TETRA TECH

Turning Brownfields into Solar Energy Facilities: Perspectives from South of the Border

Northern Lights Solid Waste Conference

February 9, 2021

Presenter Information

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Low Impact Redevelopment Use

- ✓ Quiet
- ✓ Low profile (<14’ high: solar)
- ✓ Minimal vehicular traffic
- ✓ Limited liability/risk
- ✓ Low maintenance
- ✓ Can generate positive media visibility

Los Angeles DPW Pine Tree Project

Why Solar on Landfills?

- Leverage existing infrastructure
- Offset existing environmental costs
- Potential to generate $$

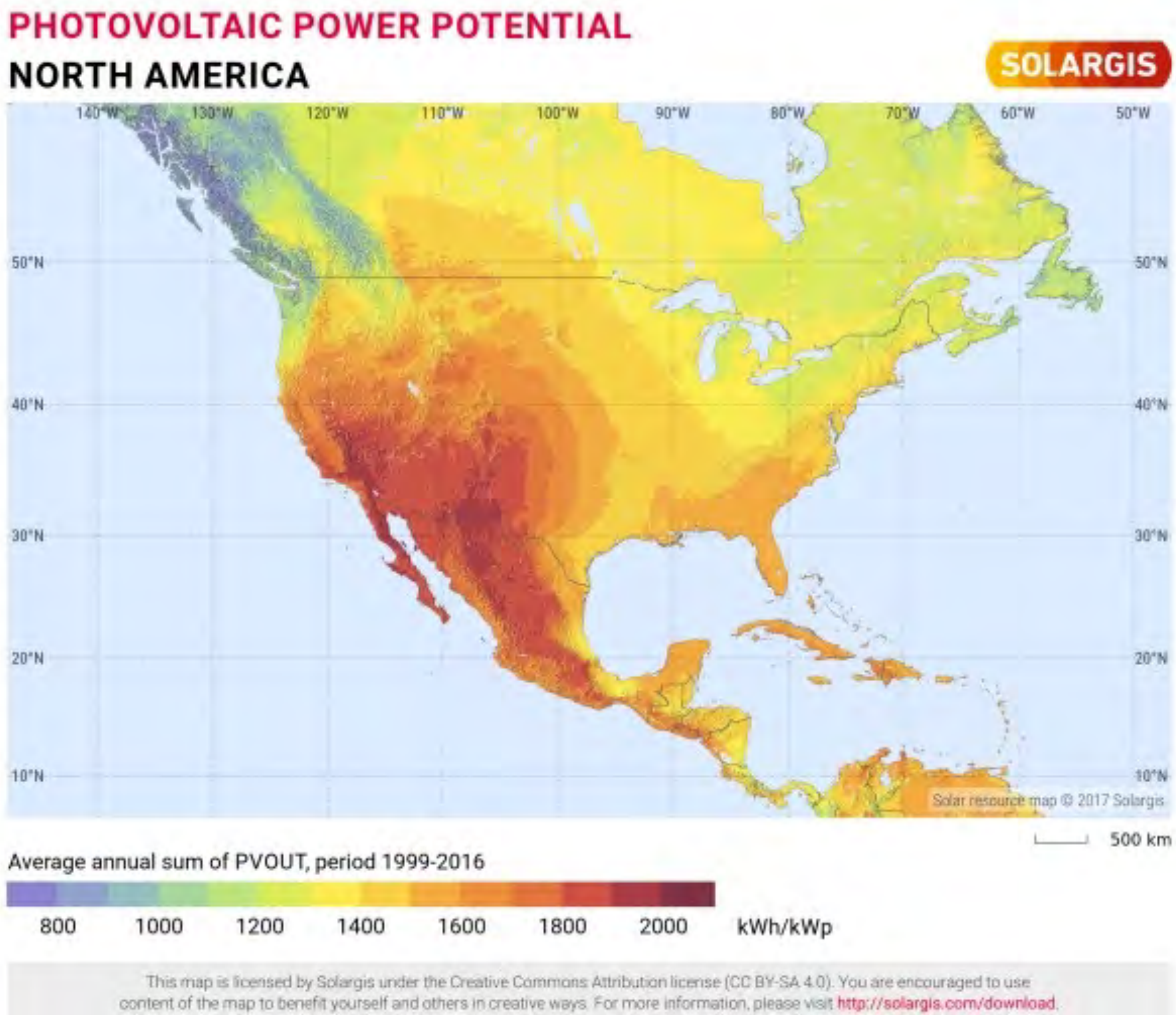
  (lease payments)
- Beneficial redevelopment of property

