BUILDING A WORLD OF DIFFERENCE

7 July 2015

INNOVATIVE APPROACHES TO IDENTIFICATION OF DISTRIBUTED SOLAR PV POTENTIAL

MON-FEN HONG, SEEMA GHOSH, RYAN PLETKA, RYAN LIDDELL, NATHAN CLARK

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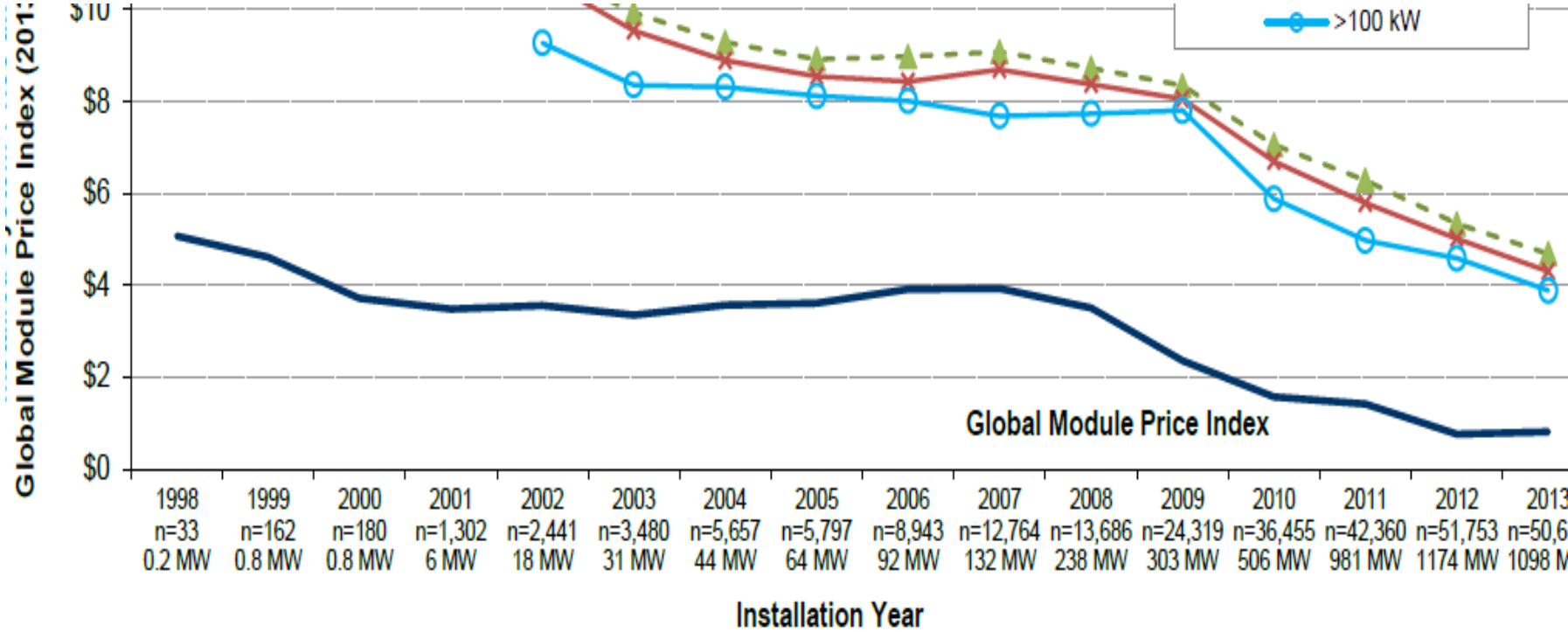
AGENDA

Overview
Technical Potential/LiDAR Analysis
Economic Analysis
Market Penetration & Adoption

