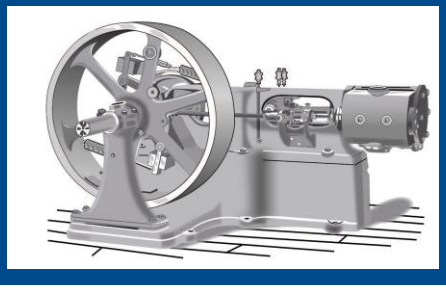

MN Chief Engineers Guild 2021 Conference

Roof Mounted Solar & Proper Roof Design

Wednesday, Sept 8th, 2021

Jason Popovich

INSPEC®

Agenda

- **Assessing Whether Roof Is “Solar Ready”**
- **Roof Design Considerations/Requirements for Roof-Mounted Solar Arrays**
- **Maintenance & Warranty Considerations**
- **Benefits of Installing a New Roof System Prior to Solar Install**
- **How Involving a Roofing Expert Can Help Ensure Smooth Installation & Minimize Potential Roofing Issues**
- **Questions?**

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Assessing “Solar Readiness”

- **Existing Roof Type**
  - Ensure existing roof type is acceptable for solar installation
    - Most recommend membrane or granular cap sheet BUR (check aging requirements). Ballasted roofs and gravel BUR often not ideal.

Assessing “Solar Readiness”

- **Existing Roof Remaining Service Life**
  - Avg Expected Lifespan of Panels Approx 25+ years
    - Roof that will meet or exceed lifespan of panels
      - Although some solar companies will remove 1x for main/reroof, most recommend installing new roof prior to solar

Assessing “Solar Readiness”

- **Warranty Remaining on Existing Roof?**
  - If installing on existing roof, check to ensure installing solar does not void warranty

Assessing “Solar Readiness”

- **Roof Obstructions**
  - Adjacent buildings or foliage blocking roof – 10% shade results in more than 10% reduction in efficiency of panel

Design Considerations

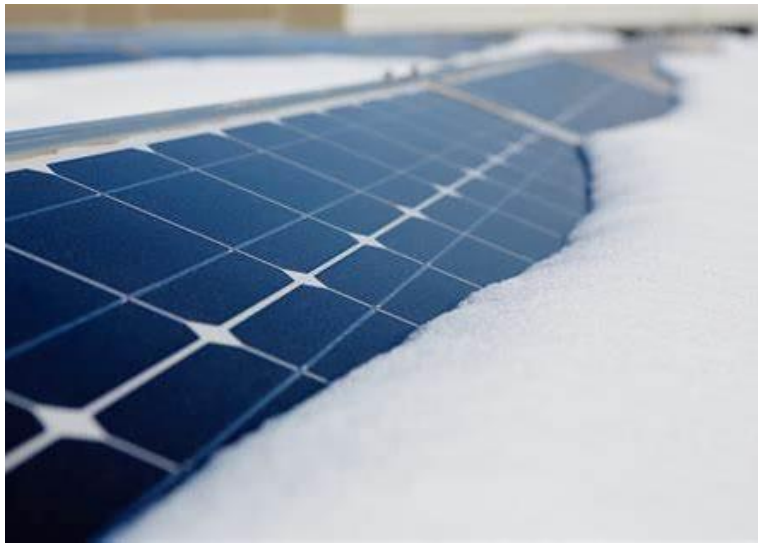
- **Structural Considerations**
  - Roof needs to be able to handle additional weight of solar array, mounting brackets, and ballast (if used).

Design Considerations

- **Structural Considerations**
  - Additional wind-uplift pressure needs to be accounted for in non-flush mounted applications

Design Considerations

- **Structural Considerations**
  - Non-flush mounted installations need also consider potential load of snow drifts



Design Considerations

- **Structural Considerations**
  - Structural load of solar array should be dispersed across roof as much as possible.

Design Considerations

- **Structural Considerations**
  - Care should be taken when installing that materials are not staged in a way that creates unancticipated point loads

Design Considerations

- **Spatial Requirements**
  - Panels min 10’ from roof edge for safety during servicing

Design Considerations

- **Spatial Requirements Cont…**
  - Panels should be placed 2x the height away from objects that may cast shadow
  - 10% > 10%

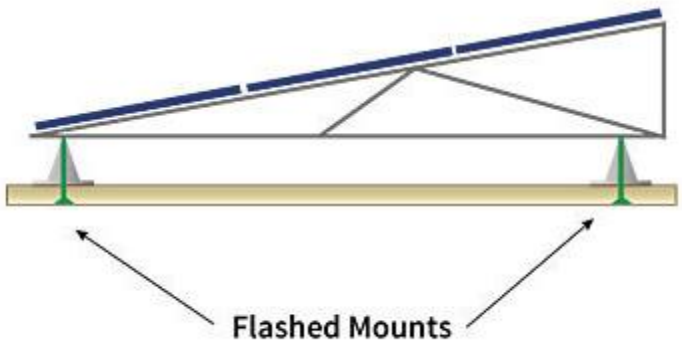
    loss

Design Considerations

- **Roof System Durability**
  - Adhered reinforced membrane or BUR w/ Granulated Cap sheet (check aging requirements of BUR)
  - Incorporation of a cover board
  - High compressive strength rigid insulation