Plainville Landfill Solar Project: Massachusetts

Solar Energy Potential: Why Solar can work in Canada

- ❖ Solar generation potential is greatest in Alberta, Saskatchewan & Manitoba

Ontario leads in solar generation capacity



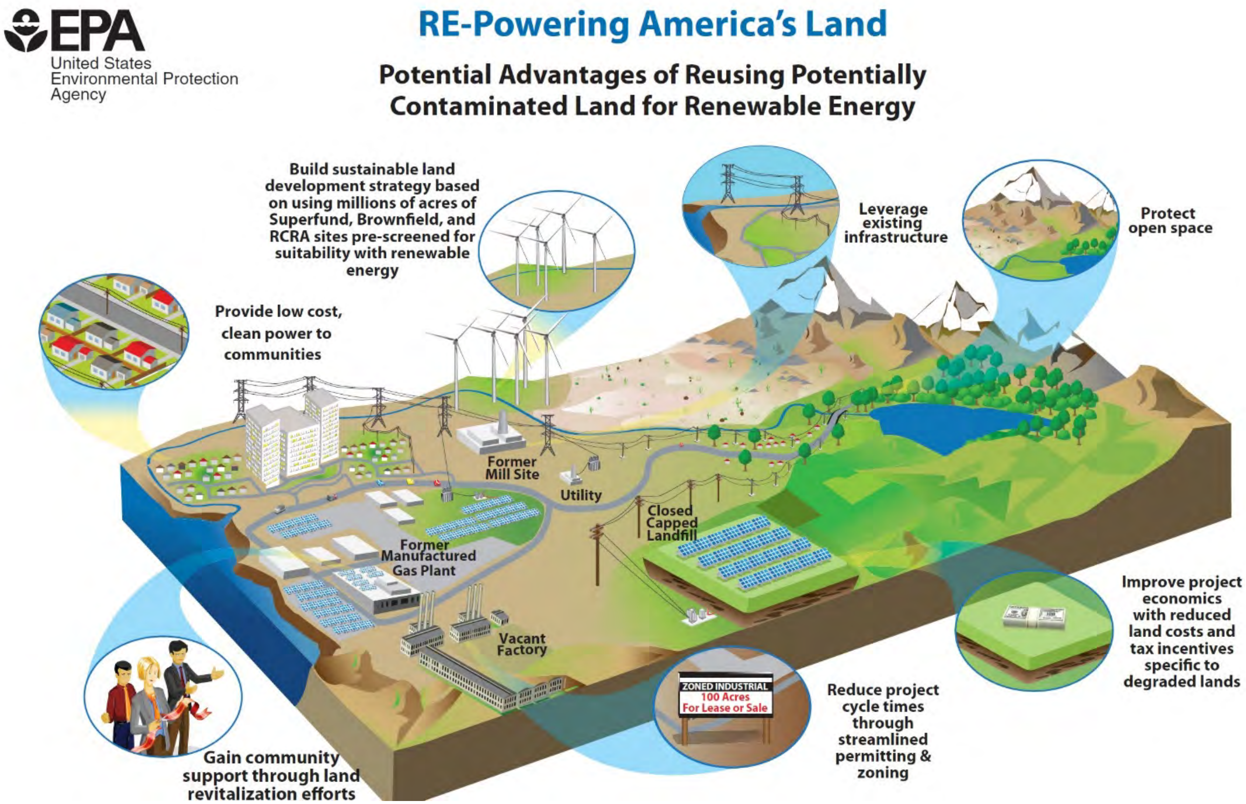
Regulatory Acceptance of Solar Energy on Landfills