OVERVIEW

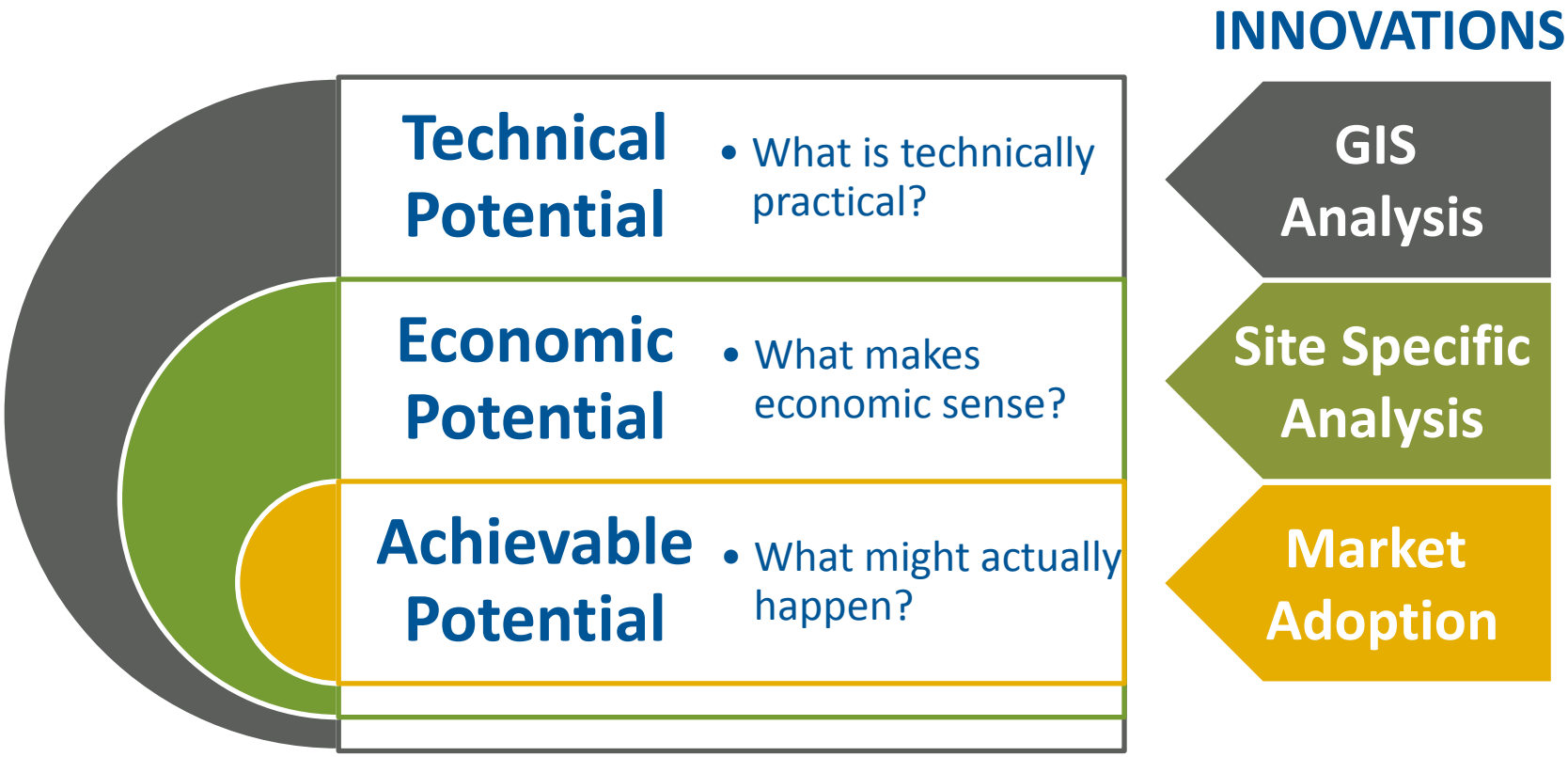
DISTRIBUTED SOLAR COSTS HAVE BEEN DECLINING NATIONALLY

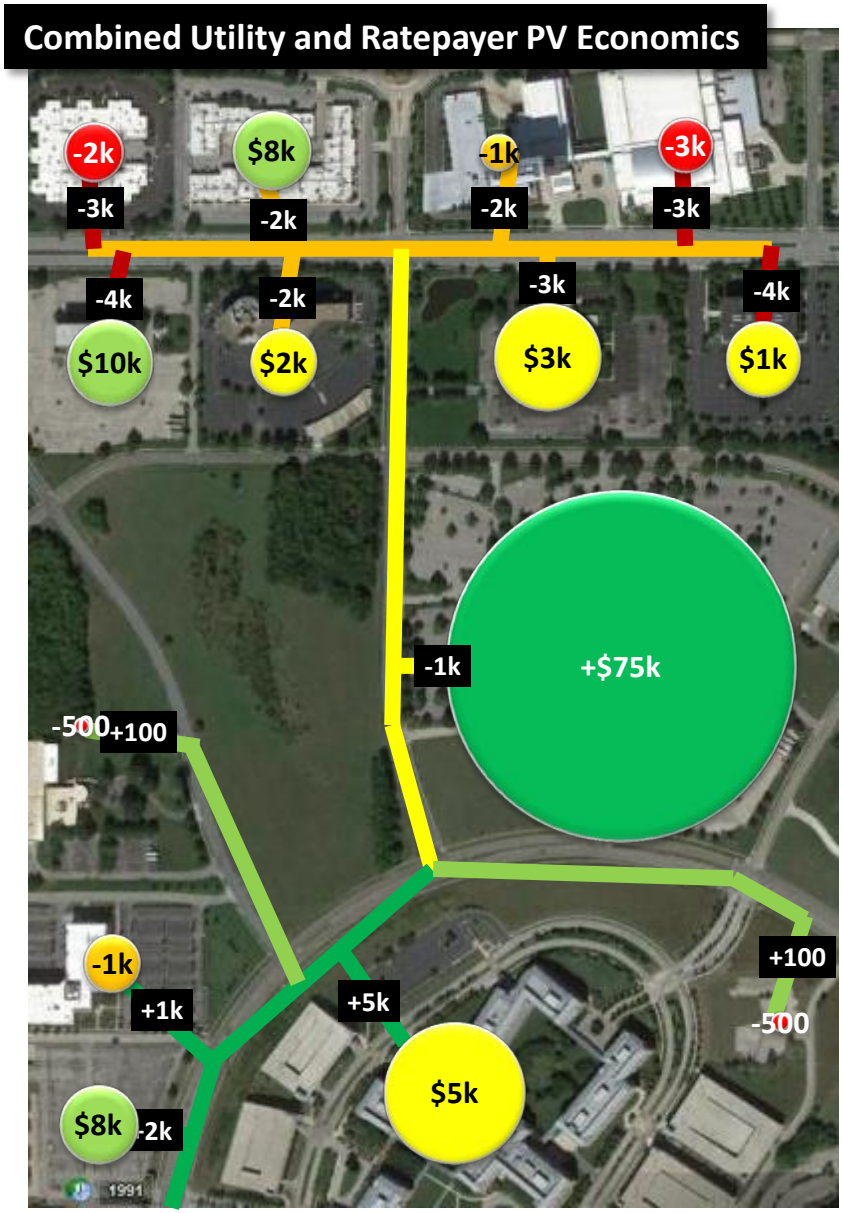


te: Median installed prices are shown only if 15 or more observations are available for the individual size range. The Global Module Price Index is SPV Market search's average module selling price for the first buyer (P. Mints).

Source: Lawrence Berkeley National Laboratory/DOE

DISTRIBUTED-SCALE SOLAR POTENTIAL APPROACH





UNDERSTAND ECONOMICS AT THE SITE LEVEL

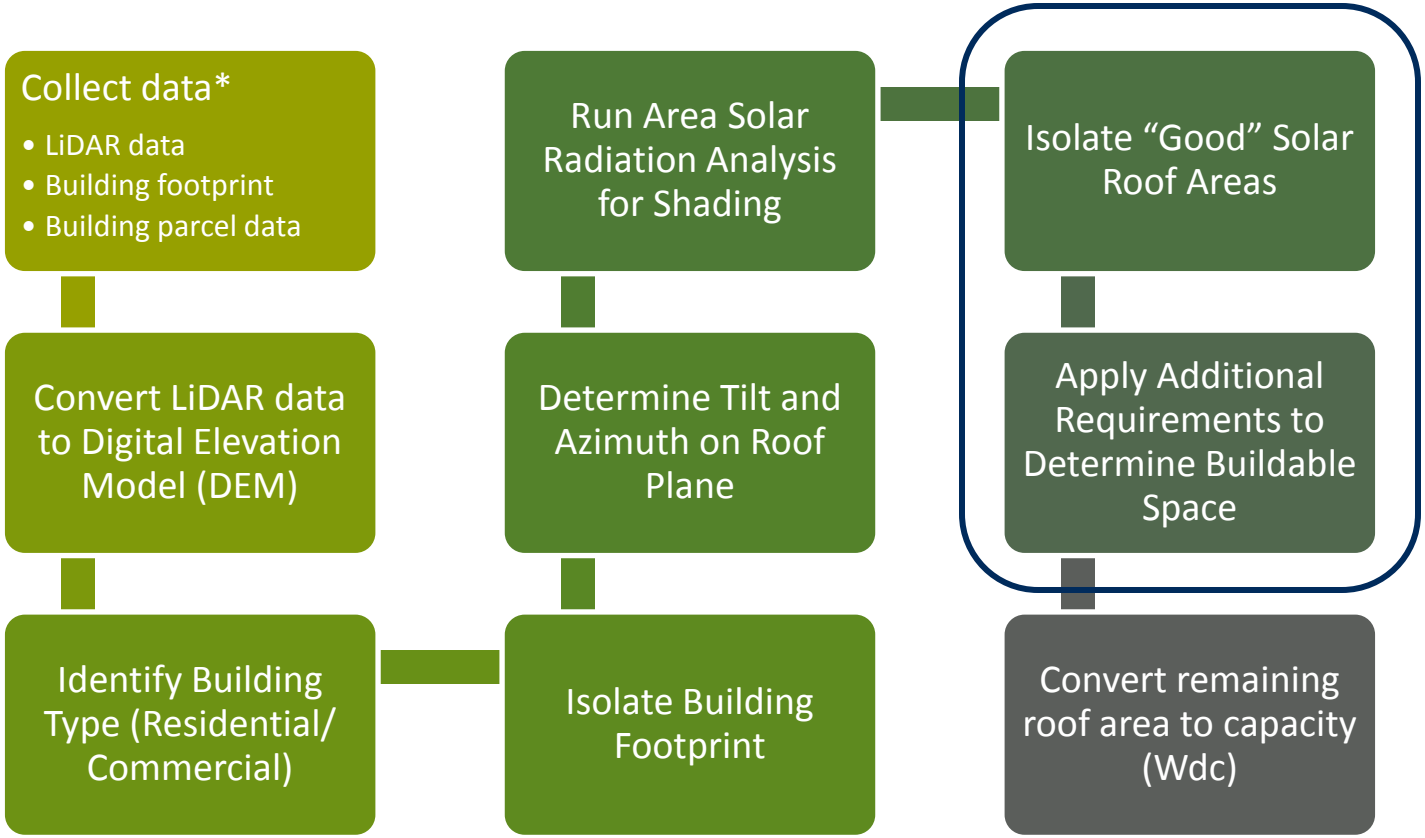
- IRP Planning
- Meeting RPS and other goals
- Distribution System Planning
- Rate design
- Identifying economic sites

