

Energy Law Presentation

Renewable Energy Photovoltaic (PV) Solar

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Five parts in Presentation

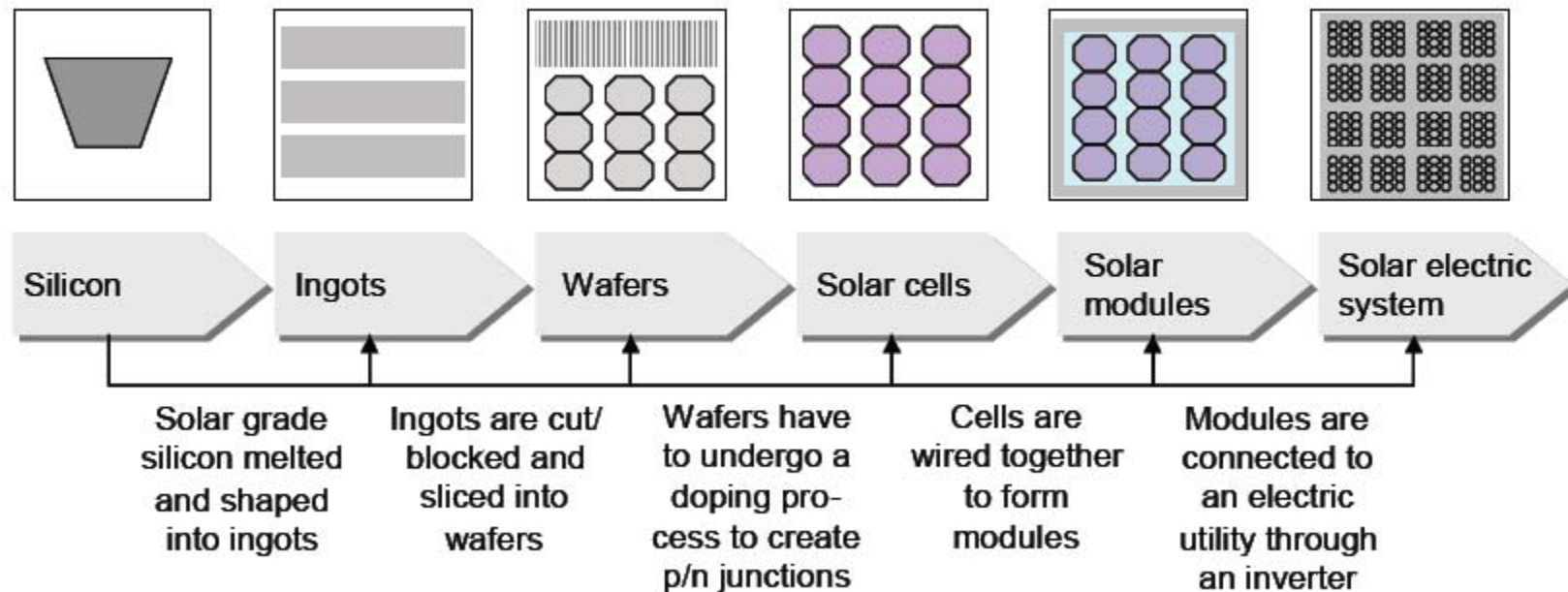
- Five Stages of the PV Solar Vertical Industry
- Business Expand: Up Stream or Down Stream
- PV Solar Market
- Incentive Plan
- U.S. & China



Part 1 PV Solar vertical industry

- Silicon Feedstock
- Ingots & wafers
- PV Cell
- PV Module
- PV System– Installer and integrator

