-film technology that will allow two high-efficiency thin-film solar devices to be stacked, allowing for much better absorption of light and creation of power. The devices are constructed in a way that significantly reduces cost, simplifies manufacturing and reduces material utilization over traditional designs
- ***Crystal Solar, Santa Clara, Calif***., is developing a new technology for the fabrication, handling, processing and packaging of very thin single-crystal silicon wafers (four times thinner than standard cells). This solution uses much less silicon, eliminating many of the wasteful and expensive wafer-processing steps and addressing the problem of handling very thin wafers



Roles of Key Stakeholder Groups in Accelerating Solar PV Development

- Governments and policy makers
  - Need to establish a framework for PV growth and enable/promote grid connection and net metering
- Utility sector players
  - Directly affected by national plans and perceptions of national objectives and power generation strategies as well as grid capacity, flexibility and operation
- PV industry
  - Policy makers should be encouraged to support developments that would promote jobs and local content

Thanks for Your Attention

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