TECHNICAL POTENTIAL

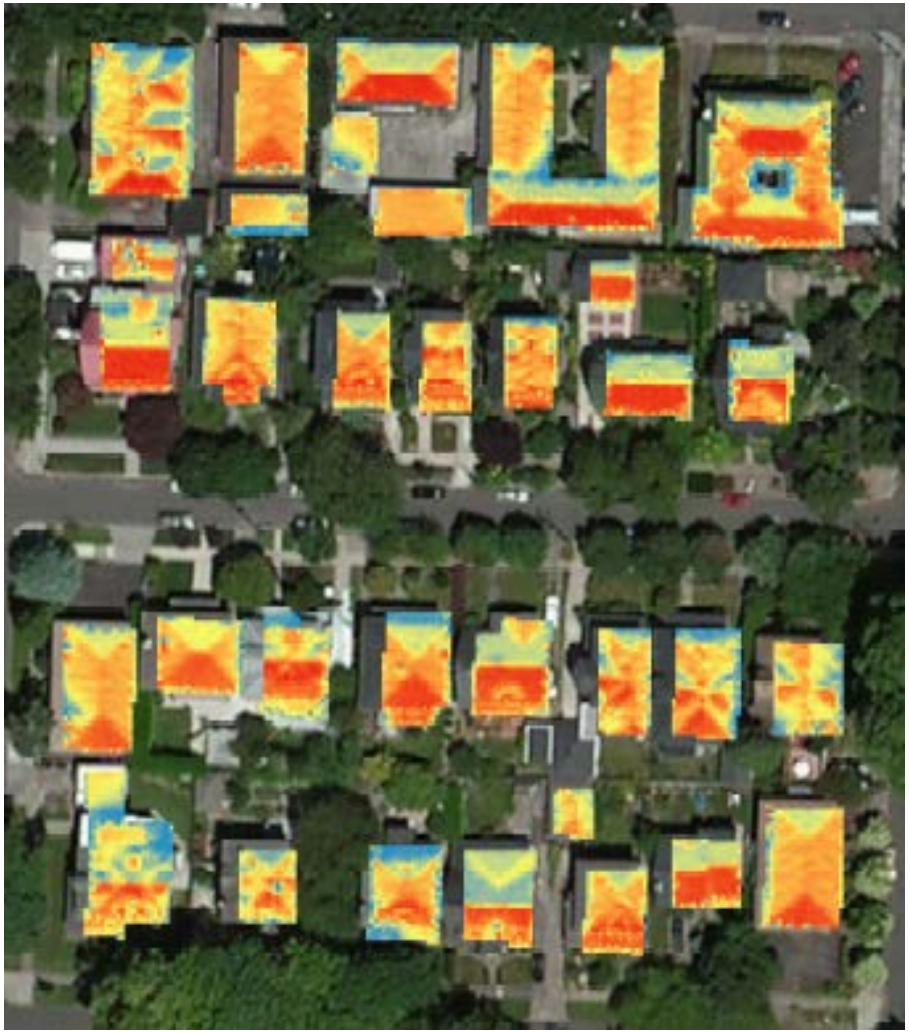
GIS Analysis

PROCESS FLOW – GIS ANALYSIS

TECHNICAL POTENTIAL APPROACH

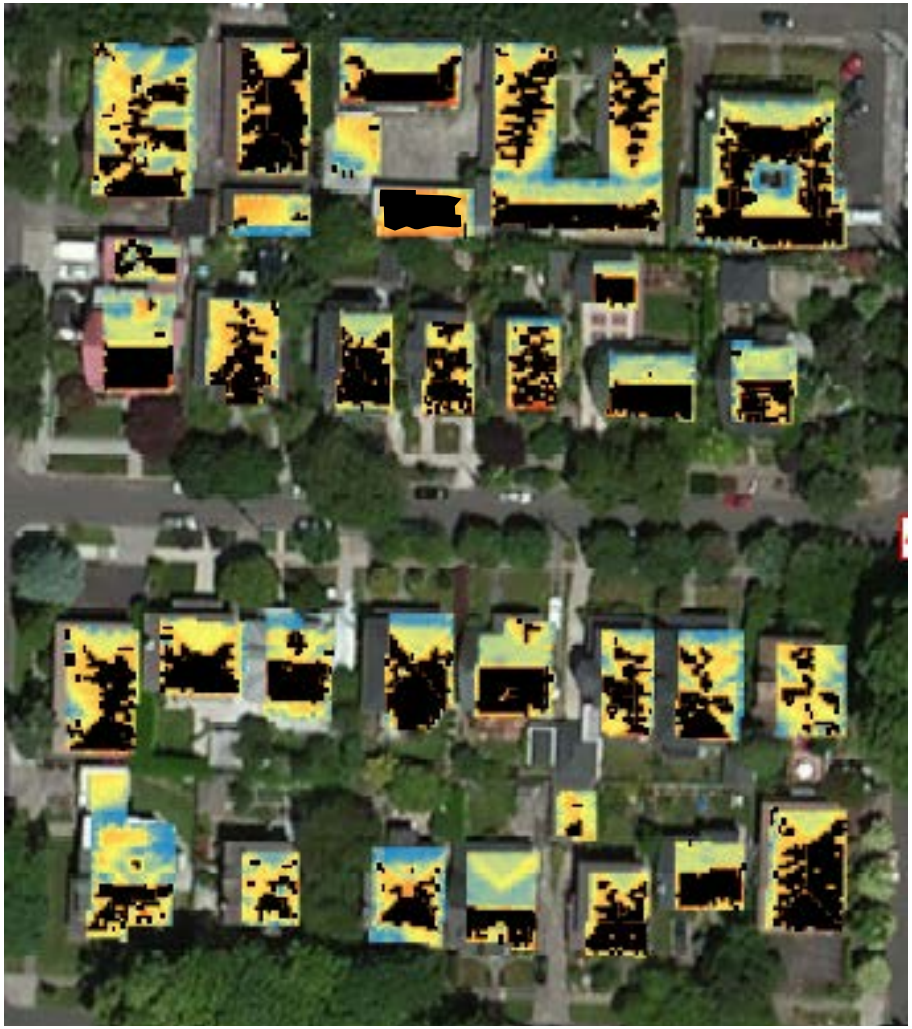


STEP 1: ISOLATE BUILDING FOOTPRINT



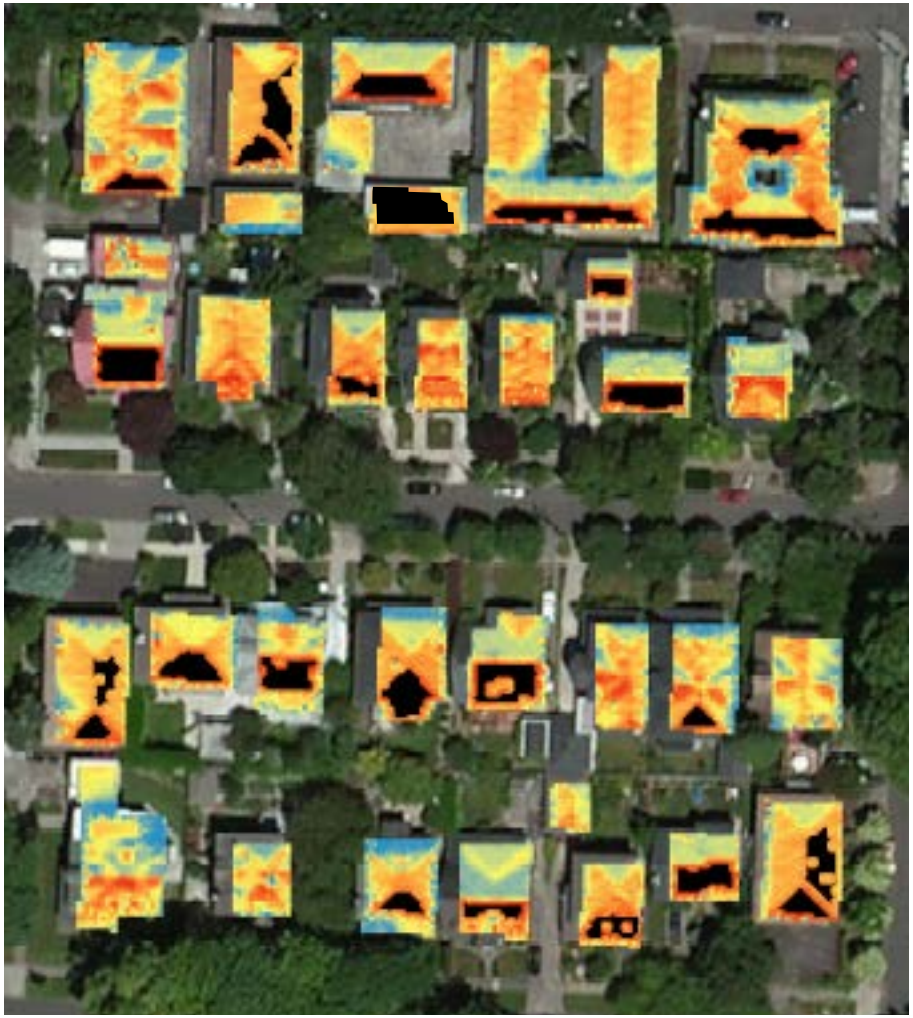