The Whole Process



Stone for Polysilicon

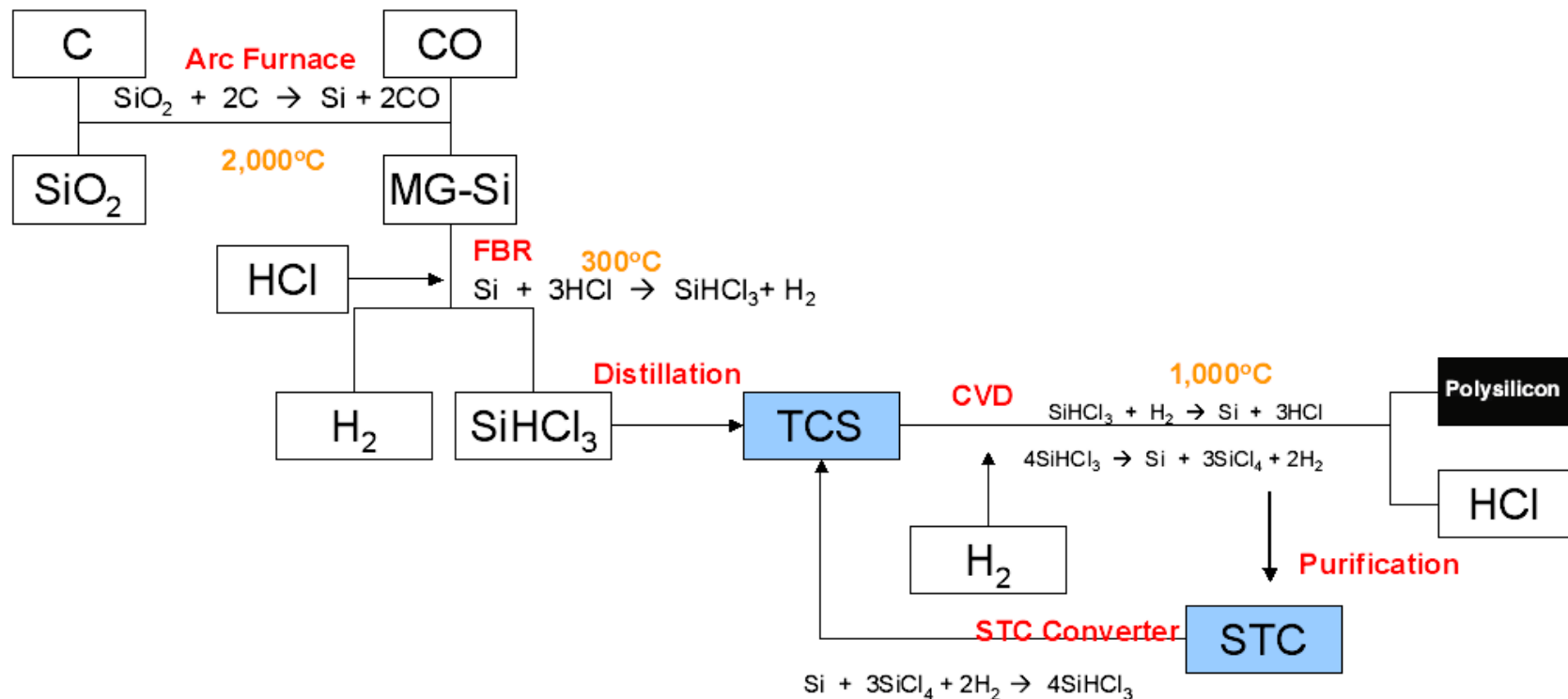


Quartzite



Polysilicon Manufacturing Process

Polysilicon Manufacturing Process





Several of the Biggest Companies

- Hemlock Semiconductor
- Wacker Polysilicon
- REC Silicon
- MEMC Electronic Materials

