Applying Nanomanufacturing Technology to Solar PV

- Nano-scale films/structures at high volume and low cost
- Similar to ICs (cost/transistor) and FPDs (pure cost/area)
- Applying to c-Si and thin film PV as well as smart glass (cost/area) and solid-state lighting (cost/lumen)
Back-Up Slides
**Typical Summer Load Profile**
Solar can serve >30% of peak generation needs

**Benefits**
- Fuel and capital savings
- Predictable & less volatile
- Emission savings
- Carbon hedge
- Transmission cost mitigation

**California ISO**
Hourly Load Profile (Summer)

**Solar Potential**

**Assumption:** Solar - Solar generation: 15GWp (DC), 18% utilization
**Source:** Load - CAISO, System load Aug 14, 2008

Represents > 500 GWp PV opportunity just in US and EU
PV Electricity Can Challenge Gas Plants
SunFab Model: 10% efficiency, $3.50/Wp installed + ITC + 9% CoC

Assumptions:
- **Load Following**
  - Heat rate: 7,300 Btu/kWh
  - Installed cost: $1,200/kW
  - Fixed O&M: $20/kW-year
  - 8.5% after-tax WACC
  - 55% utilization

- **Peaker**
  - Heat rate: 10,500 Btu/kWh
  - Installed cost: $1,200/kW
  - Fixed O&M: $20/kW-year
  - 8.5% after-tax WACC
  - 30% utilization

- **SunFarm**
  - SunFab 10% efficiency (2010)
  - $3.50/Wp installed
  - 1,800 KWh/kWp
  - 30% Federal ITC

10% SunFab Panels are more economical than gas peakers even under conservative assumptions

Source: IHS/CERA, Applied Materials
PV Learning Curve Enables Same Economics

Known Technology Learning Will Compete with Load Following

Source: IHS/CERA, Applied Materials
Cost of Capital Plays a Huge Role

$3.50/Wp Installed + ITC

Levelized Cost of Electricity (LCOE) - $/KWh

- **Load Following**
  - 9% CoC Model
  - Assumptions:
    - Heat rate: 7,300 Btu/kWh
    - Installed cost: $1,200/kW
    - Fixed O&M: $20/kW-year
    - 8.5% after-tax WACC
    - 55% utilization

- **Peaker**
  - Assumptions:
    - Heat rate: 10,500 Btu/kWh
    - Installed cost: $1,200/kW
    - Fixed O&M: $20/kW-year
    - 8.5% after-tax WACC
    - 55% utilization

- **SunFarm**
  - 6% CoC Model
  - Assumptions:
    - SunFab 10% efficiency (2010)
    - $3.50/Wp installed
    - 1,800 KWh/KWp
    - 30% Federal ITC

- **SunFarm**
  - 2% CoC Model

Assumptions:
- **Load Following**
  - Heat rate: 7,300 Btu/kWh
  - Installed cost: $1,200/kW
  - Fixed O&M: $20/kW-year
  - 8.5% after-tax WACC
  - 55% utilization

- **Peaker**
  - Heat rate: 10,500 Btu/kWh
  - Installed cost: $1,200/kW
  - Fixed O&M: $20/kW-year
  - 8.5% after-tax WACC
  - 55% utilization

Source: IHS/CERA, Applied Materials
Large PV Peaking Opportunity

Today across all major OECD markets between $3-4/Wp

Peak Generation Costs: Heat Rate 14; Running between 2-6hrs/day. Sizing reflects 30% of peak load generation. Solar excludes Mfg Tax Credit. Feed-in Tariff avg across Europe.
US SunFarm Ecosystem Scenarios

Manufacturing Facility

In-state Utility-owned Solar Farms

Owner of Solar Energy

Rate Payer

Single SunFab Manufacturing Line: 2,500 jobs, $7B Economic Activity over 15 years

1.2GW

$2.10 – $3.50/Wp fully installed

> 1,700 GWh/yr

< $0.50/month increase* creates local jobs

One Giga Watt SunFab: 31,000 jobs, $85B Economic Activity over 15 years

15GW

< $2.50/Wp fully installed

> 25,000 GWh/yr

Parity with new gas generation. Brings jobs to the community

* Solar Hybrid vs Gas fired benchmark. First 5yrs
Source: IHS/CERA, Applied Materials
Policies Can Accelerate US Solar & Green Jobs

- National progressive RES with distributed generation carve-out
- Increase federal procurement of clean energy
- Implement carbon pricing mechanism
- Clean energy bank to support renewable energy projects
- Make the renewable manufacturing incentives permanent