Identify roof planes and tilt and azimuth of each roof plane and translate to solar resource

STEP 2: FILTER FOR SOLAR RESOURCE METRIC



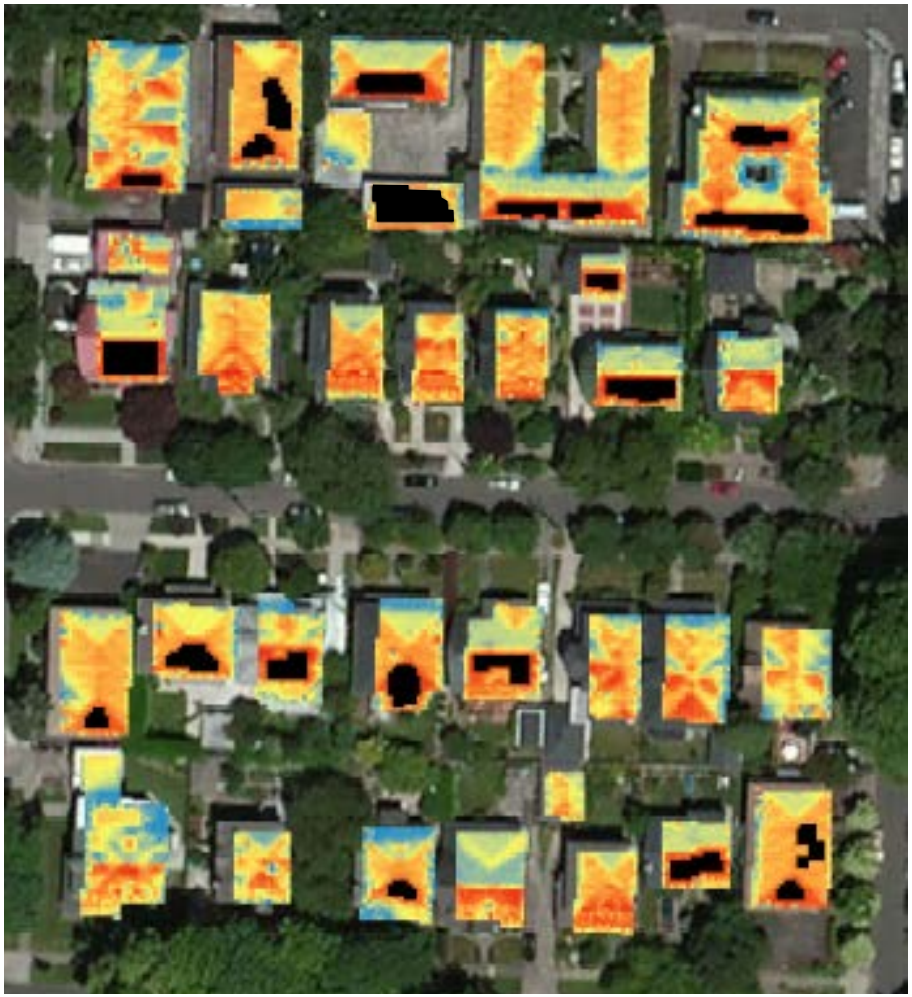
Most of the selected roofs are oriented southward or were flat roofs with minimal shading