Silicon Chunk



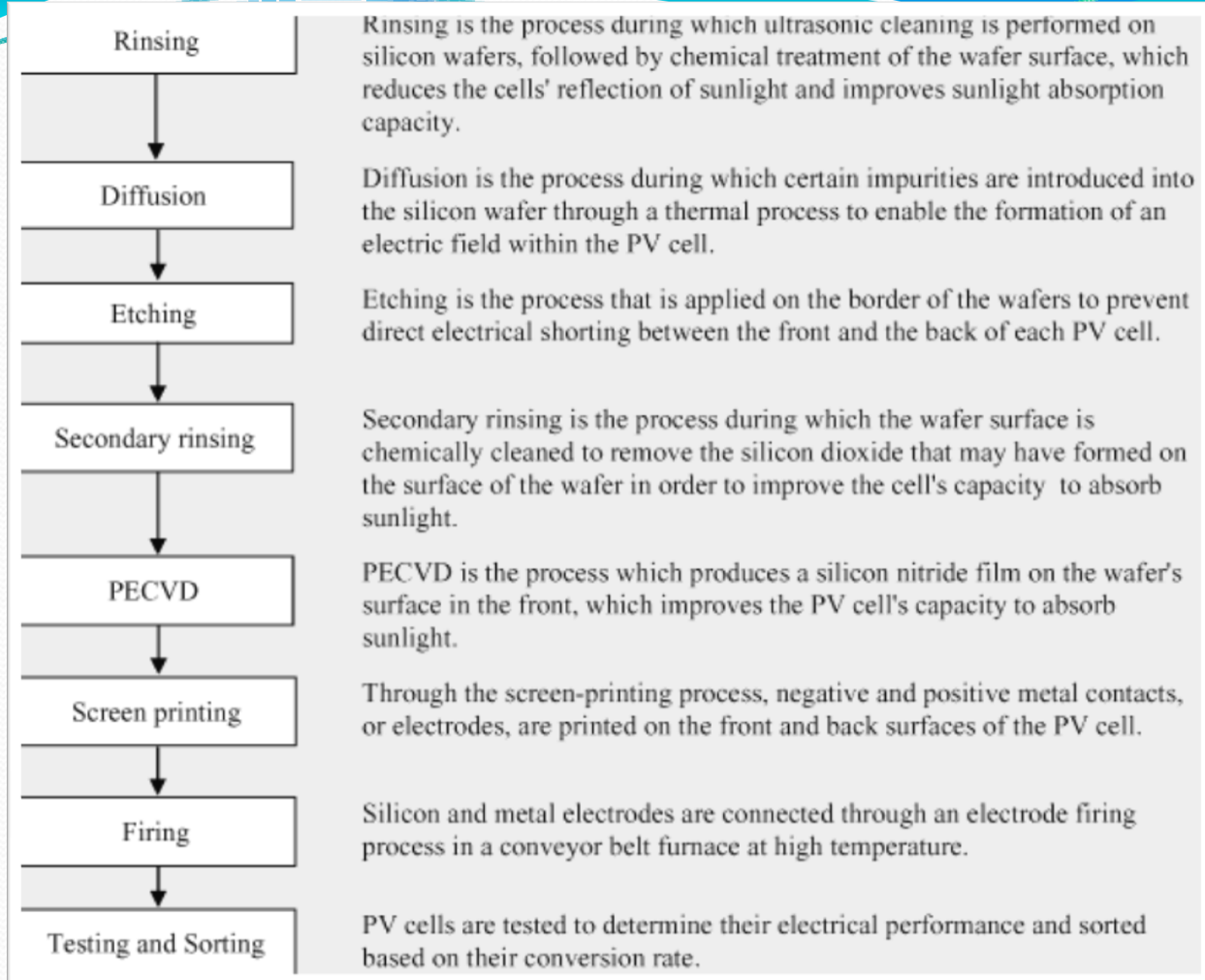
Silicon Ingots



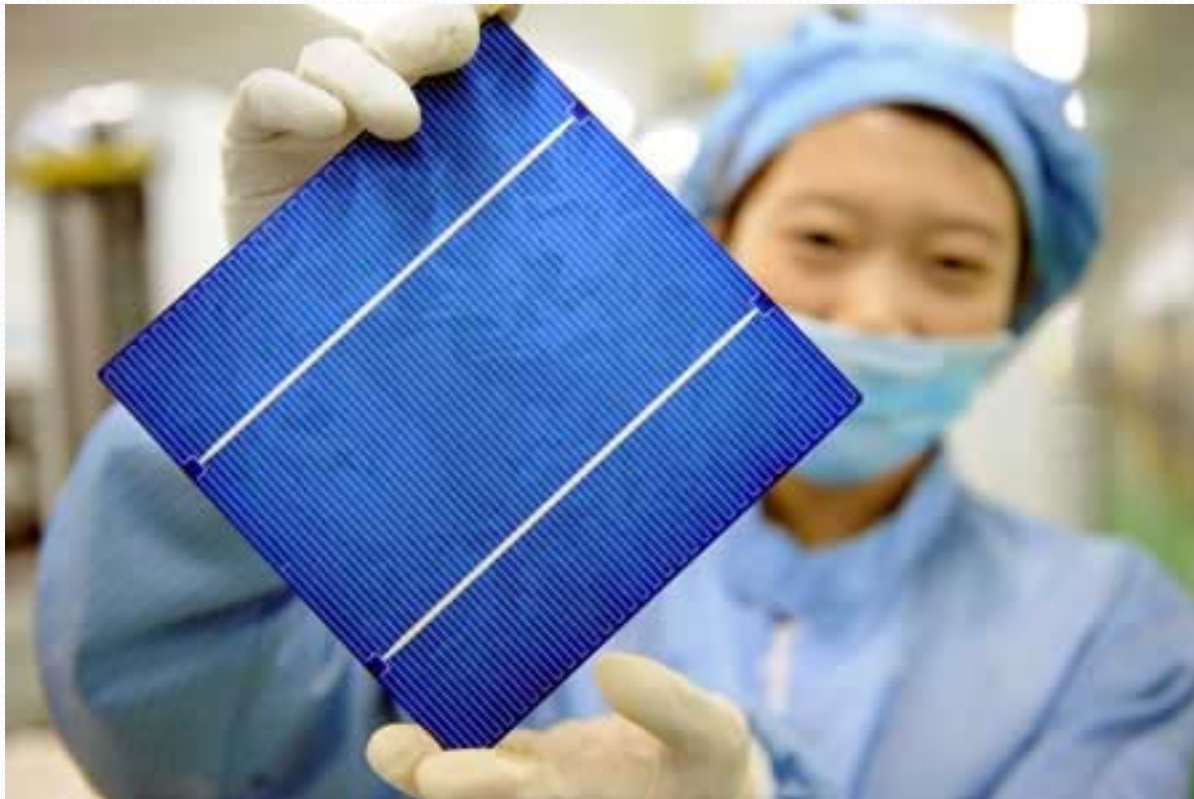
Solar Wafers



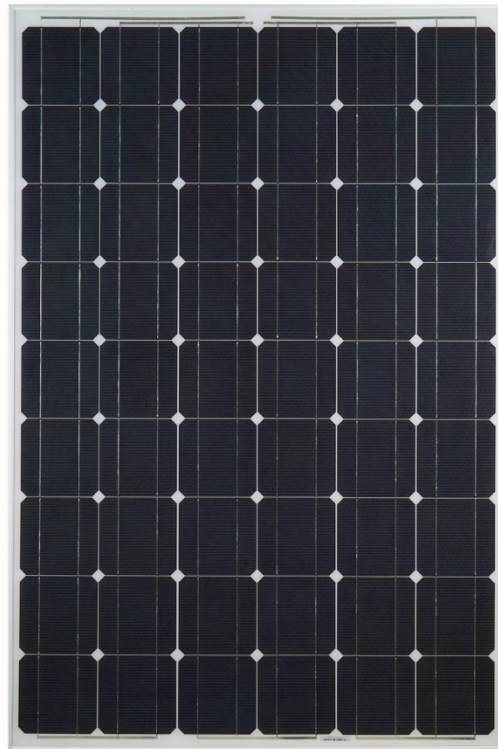
The following diagram shows the general production stages for PV cells:



PV Cell



PV Modules



PV System

New Residential PV System







Part II

Business Expand:

- Up Stream
- Down Stream

Characteristic of the different stages

Considering the below factors:

- Pricing leverage
- Operating leverage
- Supply Chain Risk
- Industry Structure
- Entry Barrier
- Room for Differentiation
- Capacity Lead Time



Pricing Leverage

- Silicon Feedstock: High Relative fixed cost, but high selling price
- Ingots and Wafers: Moderate Primarily an agency processing Biz
- PV Cell: Low Primarily an agency processing Biz
- PV Module: Low Primarily an agency processing Biz
- PV System: Very low

Operating Leverage

- Silicon Feedstock: High Depreciation The costs are 25% of COGS (cost of goods sold)
- Ingots & wafers: Moderate Depreciation The costs are 20% of COGS
- PV Cell: Low Depreciation The costs are 12% of COGS
- PV Module: Very Low Depreciation The costs are 5% of COGS
- PV System: Very Low



Supply Chain Risk

- Silicon Feedstock: No risk on raw material, risk of enforcing sales contracts
- Ingots & wafers: Moderate risk of raw material contracts, but high risk of sales contracts
- PV Cell: Very high risk of managing supply contracts as well as sales contracts
- PV Module: High risk of managing sales contracts
- PV System: High risk of project management delays



Industry Structure

- Silicon Feedstock: Oligopoly, which is beginning to fragment
- Ingots & wafers: Oligopoly, which is beginning to fragment
- PV Cell: Highly Fragmented. May see consolidation
- PV Module: Highly Fragmented. May see consolidation
- PV System: Highly fragmented, difficult to scale



Entry Barrier

- Silicon Feedstock: High due to long learning curve to achieve the desired cost structure
- Ingots & wafers: Moderate for technology, but rising due to need for capital to achieve scale and attractive cost structure
- PV Cell: Limited entry barriers until **high efficiency cells** become mainstream (conversion efficiency)
- PV Module: No entry barriers
- PV System: No entry barriers other than capital



