U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

ADVANCED MANUFACTURING OFFICE

Industrial Assessment Center

U.S. DEPARTMENT OF ENERGY

Alternative Energy

Module 7

Alternative Energy Usage

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Types of Recommendations

back	2.9xxx	Alternative Energy Usage	511	$44,811,635	8.1	14.5%
	2.91xx	GENERAL	511	$44,811,635	8.1	14.5%
open	2.911x	Solar	475	$22,773,099	8.3	14.4%
open	2.912x	Wind Power	21	$14,414,107	6.5	11.8%
open	2.913x	Hydrogen	4	$886,862	4.6	0.0%
open	2.914x	Biofuels	11	$6,737,568	5.4	33.3%

What's the idea?

- Utilize alternative energy sources to offset energy expenses in industrial processes

For example

- Use electricity generated from solar/wind to reduce grid load
- Use solar heat to pre-heat boiler inlet
- Replace battery-powered forklifts with hydrogen fuel-cell forklifts
- Use biodigester to generate biogas for heating or electric power generator

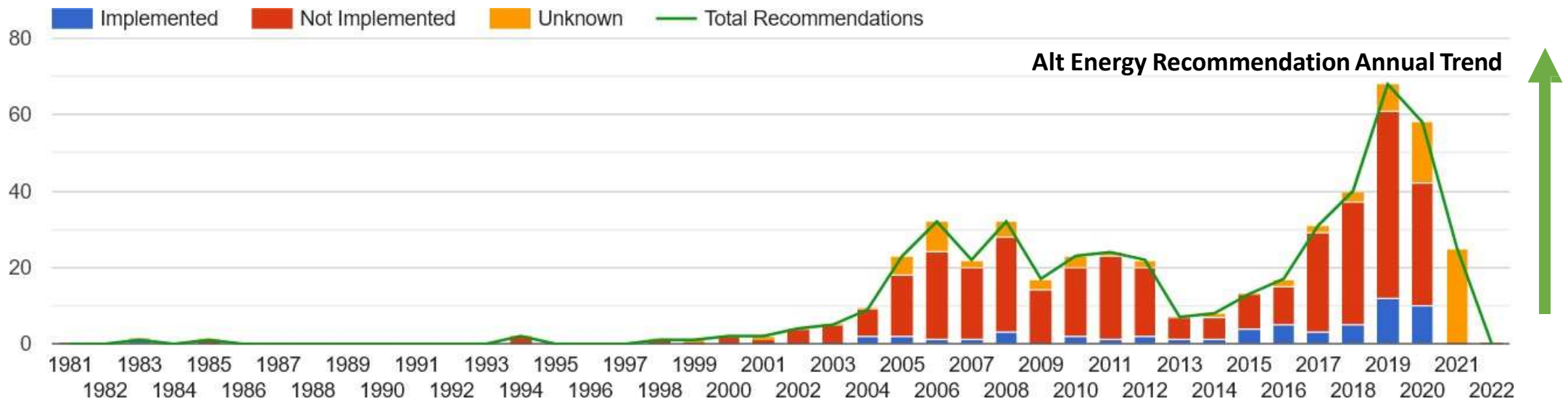
Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

Alternative Energy Usage

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Alternative Energy Rec's in the IAC

The average implementation rate is 46%, yet the average Alt Energy implementation is **14.5%**.
The good news is…



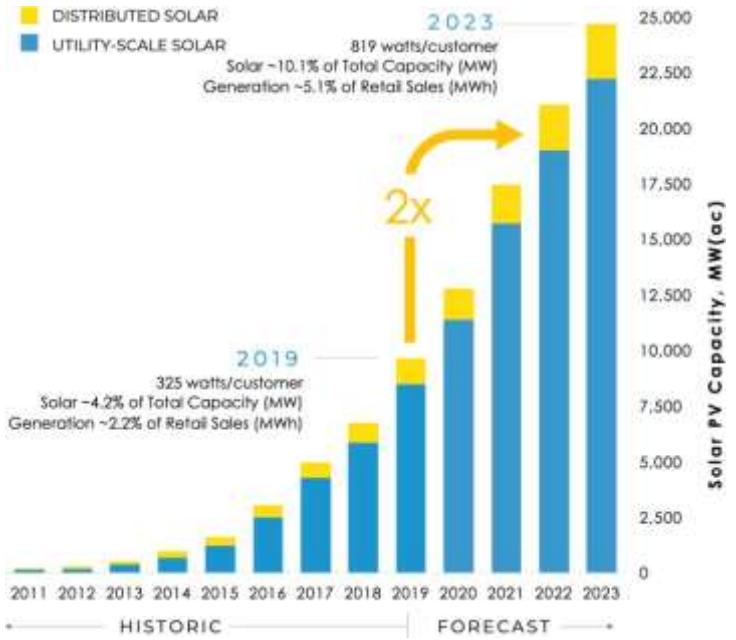
Objective: Increase recommendation & implementation rate