STEP 3: LOCATE MINIMUM CONTIGUOUS AREA



Filter for minimum contiguous area of 100 square feet

STEP 4: GEOMETRIC CONSTRAINT



Edges must be at minimum 4 feet in length

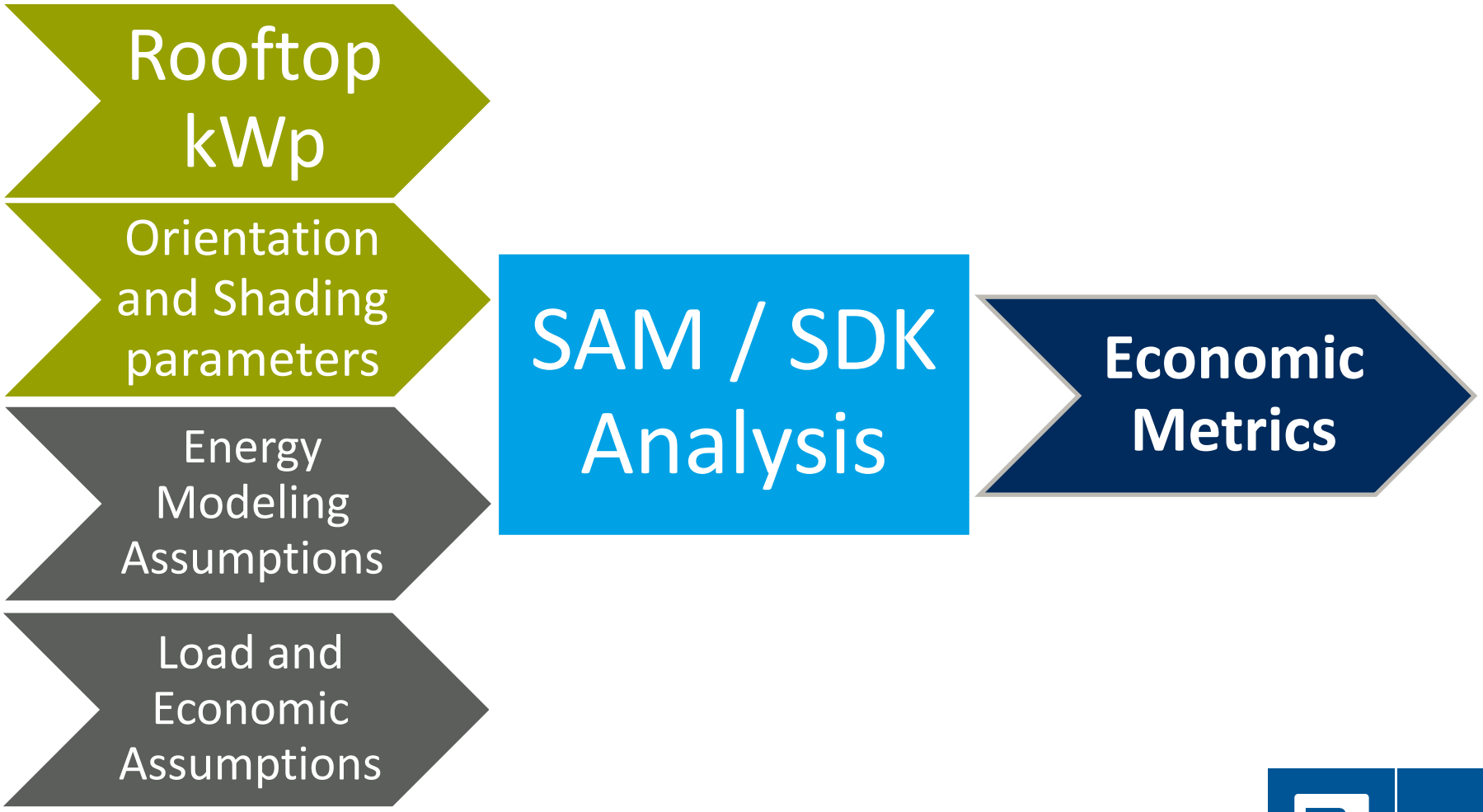
TECHNICAL POTENTIAL BASED ON CURRENT BUILDING STOCK

Other factors that which influence long-term potential that could be considered:

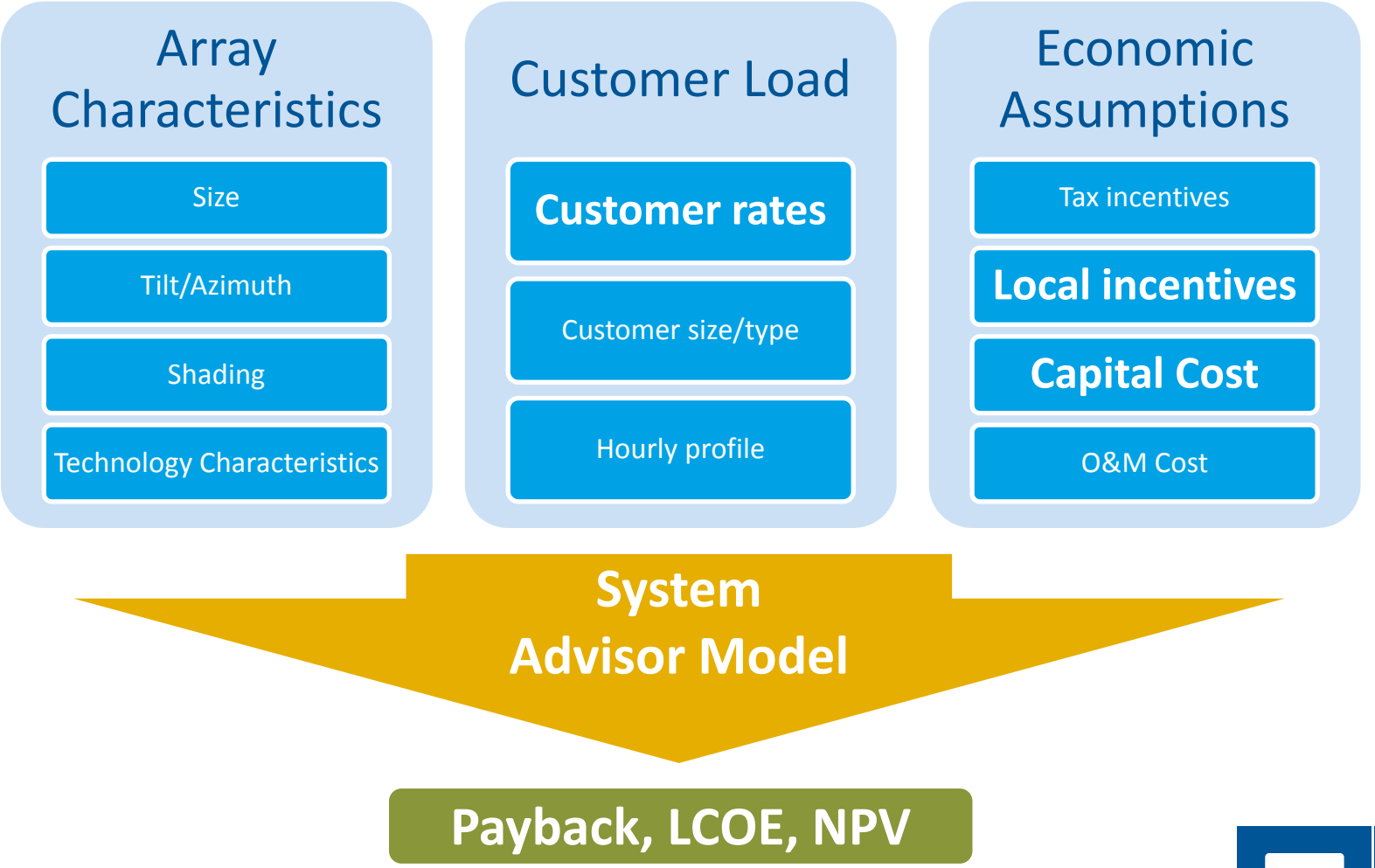
- New construction
- Modifications to the existing building stock
- Growth/removal of trees and other shading sources
- Improvements in solar panel efficiency
- Changes in permitting/zoning requirements and restrictions
- Innovations in mounting structures, such as lower cost solar carports

