



# Application of Solar PV Technology from a Business Perspective

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# Introduction

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- Dome-Tech, Inc.; a UTC Company
  - Energy Engineering, Greenhouse Gas Reduction & Project Development Services
  - Retro-commissioning and Commissioning Services
  - Energy Procurement Services
  - Located in Edison, NJ with offices in NYC and the Philadelphia, PA area



# United Technologies Corporation



**UTC Fire & Security**



**Pratt & Whitney**



**Carrier**



**Otis**



**Sikorsky**



**Hamilton Sundstrand**



**Research Center**



**UTC Power**

*"Building Your Greener World"*



# UTC Global Leadership



**Successful businesses improve the human condition. We maintain the highest ethical, environmental and safety standards everywhere.**

*2005 Award*



**Sustainable Cities Program**

*1999-2005 Award*



*2005 Award*



**Global 100 Most Sustainable Corporations**



World Business Council for Sustainable Development

**Energy Efficiency in Buildings Project**

*"Building Your Greener World"*



## Why Invest in a Solar PV project?

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- You have taken all other low cost steps to conserve energy and reduce your carbon footprint,
- You want to do more,
- You are want to make a sustainable investment,
- And you want to do the right thing!



# Typical Project Goals

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- Reduce GHG emissions
  - Reduced use of grid power
- Reduce operating costs
  - “Free” power after investment is paid back
  - Or lock in a known long term rate for purchased power
- Earn a satisfactory return on investment
  - Viable use of client’s or investors’ capital
- Public image
  - Community, customers and employees



## Where do I put it?

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- Roof mounted systems
  - Minimal impact on land resources
  - Will likely have to be removed and reinstalled to replace the roof over its lifetime
  - Am I comfortable with an outside entity having access to my roof for 20 or more years?
- Ground Mounted systems
  - Highly visible
  - Long term commitment to land use
  - Low impact on site operations



## Where do it put it?

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- **Roof mounted systems**
  - Don't use valuable real estate, not readily visible
  - Fewer approvals
  - Structural considerations
  - Limited space dictates technology & limits inclination
- **Ground mounted systems**
  - Use valuable real estate; unless it's a brownfield!
  - Regulatory approvals; Planning & Zoning, Soil Conservation, DEP?
  - Accessible & Visible
  - Spacing flexibility allows for optimal inclination and tracking capability





# What is Needed to Attract Owners and Investors?

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- **Acceptable risk**
  - Project risk; can it be built and operated at the price I assumed? Will it operate/performance as advertised?
  - Technology risk; will it work?
  - Counterparty risk; will the customer pay? Will the investor maintain the system?
  - Regulatory risk; will the rules allow me to make money? Will I be able to
- **Acceptable returns**
  - IRR, ROIC, ROE, etc. are commensurate with the risk taken
  - Payback is reasonable



# Why is Solar so Popular in New Jersey?

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- Vision & Leadership of the BPU
  - Renewable portfolio standard
- Creation of a framework that balances the needs of stakeholders....
  - Population (present and future)
  - Rate-payers & Utilities
  - Investors
- And creates a viable climate for investment....
- Yet adjusts to allow improvements to the framework
  - Program evolves to drive results



## What are the financial drivers of a solar project?

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- Offset electric purchases from the grid by the host
- Sale of renewable energy credits
- Federal investment tax credit
- Accelerated depreciation



## Are there subsidies?

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- Not directly, but there are financial incentives that make investing in solar attractive
- Investment Tax Credits
- Accelerated Depreciation
- Renewable Energy Credits



## What is a Renewable Energy Credit

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- An attribute of energy produced from a renewable source; solar, wind, hydro, biomass, landfill gas, digester gas, etc.
- NJ has a renewable portfolio standard (RPS) that requires renewable energy content in every kilowatt sold in NJ
- Energy providers can buy/resell renewable energy or purchase credits to comply or pay a compliance penalty



# GHG Reductions

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- GHG reductions come from the avoidance of electricity generated from fossil fuels
  - Coal, natural gas and oil
- ~1095 lbs of CO<sub>2</sub> are avoided per Megawatt-Hour of electricity produced from a solar pv system in New Jersey



## Typical Project Considerations

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- Business structure; client owned or investor owned
- Project Location; roof mounted or ground mounted
- Technology selection
  - Solar PV panel selection; crystalline or thin film
  - Tracking capability



# Business Structures

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- Client owned
  - Client buys the system and owns it
  - Financed by debt or equity
  - Customer gets energy savings, tax benefits and RECs
- Investor owned
  - Investor buys the system and owns it
  - System installed on customer's property
  - Investor gets tax benefits and RECs
  - Customer gets energy savings and a known price of electricity





# Technology Choices

	<i>Crystalline Panels</i>	<i>Thin-film PV</i>
Technology Maturity	<b>Commercially available for the past 40 years.</b>	<b>Commercially available for the past 15 years.</b>
Proven Longevity	<b>40 year old systems still in operation.</b>	<b>Too soon to tell. However, most systems have 25 year warranties.</b>
Method of Manufacture	<b>Thin wafers are cut from a crystalline silicon block, and assembled in a panel with metal conducting strips.</b>	<b>Constructed by depositing very thin layers of photosensitive materials on backing such as glass, stainless steel or plastic</b>
Sunlight-to-Electricity Conversion Rate	<b>Up to 18.5%</b>	<b>Up to 12%</b>
Power Density	<b>8.7 watts per square foot</b>	<b>4.1 watts per square foot</b>
Approximate Loading	<b>5 pounds per square foot (Point load is 55.2 pounds per square foot)</b>	<b>12 ounces per square foot</b>
Durability/Breakability	<b>Rigid/ Impact resistant tempered glass surface</b>	<b>Flexible/ virtually unbreakable</b>
Performance When Damaged	<b>Degrades to zero</b>	<b>Slight reduction</b>
Roof Attachment Detail	<b>Panels are ballasted (not fastened to roof). Removal can be cumbersome.</b>	<b>Membranes are hot welded to the roof. Removal can be cumbersome.</b>



# Roof Mounted Application

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# Ground Mounted Application

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*“Building Your Greener World”*