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

[2.911x] Solar Energy

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2.9111	USE SOLAR HEAT TO HEAT MAKE-UP AIR	24	$166,524	7.3	0.0%
2.9112	USE SOLAR HEAT TO HEAT WATER	76	$875,777	6.0	16.9%
2.9113	USE SOLAR HEAT FOR HEAT	35	$1,467,117	6.0	13.8%
2.9114	USE SOLAR HEAT TO MAKE ELECTRICTY	339	$20,151,476	9.1	15.1%



Things to note:

- **Most common type of alternative energy recommendation**
- Utility, state, and federal incentive programs
- Survey environment for suitability
  - DOE sanctioned software to simulate generation capacity: **SAM** (System Advisor Model)
- Size installation to maximize utility savings
  - Use the utility tariff and interval data to inform project scale

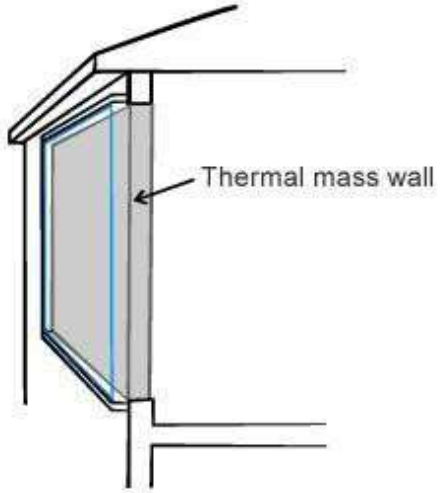
Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