Room for Differentiation

- Silicon Feedstock: High level of differentiation depending on chemical knowledge
- Ingots & wafers: Moderate level of differentiation based on cost
- PV Cell: Currently low differentiation; Possible from high efficiency cells
- PV Module: Limited scope
- PV System: Limited scope



Capacity Lead Time

- Silicon Feedstock: Very High – 18 months
- Ingots & wafers: Moderate – 6 months
- PV Cell: Low – 3 months
- PV Module: Very Low – 1 month
- PV System: Very Low

Pricing Leverage	High - Relatively fixed cost, but high selling price.	Moderate - Primarily an agency processing Biz with high margin risk.	Low - Primarily an agency processing Biz with low margin risk.	Low - Primarily an agency processing Biz with low margin risk.	Very low.
Operating Leverage	High - Depreciation and other sticky costs are 25% of COGS.	Moderate - Depreciation and other sticky costs are 20% of COGS	Low - Depreciation and sticky costs are 12% of COGS.	Very Low - Depreciation and sticky costs are 5% of COGS.	Very low.
Supply Chain Risk	No risk on raw materials, risk of enforcing sales contracts.	Moderate risk of raw material contracts, but high risk of sales contracts.	Very high risk of managing supply contracts as well as sales contracts.	High risk of managing sales contracts.	High risk of project management delays
Industry Structure	Oligopoly, which is beginning to fragment.	Oligopoly, which is beginning to fragment.	Highly Fragmented. May see consolidation.	Highly Fragmented. May see consolidation.	Highly fragmented, difficult to scale
Entry Barrier	High due to long learning curve to achieve the desired cost structure.	Moderate for technology/process, but rising due to need for capital to achieve scale and attractive cost structure.	Limited entry barriers until high efficiency cells become mainstream.	No entry barriers.	No entry barriers other than capital.
Room for Differentiation	High level of differentiation depending on "chemical knowledge"	Moderate level of differentiation based on cost.	Currently low differentiation. Possible from high efficiency cells	Limited scope.	Limited scope
Capacity Lead Time	Very High - 18 months	Moderate - 6 months	Low - 3 months	Very Low - 1 month	Very low