- USEPA Re-Powering America's Land Initiative

www.epa.gov/re-powering

- New York State: SEQR Exemption for solar projects (<25 acres)

6NYCRR § 617.5(C)(14) & (15)



Renewables on Landfills: United States Overview

- ~240 Solar Projects on Landfills
- 174 Solar Projects > 1 Megawatt (MW) in size (*Source: USEPA Re-Powering America's Land Initiative Tracking Document: October 2020)*
- Canada is home ~138 solar projects >1 MW in size *(Source Canadaaction.ca)*

Solar on Landfill Growth over Time

- ✓ First Solar on Landfill project completed in 2006
- ✓ Majority of renewables on brownfields are solar landfill projects
- ✓ Greater financial and regulatory acceptance over time

Source: USEPA Re-Powering America's Land Initiative Tracking Document: January 2019

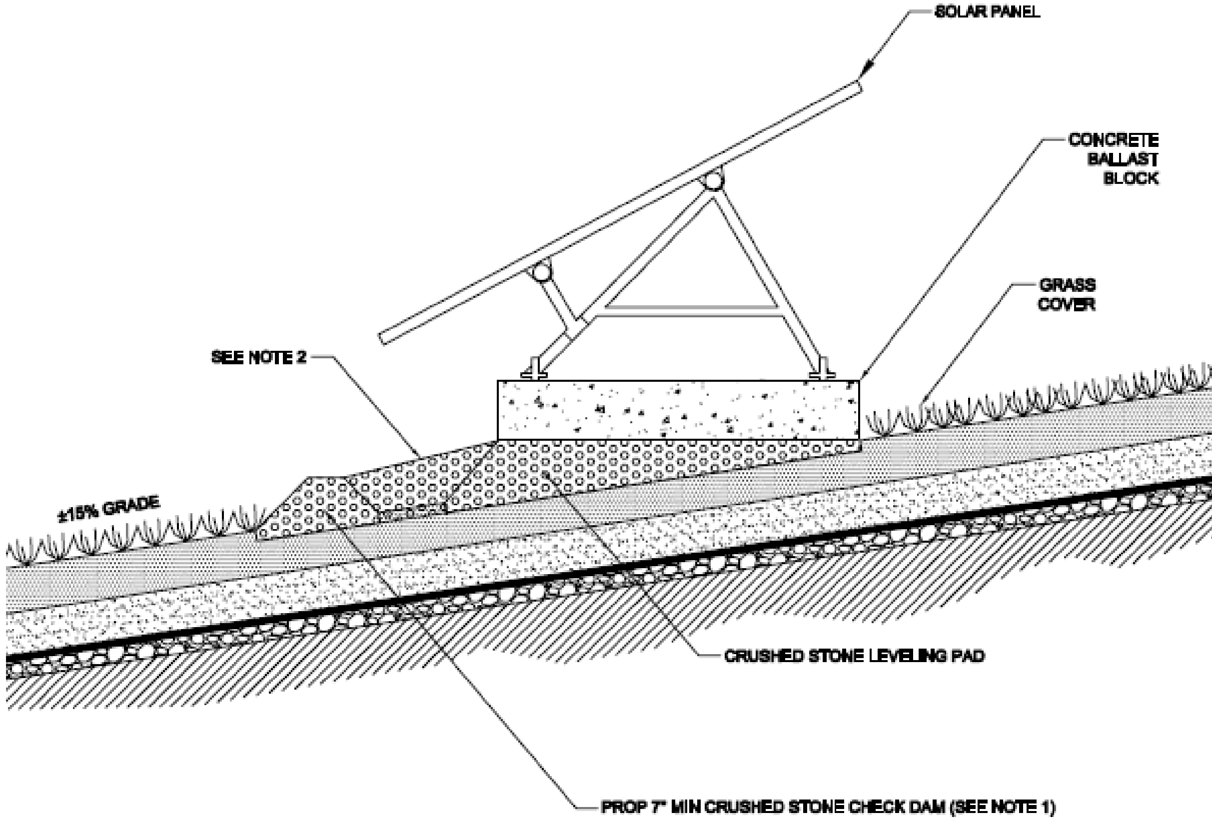
Typical Solar Facility Components

- Solar panels anchored to a racking system
- Structural supports (typically concrete ballast on landfills)
- String or central inverters
- Interconnection transformers (concrete pad)
- Battery Electric Storage System (BESS)
- Underground or above ground wiring to the Grid
- Performance monitoring and weather station
- Security fence and access roads

Weibel Avenue Landfill Solar Project: New York

Typical Solar Landfill Design Components

- No penetrating racking support structures *(Concrete ballasted system)*
- Can be installed on steep slopes
- Installation more expense than greenfield solar systems



NOTES:
1. CRUSHED STONE CHECK DAM SHALL BE CONSTRUCTED OF SAME STONE AS BALLAST LEVELING PAD.
2. EXTEND CRUSHED STONE LEVELING PAD TO CHECK DAM AT EACH BALLAST LOCATION.

Battery Energy Storage System Components

5 MW Direct Current (DC) BESS:
New York

What is the Ideal Solar Site?

- ✓ Solar utilizes large areas: 2.4 hectares = ~1 MW AC
- ✓ Compatible zoning
- ✓ Geotechnically stable
- ✓ Local fiscal incentives available
- ✓ Close to point of grid interconnection
- ✓ Facilities with operating or former Landfill gas operations

Saratoga Springs Solar Landfill Project, New York

Landfill Gas and Solar Interconnection

- Interconnection to the utility Grid is a significant solar development hurdle