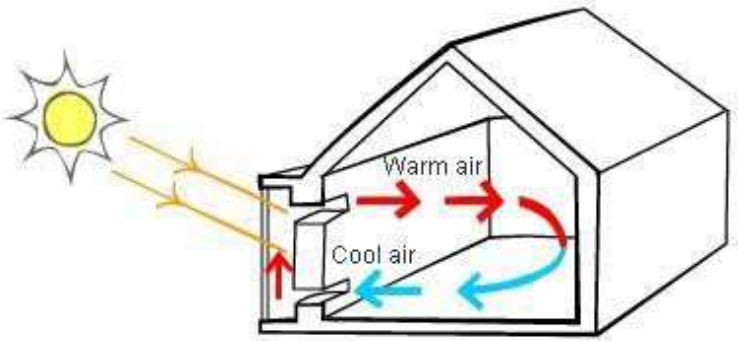
[2.9111] Solar Air Heating

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Concept

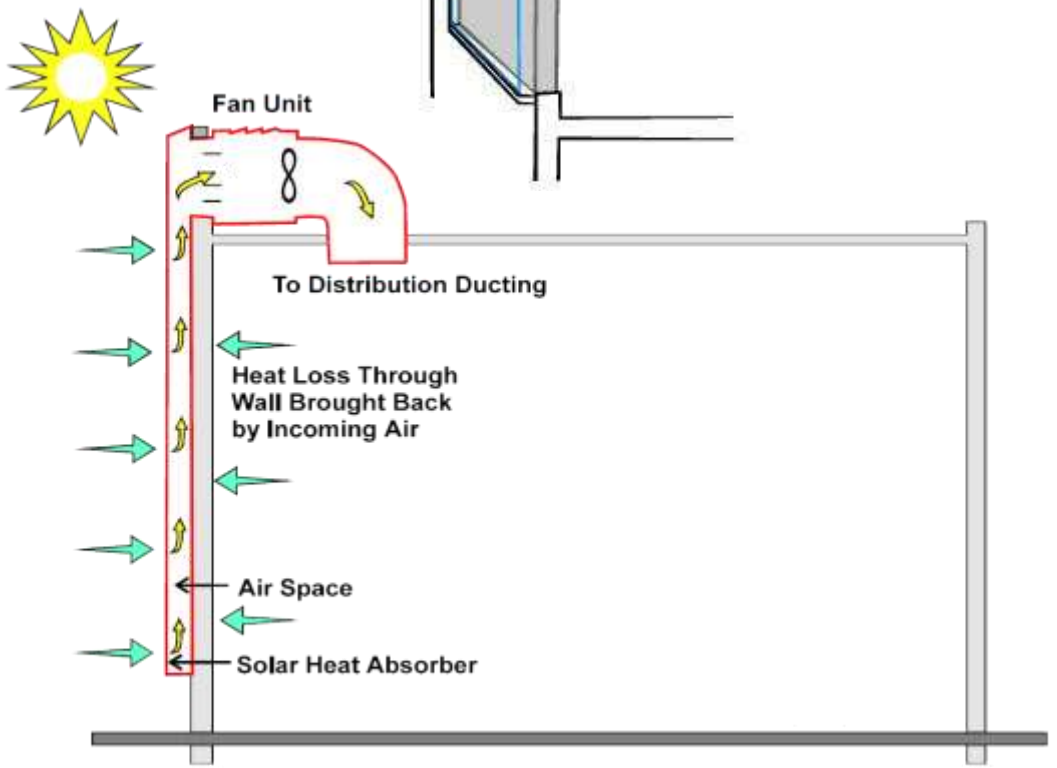
- Preheat air intake using solar radiation to bring down air heating and ventilation costs





Types of devices

- Solar walls
- Trombe walls
- Solar chimneys



Use cases

- Kilns
- Dryers
- Metal annealing
- Space conditioning

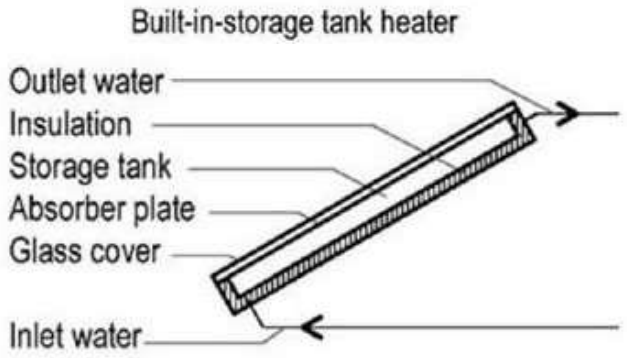
Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

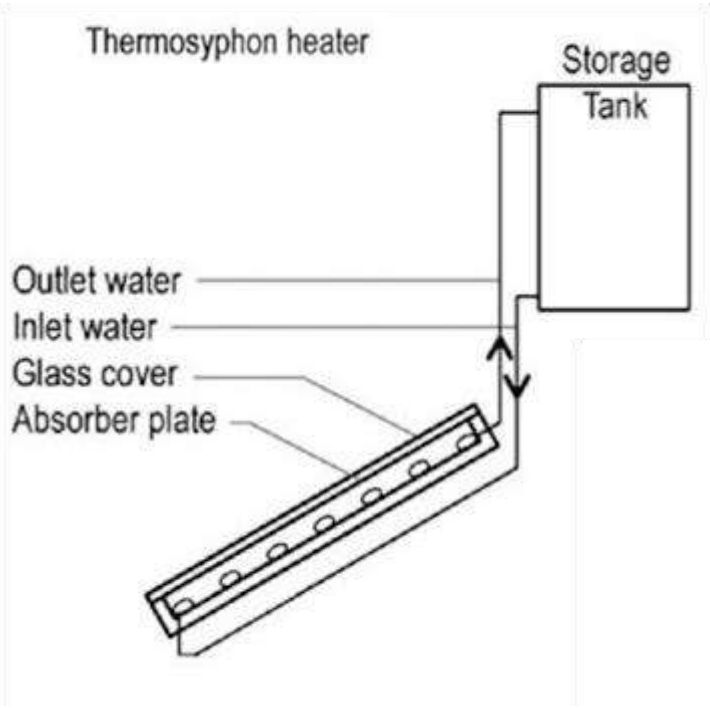
[2.9112] Solar Water Heating

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Concept

- Preheat water heater intake using solar radiation to reduce electric/gas heating expenses