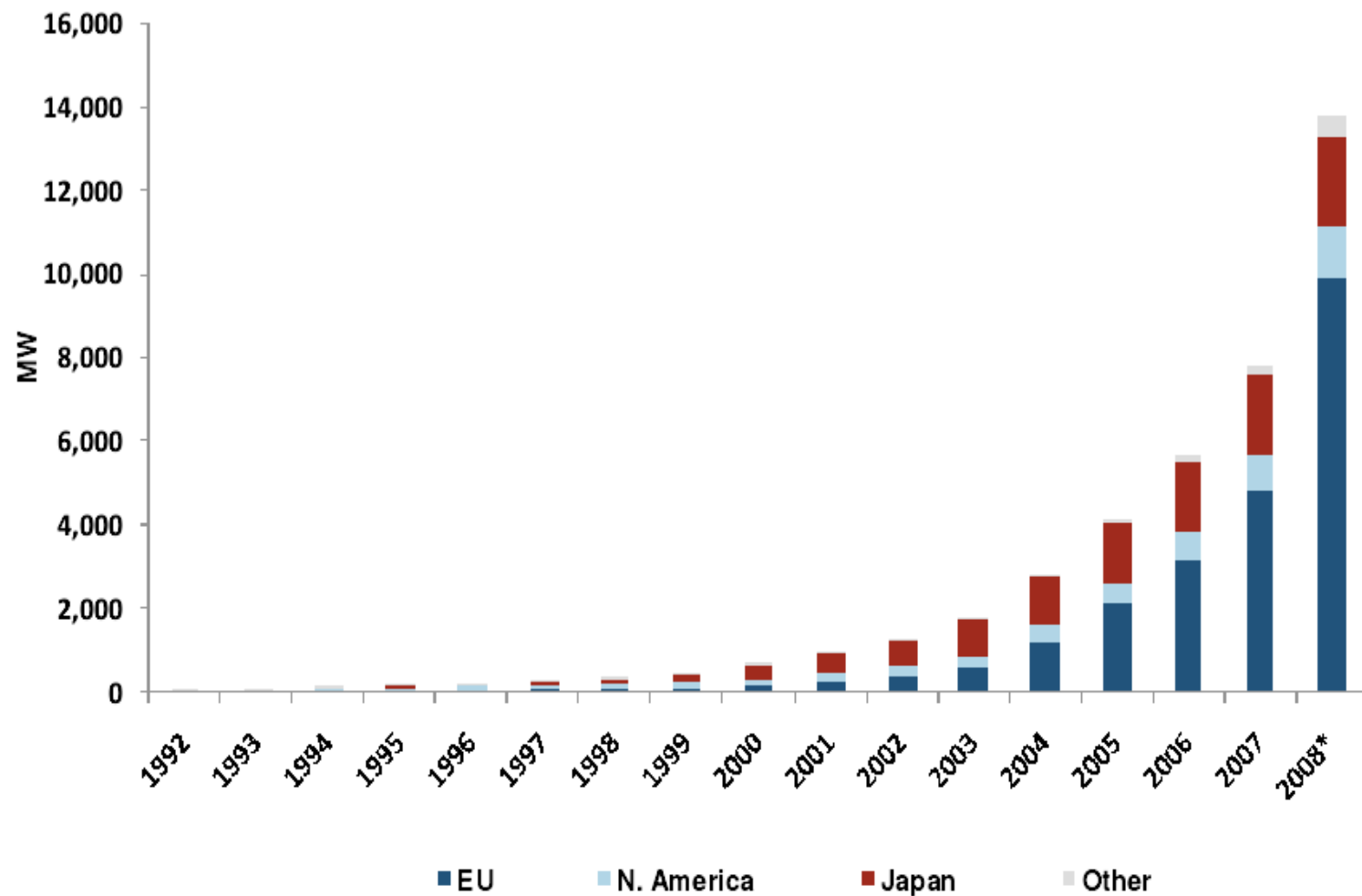
Source: Morgan Stanley Research



Part III

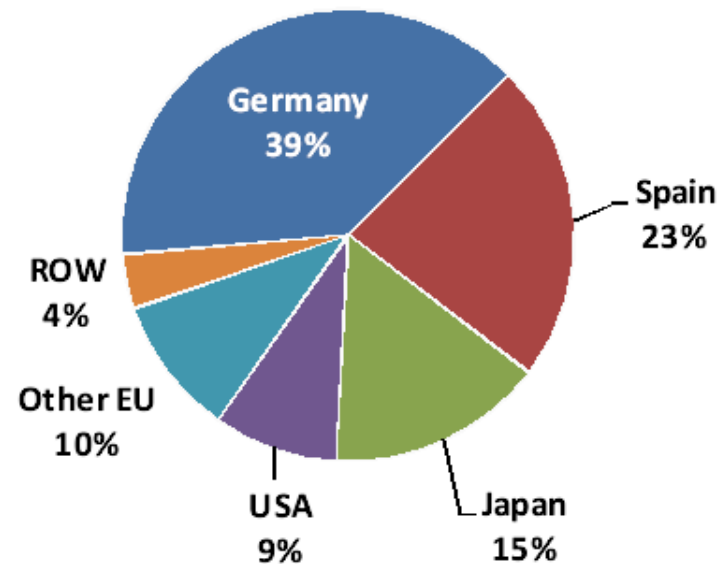
PV SOLAR MARKET

Cumulative Installed PV



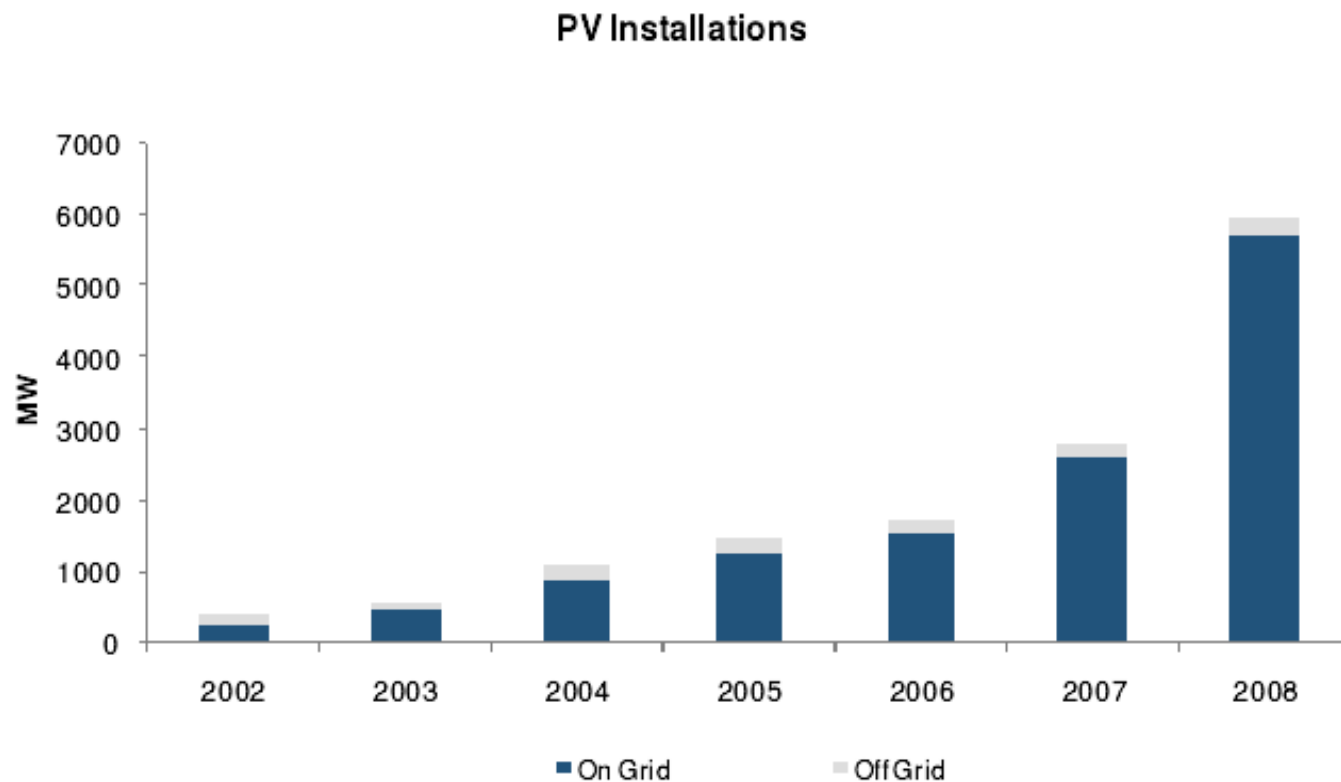
Installed PV Capacity by Region

EXHIBIT 14: INSTALLED PV CAPACITY BY REGION (2008)