ECONOMIC POTENTIAL

PROCESS FLOW – DG ECONOMIC ENGINE



ECONOMIC POTENTIAL USED NREL'S SYSTEM ADVISOR MODEL TO CALCULATE ECONOMIC METRIC



Multiple drivers in determining payback

THE POWER OF CLOUD COMPUTING

- **Roughly 4 hours to run**
  - 4 scenarios
  - 160,000 sites
    - Made up of 225,000 mounting planes
    - ➔ 640,000 SAM runs
  - 75 cloud instances
  - **~2,600 SAM runs per minute**

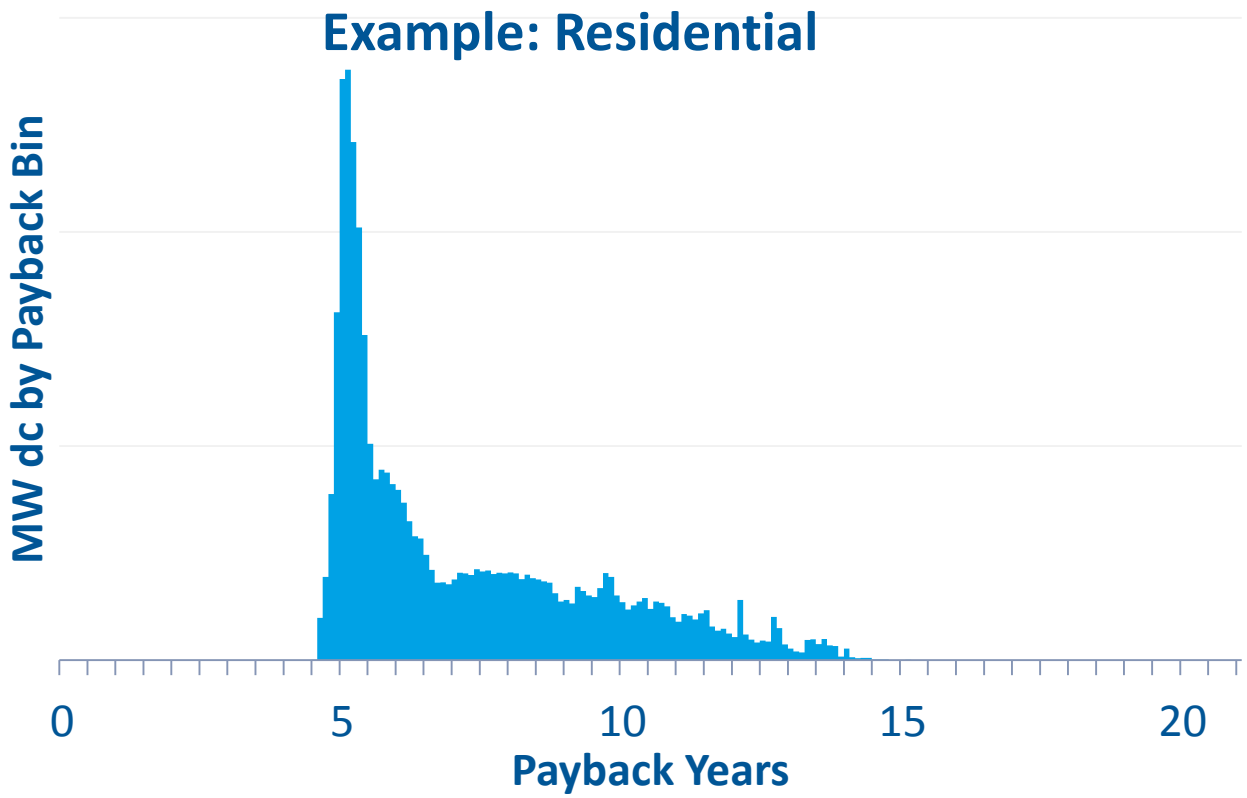
Compare this to 32 days without cloud computing!

ECONOMIC METRIC DEPENDS ON CLIENT SPECIFIC QUESTIONS

DEFINING WHAT IS ECONOMIC

- **Economic Cutoff**
  - Payback versus Project life (<20 years)
  - LCOE versus utility rates
  - NPV of >= 0
  - Other
- **Other Considerations**
  - Multi-family dwellings
  - Tenant-occupied buildings
  - Site specific exclusions – based on available data

EXAMPLE: RESIDENTIAL PAYBACK DISTRIBUTION



Incentives, cost assumptions and rate class are crucial assumptions.