Types of devices

Passive – stored in elevated tanks

- Integral collector-storage (less expensive)
  - Warms water for the conventional tank, the stored batch is drawn from when hot water is demanded
- Thermosiphon (more expensive)
  - Hot water rises to the top of the collector and moves into a storage tank which feeds to a tank within the facility

Active – self contained electric/gas backup

- Direct: moves the water itself through collector
- Indirect: moves antifreeze through collector which heats tank water via a heat exchanger

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

[2.9114] Solar Electricity

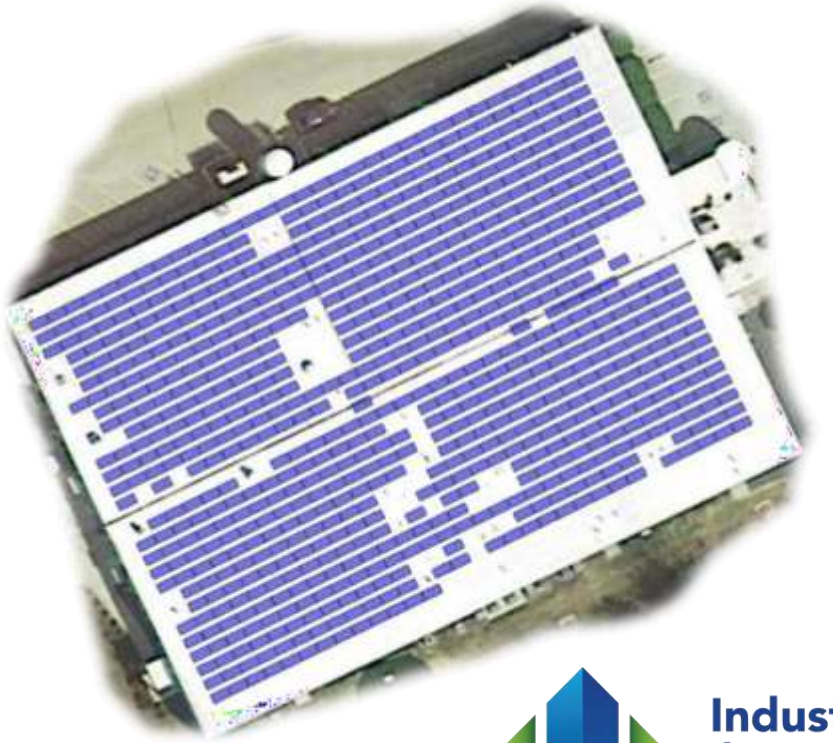
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

What makes solar PV attractive to manufacturers?

- Facilities often have the surface area needed for a Solar PV project
- Costs have decreased to the point where Solar PV can be competitive with the grid
- Requires minimal maintenance and **lasts 25 to 30 years**
- Environmentally responsible & tax incentivized

Notes for making a Solar PV recommendation

- Available space for project
  - Size project to produce only enough to meet the facility's needs
  - General rule of thumb: **1 kW of solar capacity per 100ft^2**
- Solar project modelling and simulation
  - NREL's SAM (System Advisor Model) & PV-Watts calculator
- What incentive programs are available?
  - Database of State Incentives for Renewables & Efficiency
- The IAC encourages the company to seek out proposals from various solar installers to get a competitive price



Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

[2.912x] Wind Power

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2.912x	Wind Power	21	$14,414,107	6.5	11.8%
2.9121	INSTALL WIND POWERED ELECTRIC GENERATOR	20	$13,310,333	6.6	12.5%

When is it viable?

- Open areas at higher elevations
  - Weather stations record windspeed data
  - Benchmark: Average annual wind speeds of 6.5m/s or greater at 80m
- **Constant operation loads**
- Look at utility's electricity billing structure & facility's consumption profile
  - Is there significant savings to be made?
- Does the state have incentive programs for the use of wind turbines?

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

[2.913x] Hydrogen

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2.913x	Hydrogen	4	$886,862	4.6	0.0%
2.9131	INSTALL HYDROGEN FUEL CELL	4	$886,862	4.6	0.0%

When is it viable?