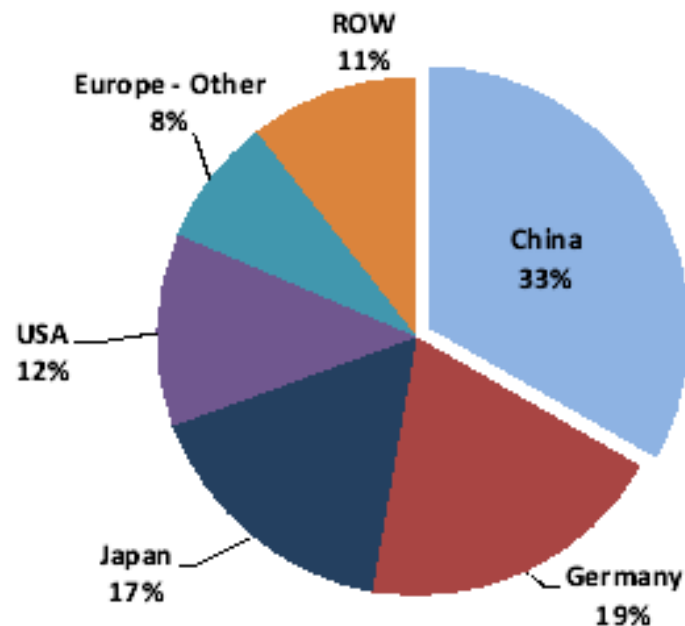
Source: www.solarbuzz.com & Jefferies estimates

Historical PV Installation Growth



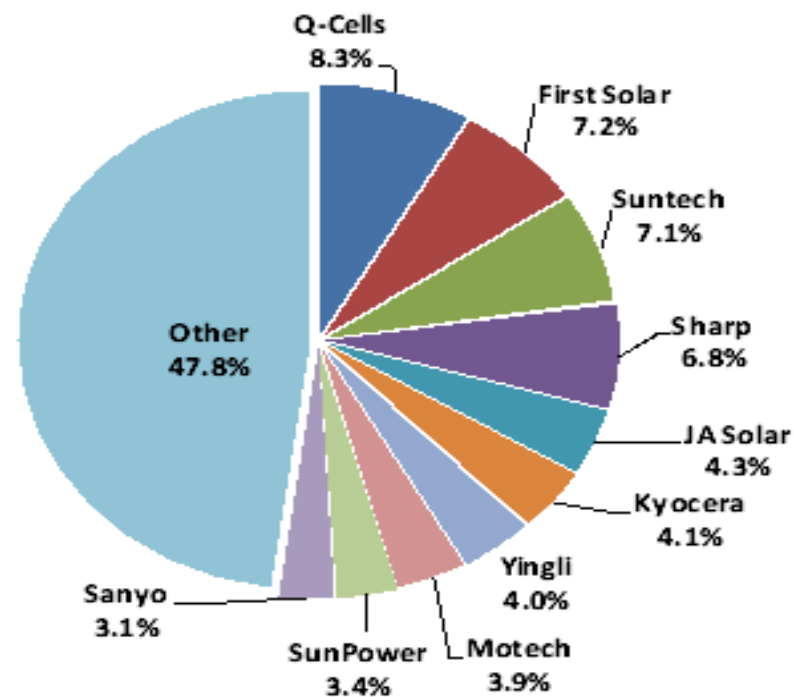
Source: www.solarbuzz.com & Jefferies estimates

Geographic Distribution of Manufacturing – China is the World's Largest Cell Producer



Source: Prometheus, EIA, Solarbuzz, Company documents and Jefferies & Company, Inc.

2008 Cell Production Share by Company



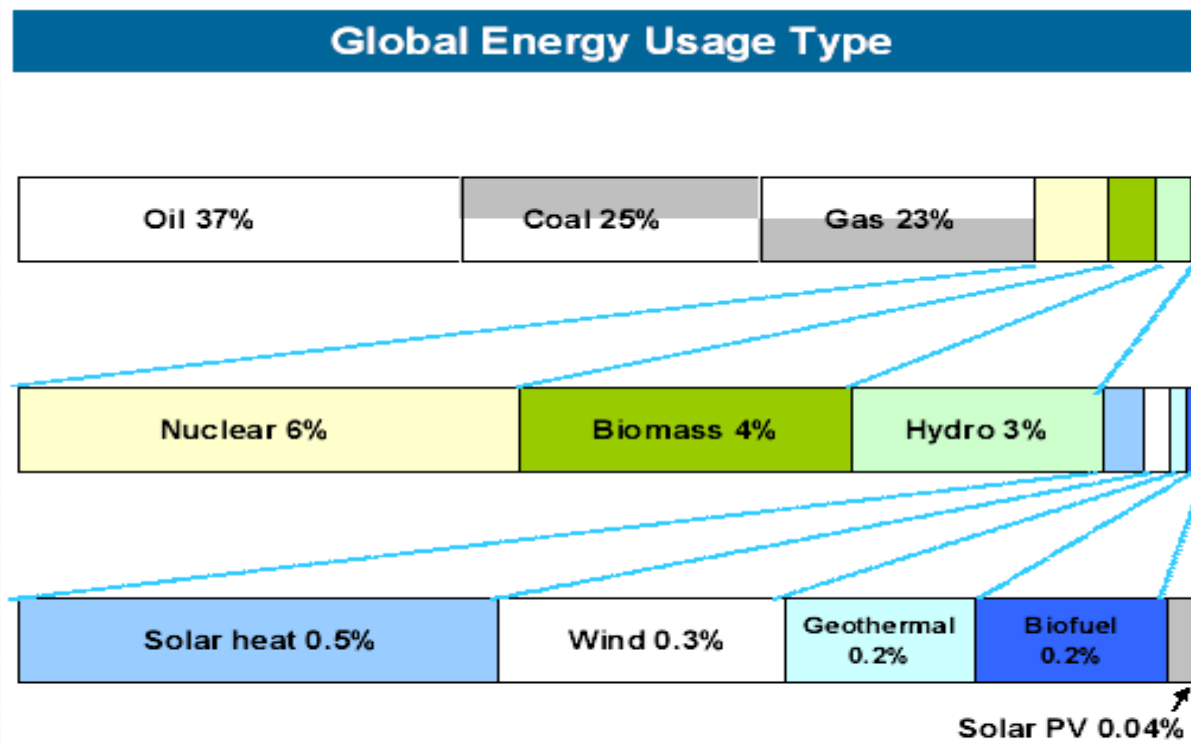
Source: Various sources and Jefferies' estimates