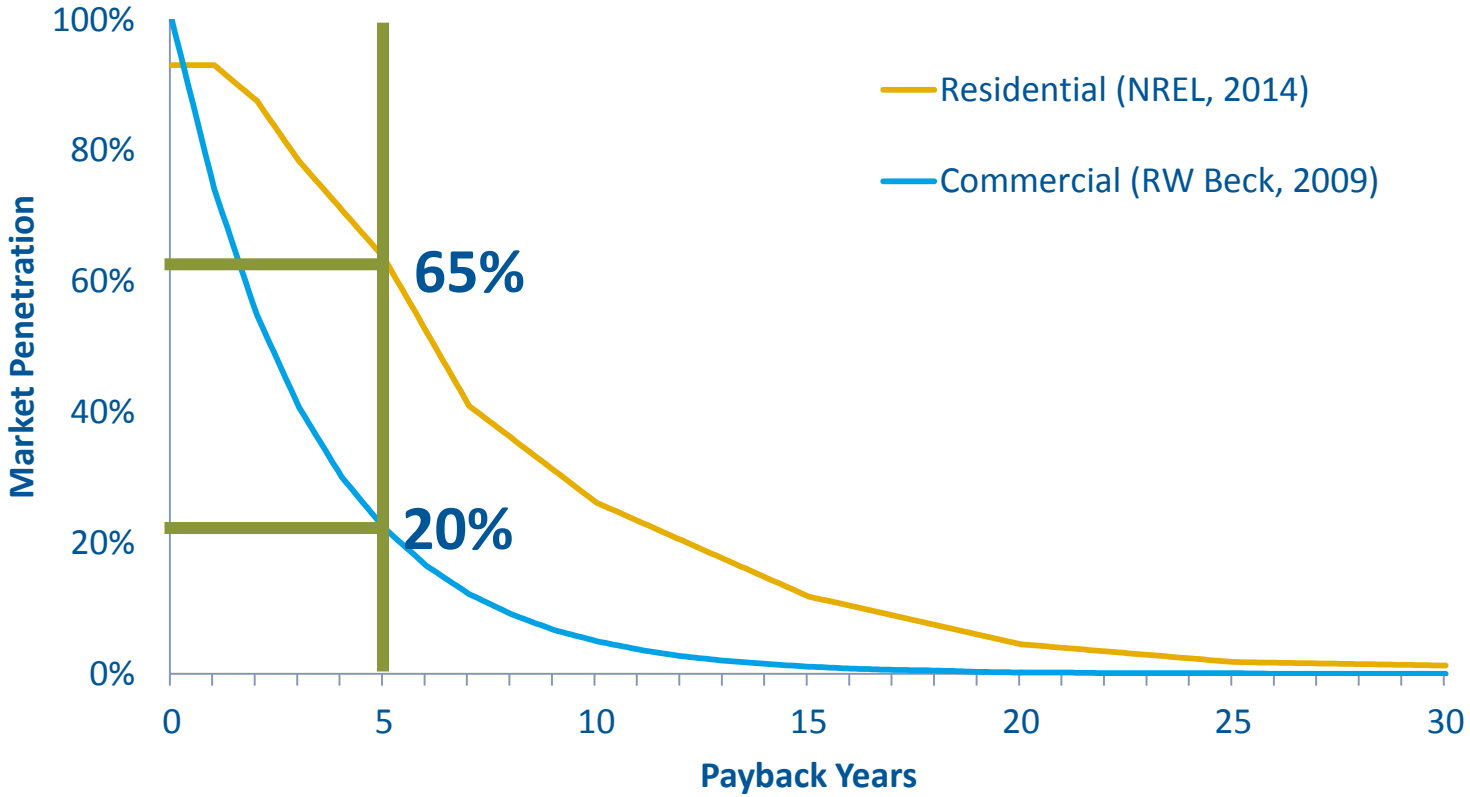
ACHIEVABLE POTENTIAL

PROCESS FLOW – ACHIEVABLE POTENTIAL

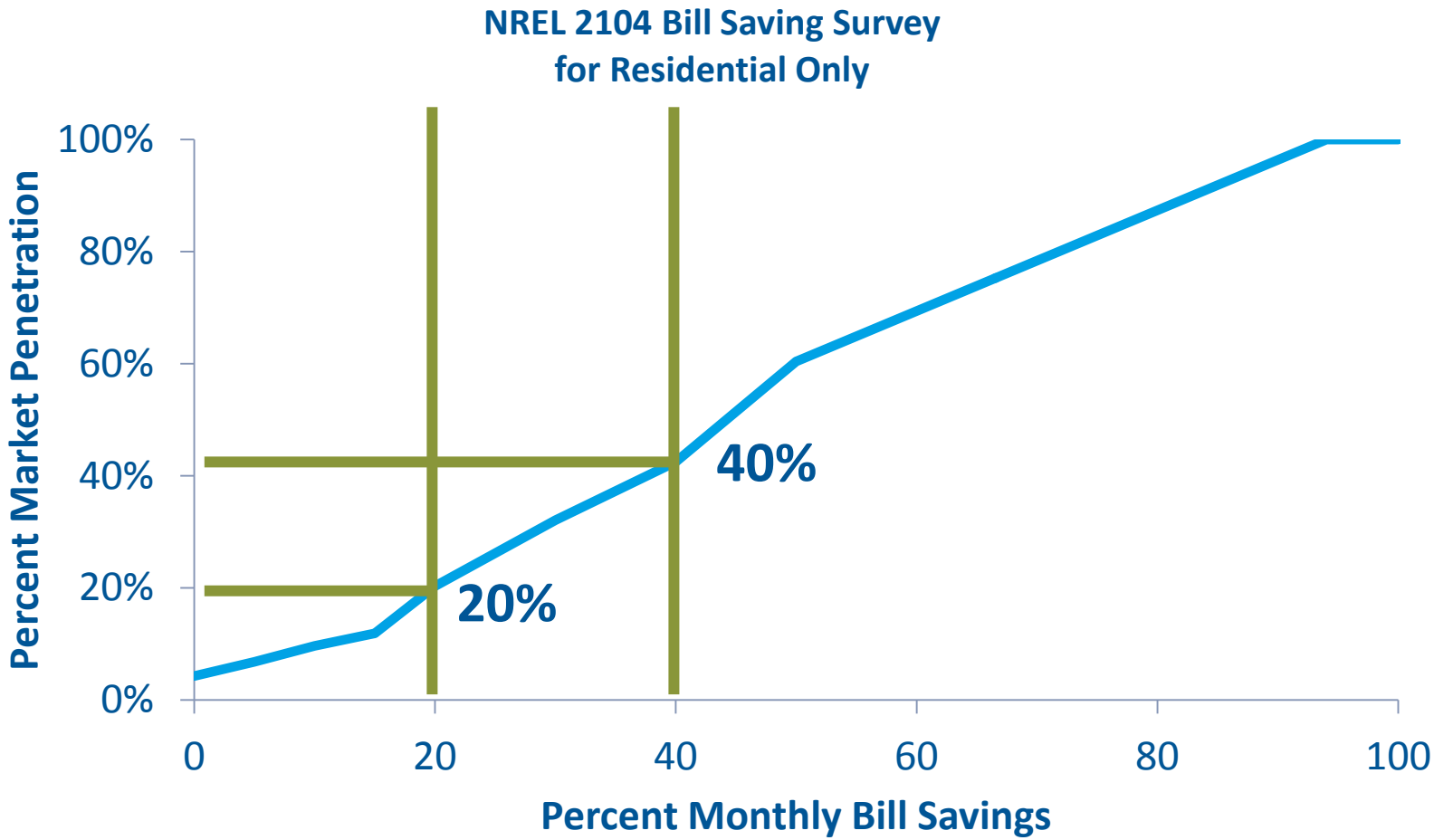
- **Two Step Process for Achievable Potential**

1. **Maximum Market Potential**: Given certain payback distributions, what is the total market size that could potentially adopt
2. **Annual Adoption**: Adoption of solar over time