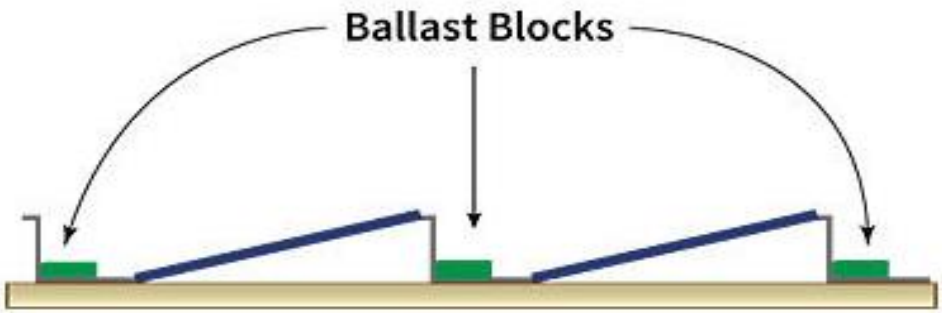
Design Considerations

- **Mounting Technique**
  - Mechanically Attached
    - More roof visibility and access, but many penetrations in roof



Design Considerations

- **Mounting Technique**
  - Ballasted
    - Fewer penetrations, but added weight and potential for some movement – protector sheet recommended



Design Considerations

- **Mounting Technique**
  - Hybrid
    - Combination of mechanically attached with some ballast
      - Typically used on buildings above 60’ tall where wind uplift is further concern or when structure cannot support weight of full ballast

Mantenance Considerations

- **Set solar array rack heights and ballast such that drains are not obscured**

Mantenance Considerations

- **Allow 4’ Access Rows for Maintenance of Mechanical Equipment, Skylights, and Other Penetrations**

Mantenance Considerations

- **Ensure Roof Membrane Protected From Damage During Install**

Mantenance Considerations

- **Ensure Membrane Protected from Punctures or Tears**

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- **Ensure Membrane Protected from Punctures or Tears**

Mantenance Considerations

- **Have Regular Inspections Performed by Roofing Expert to Check:**

1. Integrity of Penetrations
2. Drainage
3. Membrane Condition
4. Potential Insulation Compression

Benefits of New Roof

- **Roof Can Be Designed with Life Expectancy That Meet or Exceeds That of Solar (25+ years)**
- **Rigid Insulation with Increased Compressive Strength and Cover Board Can be Added to Account for Additional Weight**

Benefits of New Roof

- **New Roof Can be Designed to Accommodate Additional Wind Uplift Pressure From Non-Flush Mounted Solar**
- **Roof System That Allows for Easier Location of Leaks and Simplified Repairs Can be Utilized**

Benefits of New Roof

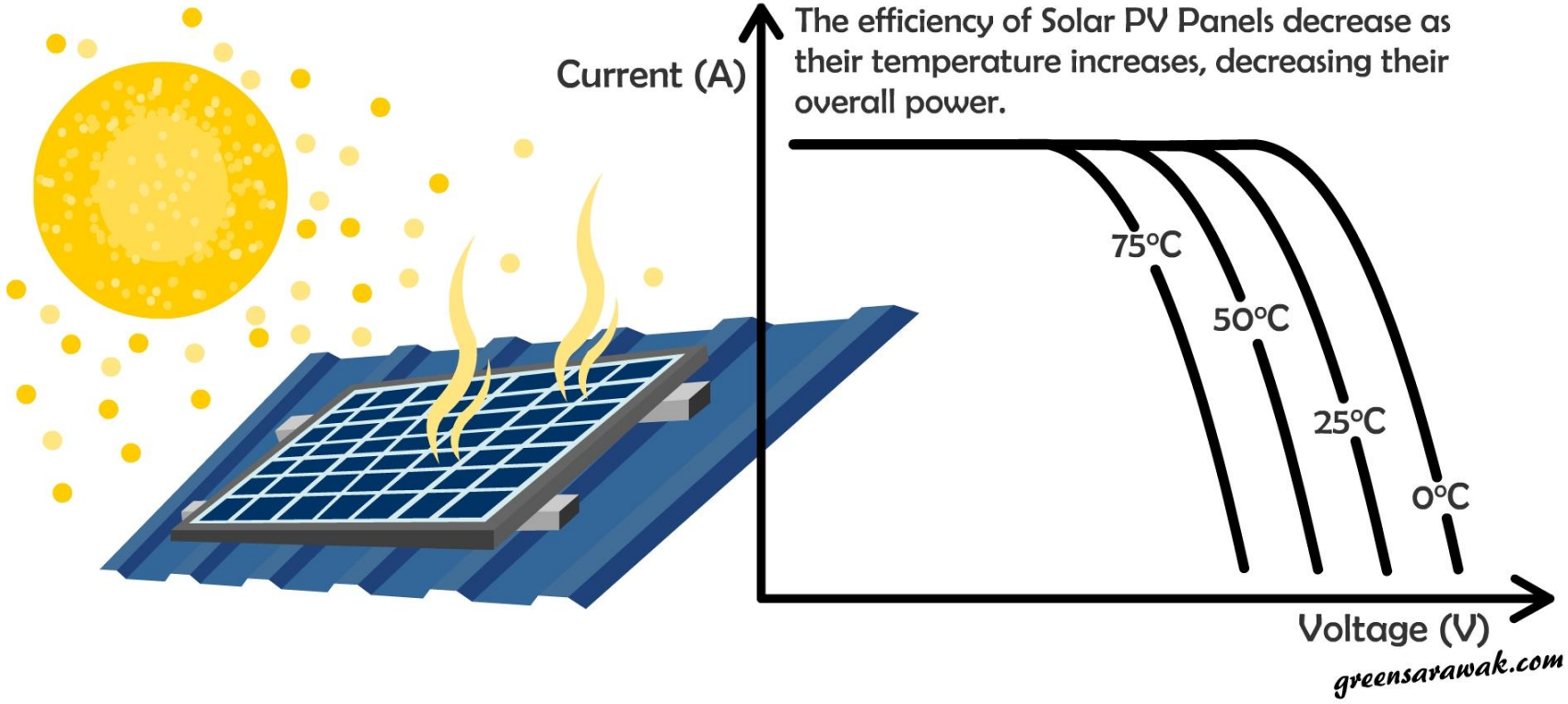
- **Possible to Relocate Mechanical Equipment, Thus Utilizing Space in Most Optimal Way for Solar**