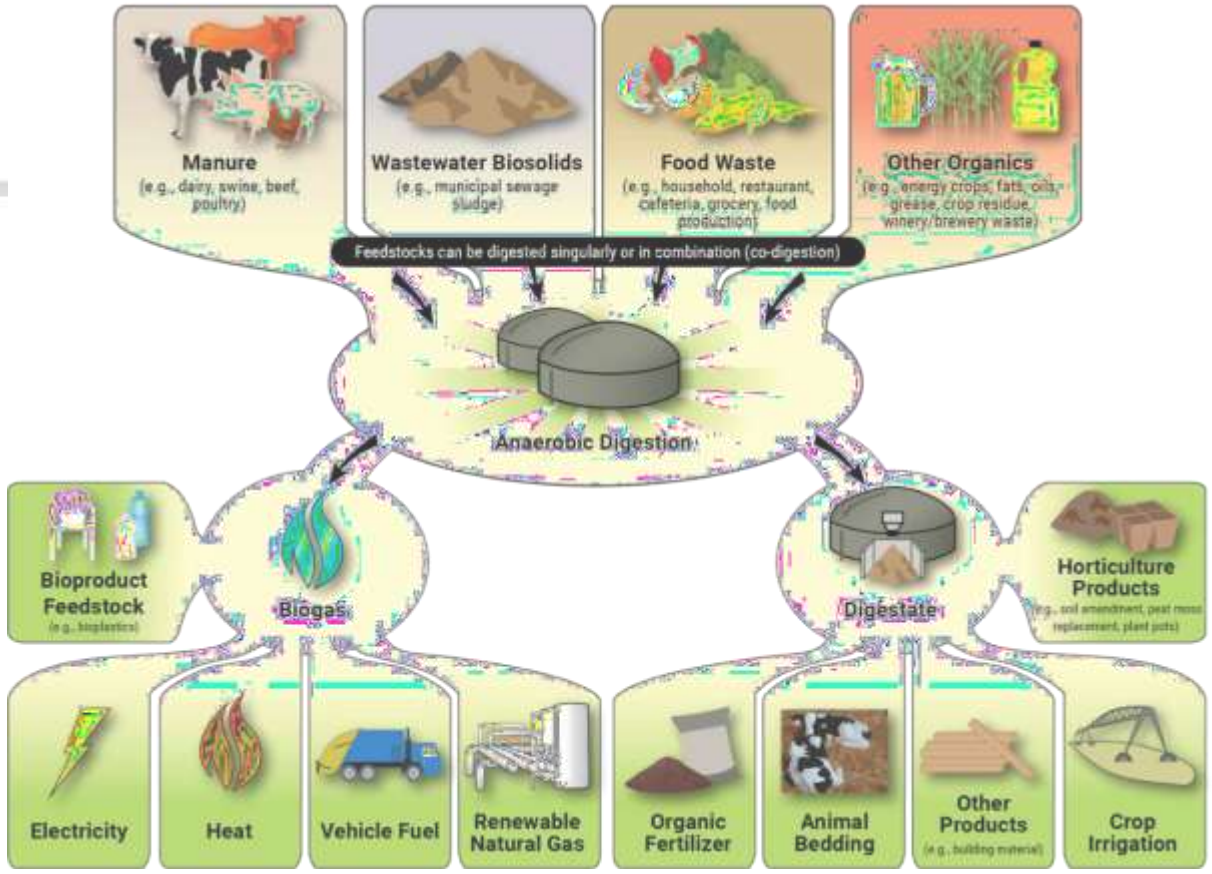
- Potential replacement for smaller battery or ICE operated transportation devices
  - Golfcarts
  - Corporate campus shuttles
  - Forklifts
- Emergency backup power (few moving parts and high durability)
- Government discounts exist for companies willing to pilot this technology
  - Hydrogen Laws and Incentives

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

[2.914x] Biofuels

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2.914x	Biofuels	11	$6,737,568	5.4	33.3%
2.9141	Install Anaerobic Digester	11	$6,737,568	5.4	33.3%



What's the idea?

- Win-win, helps manage waste while producing usable fuel
- Anaerobic digestion is an established technology for the treatment of waste and wastewater, the final products are stable sludge and biogas (i.e., Methane) which can be; sold, used for heating, co-generation of electricity and heat, infused into fertilizer, etc

When is it viable?

- Industrial biproduct is a bio-digestible substance
  - Part of industrial process requires heating (i.e., boiler or furnace) or high electric demand

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

Questions?