Solar only a small percentage of total electricity production

	2003	2010E	2015E	2020E	2025E	2030E
World electricity consumption in Trillion kWh	14.8	20.6	23.2	26.0	28.9	31.8
Solar installed capacity (GW)	1.8	28.7	154.4	573.1	1,426.1	2,296.7
Interim CAGR	NA	48%	40%	30%	20%	10%
Solar Trillion kWh, based on 1200 kWh/kW/Yr	0.0	0.0	0.2	0.7	1.7	2.8
% solar generation	0.0%	0.2%	0.8%	2.6%	5.9%	8.7%

Source: EIA, Jefferies

2006



Source: REN 21, BP 2006 Statistical Review, Bloomberg; Morgan Stanley Research



Part IV Incentive Schemes

- FiT
- Subsidy/Tax Relief



Terms

- MW: Megawatt (ten to the sixth power)
- GW: Giga Watt (ten to the ninth power)
- FiT: Feed In Tariff
- Subsidy/Tax Relief
- PTC: Production Tax Credit
- ITC: Investment Tax Credit



FiT

- Feed-in Tariff is an incentive structure to encourage the adoption of renewable energy through government legislation.
- The regional or national electricity utilities are obligated to buy renewable electricity at **above-market rates** set by the government. The higher price helps overcome the cost disadvantage of renewable energy sources. The rate may differ among various forms of power generation.



FiT

- Under the FiT model, 100% of production is exported to the grid at a tariff guaranteed for some years, while electricity consumed is imported from the grid at normal electricity rates.

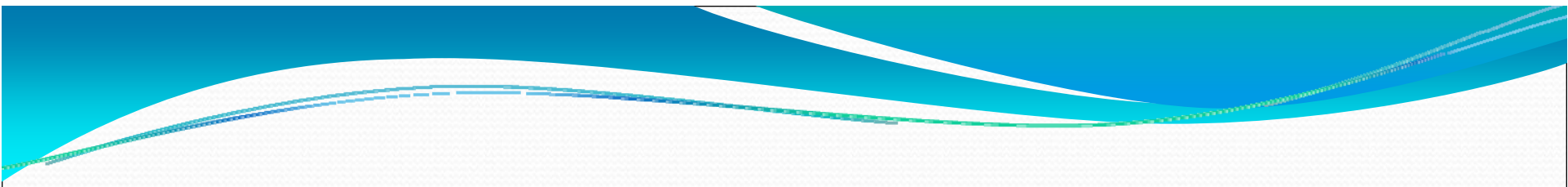


FiT

- A FiT is normally phased out once the renewable reaches a significant market penetration, such as 20%, as it is not economically sustainable beyond that point. Many countries offer a 20 years FiT.
- FiT was introduced by German government in 2004, then adopted by Spain, Italy and France

Subsidy/Tax Relief

- Subsidy/Tax relief provides upfront relief on the initial cost of a solar system, through a direct payment to the owner of the modules, or through a tax credit(offset of owner's income tax liability)
- This model is best demonstrated in the U.S.

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- Net Metering: Utility companies buy electricity generated from solar systems at the regulated price of electricity. This electricity is then fed back into the grid. In this arrangement, the customer that generates electricity would still buy his/her electricity from the grid; however, he would only pay for **the difference** between the amount of electricity produced and the amount of electricity consumed. And instead of paying the retail price of electricity to the solar generator, the utility is only required to pay its **cost** to produce the electricity. **The cost to produce electricity for the utility may be only one-third of the retail price.**

FiT v. Subsidy/Tax Relief

- In contrast to Europe, U.S. installer only have an incentive to match their solar installations production with their actual use of electricity.



Part V

- Incentive Plan in China
- Incentive Plan in U.S.



CHINA'S POLICY

- Renewable Energy Law: Effective on Jan. 1, 2006. It is the first time from the central government to develop a national framework for renewable development.

China Up Front Subsidy

- Rooftop: 15 RMB/W (\$2.1923) (exchange rate: 1\$=6.8421RMB)
- BIPV: 20 RMB/W (\$2.9231) (Building Integrated Photovoltaic)
- Budget: several provinces have proposed various PV support plans
- Criteria: system size below 50 KW, PV product reach certain technology standard

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- Recently, Chinese government announced it will provide RMB 20 billion (US\$ 2.923 billion) as the subsidy to PV Solar



China's Feed-in Tariff

- Government official has set RMB 1.09/kwh as preferred FiT for demonstration projects



U.S. Upfront Subsidy

- US Investment Tax Credit Until 2016. The credit is equal to 30% of the expenditures. Investment Tax Credit(ITC) reduces federal income taxes for qualified tax paying owners based on capital investment in renewable energy projects.

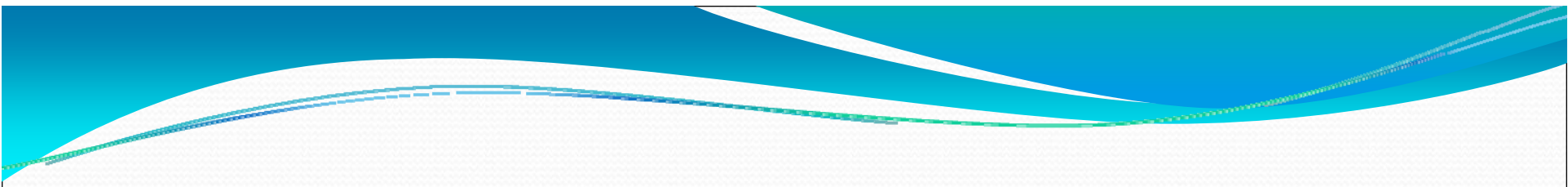
Business ITC and Residential ITC

- In Emergency Economic Stabilization Act of 2008, section 48 business solar investment credit and the section 25D residential solar ITC.
- Business Solar Investment Tax Credit (IR Code §48) The bill extends the 30% ITC for solar energy property for eight years through December 31, 2016. The bill allows the ITC to be used to offset both regular and alternative minimum tax (AMT).