Benefits of New Roof

- **Roof That Maximizes the Output/Efficiency of Solar Can Be Installed**
  - The temperature of your solar panel has a direct effect on its ability to generate electricity. This has to do with the laws of thermodynamics and how heat limits any electronics ability to produce power.

Benefits of New Roof

Solar Panel Temperature Coefficient



Benefits of New Roof

Solar Panel Temperature Coefficient (Cont)

- For solar panels, this impact is reflected through the temperature coefficient, which is expressed as the percentage decrease in output for every 1-degree Celsius (° C) increase in temperature from 25° C (77° F). Solar panels are tested for their efficiency at 25° C, and that is why this is used as the reference point.

- Most solar panels have a temperature coefficient of around -0.3% / ° C to -0.5% / ° C.

Benefits of New Roof

Solar Panel Temperature Coefficient (Cont)

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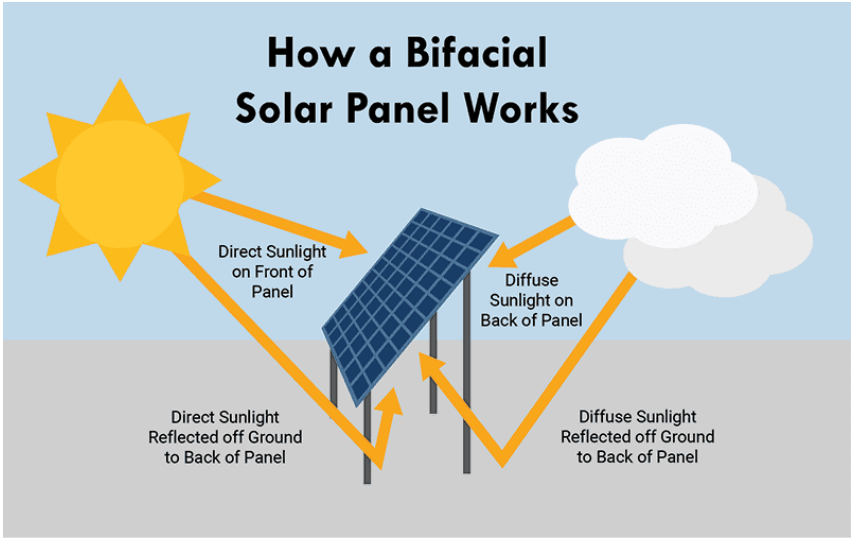
- Most solar panels have a temperature coefficient of around -0.3% / ° C to -0.5% / ° C.

Benefits of New Roof

- **Potential to Utilize Reflective Membrane with Bifacial Panels**
  - Can increase efficiency 20-35% over standard panels over dark membrane.



Benefits of New Roof

- **Intalling a New Roof Prior to or During Solar Install:**
  - Ensures roofing codes are met/best practices are followed (access, fire codes, electrical codes, drainage, uplift, etc)
  - Reduces likelihood solar will need to be removed and reinstalled during useful life
  - Allows specification of desired solar attachment method (mechanical vs ballast)
  - Allows for selection of roof system that will best compliment the solar

Summary

Regardless of Whether a New Roof is Installed, a Holistic Approach Should be Taken to Ensure:

- **Roof is acceptable for solar**
- **Proper codes/best practices are followed**
- **Integrity of roof system is protected**
- **Maintenance items can be easily addressed when they arise**
- **Undue costs are avoided**
- **Desired level of performance is achieved**

Summary

Involving Your Chosen Roofing Expert Can Help Ensure Roof-Mounted Solar Projects are Not Only Feasible but Will Have a Long Service Life.

Questions?

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