- Landfill Gas to Energy Facilities are already grid connected
- Leverage LFG grid interconnection as landfill gas generation rates decrease

Orange County, California

Landfill to Energy Version 2.0

- LFG to Energy facilities are typically designed for near peak load conditions
- Landfill gas peak generation is greatest within about 5 – 7 years of disposal (ATSDR Landfill Gas Primer, 2001)
- Majority of landfill gas generated within 20 years of disposal
- Low cost grid interconnection capacity potentially available after several years of LFG to Energy operation

Plainville Landfill, Massachusetts

Renewables Planning and Design Considerations

- Strategize early and create team with experienced partners
- Early communications with internal and external stakeholders (e.g., Municipality, Interconnection team, neighbors)
- Design the facility landfill closure with solar redevelopment as an end use

Strategies for Development of Solar Projects on Landfills

Conduct a Feasibility Assessment:

- Any post-closure use restrictions
- Landfill cap construction (e.g., cap thickness, depth to barrier layer)
- Evaluate facility compliance history and potential for corrective action *(landfill repair)*
- Thickness of waste and potential for differential settlement
- Local regulatory requirements *(Many locales are supportive of the concept)*

East Bridgewater Landfill, Massachusetts

Anticipated Design Studies for Solar

- ✓ Electrical Interconnection Impact Study
- ✓ Solar Assessment Study
- ✓ Environmental Due Diligence (Required by solar investors and developers)
- ✓ Geotechnical investigation
- ✓ Wetlands delineation and T&E species studies (if necessary)
- ✓ Storm water management study

Bridgeton Landfill, Michigan

Renewables Advantages at Landfills

- ✓ Beneficial redevelopment of landfills with limited reuse options
- ✓ Leverages existing utility infrastructure
- ✓ Helps meet sustainability goals
- ✓ Promotes positive community relations
- ✓ Can generate redevelopment revenue for under-utilized Sites

"It's not about what it is, it's about what it can become." Dr. Seuss
The Lorax: 2012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Questions and Thank You