Residential Solar Investment Tax Credit(IR Code §25D)

- The bill extends the 30% ITC for residential solar property for eight years through December 31, 2016. It also removes the cap on qualified solar electric property expenditures (currently \$2000), effective for property placed in service after December 31, 2008. The bill allows individual taxpayer to use the credit to offset AMT liability, and to carry unused credits forward to the next succeeding taxable year.

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- Unused commercial credits can be carried forward for up to 20 years. Unused residential credits can be carried forward at least until tax year 2016.

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- There are standard tax form found at www.irs.gov
 - If you sell you house, you cannot still claim the credit.

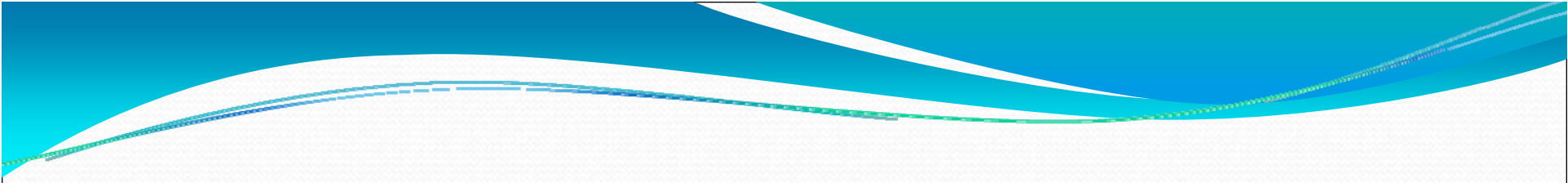


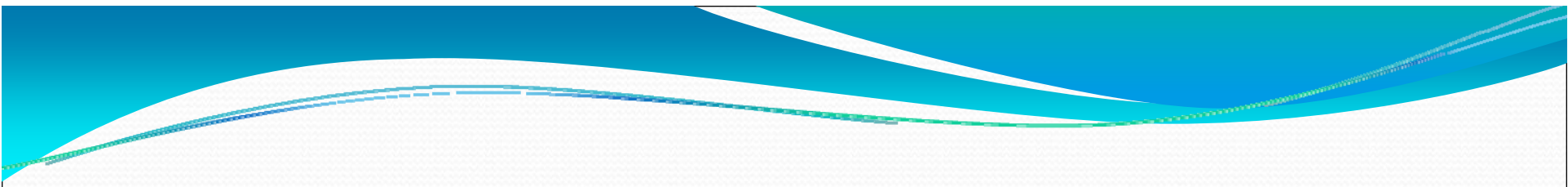
PTC

- Production Tax Credit (PTC), the Emergency Economic Stabilization Act of 2008 (EESA), provides a kwh-based credit for energy produced at new qualifying facilities during the first ten years of operation.
- Companies that generate wind, solar, geothermal, and “closed-loop” bio-energy (using dedicated energy crops) are eligible for the PTC which provides a 2.1-cent per kilowatt-hour (kWh) benefit for the first ten years of a renewable energy facility's operation.

New Clean Renewable Energy Bonds(CREBs)

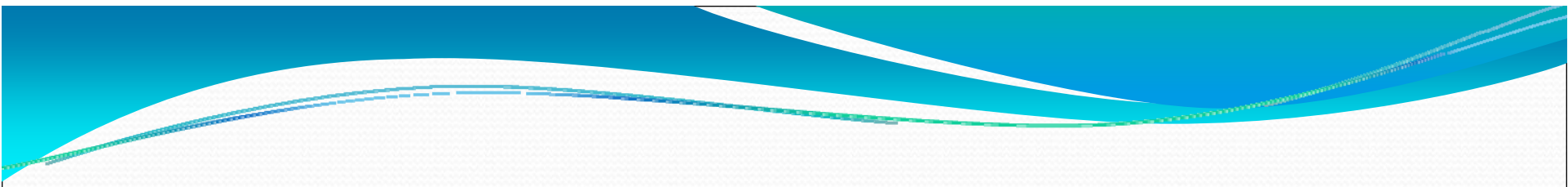
- The bill authorizes \$800 million of new clean renewable energy bonds to finance facilities that generate electricity from renewable resources, including: solar, wind, closed-loop biomass, open-loop biomass, geothermal, small irrigation, qualified hydropower, landfill gas, marine renewable and trash combustion facilities.

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- The lender will receive a tax credit from the Federal Government instead of an interest check from the borrower. So, borrower need not to pay interest to lender

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- This \$800 million authorization will be allocated as follows: 1/3 will be used for qualifying projects of State/local/tribal government; 1/3 for qualifying projects of public power providers; and 1/3 for qualifying projects of electric cooperatives. State and local governments, public power providers and electric cooperatives will be allowed to issue CREBs to finance new renewable electric power facilities, including solar installations, through December 31, 2009.

Extension of Energy-Efficient Buildings Deduction

- Current law allows taxpayer to deduct the cost of energy-efficient property installed in commercial buildings. The amount deductible is up to \$1.80 per square foot of building floor area for property installed in commercial buildings as part of: (1) interior lighting systems, (2) heating, cooling, ventilation, and hot water systems, or (3) the building envelope.

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- Expenditures must be certified as being installed as part of a plan designed to reduce the total annual energy and power costs with respect to the interior lighting systems, heating, cooling, ventilation, and hot water systems of the building by 50 percent or more in comparison to certain established standards. The bill extends the energy efficient commercial buildings deduction for five years, through December 31, 2013.

Save the POLAR BEARS!!!