MAXIMUM MARKET PENETRATION CURVES BASED ON SURVEY RESULTS OF CUSTOMERS

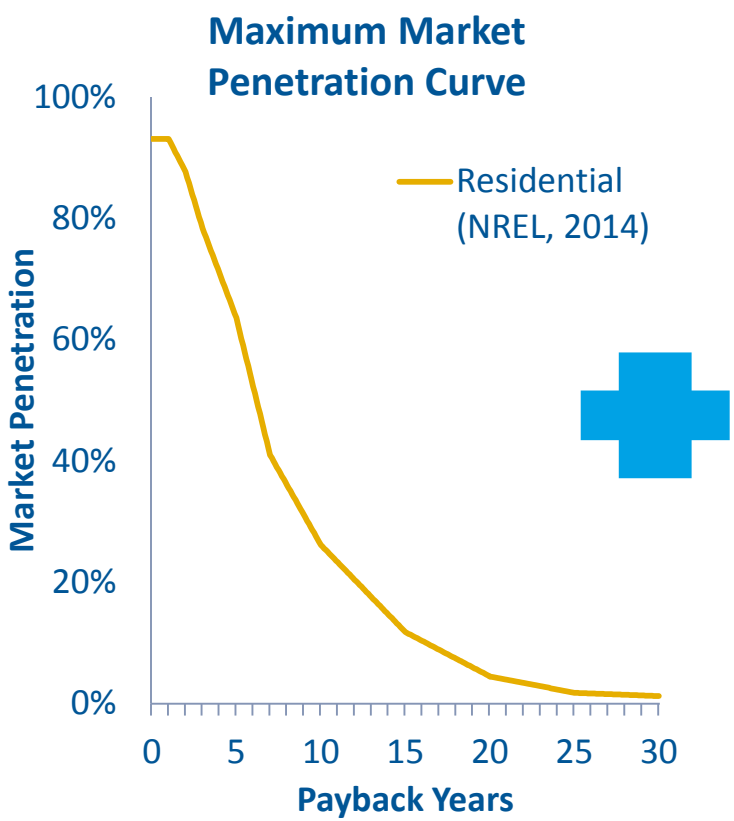


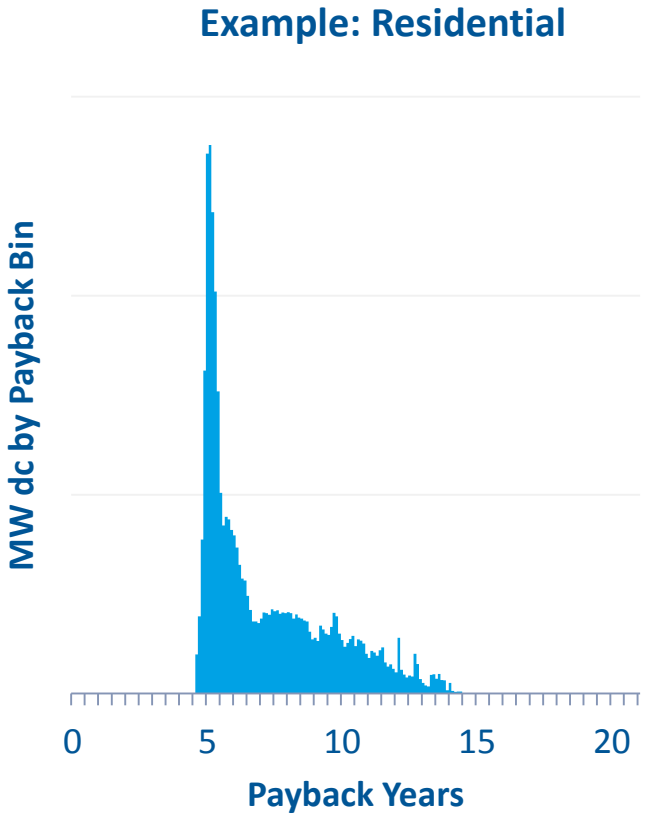
ALTERNATIVE MARKET PENETRATION CURVES



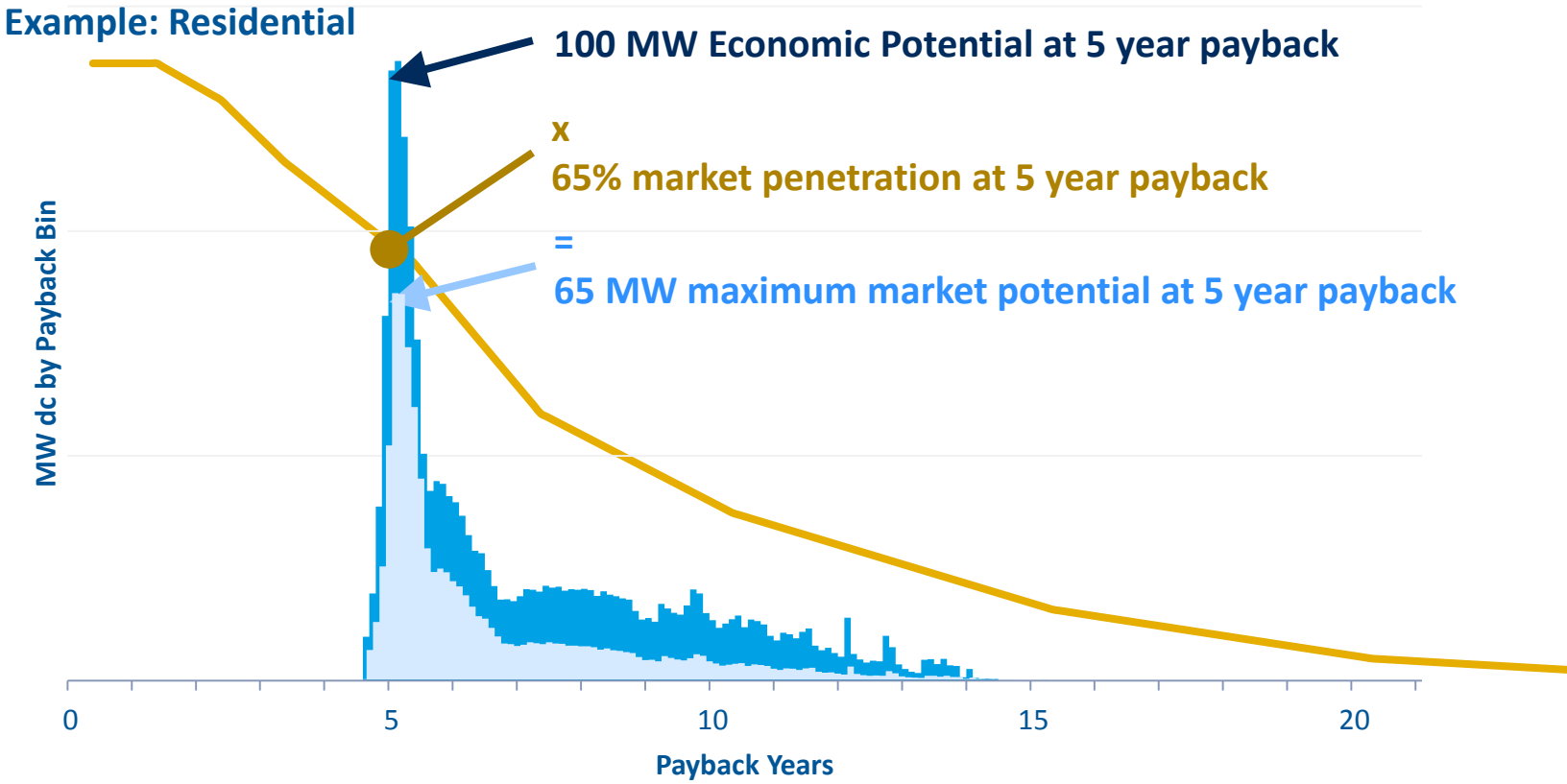
Grid Parity is not the Holy Grail

MAXIMUM MARKET PENETRATION CURVE APPLIED TO PAYBACK DISTRIBUTION



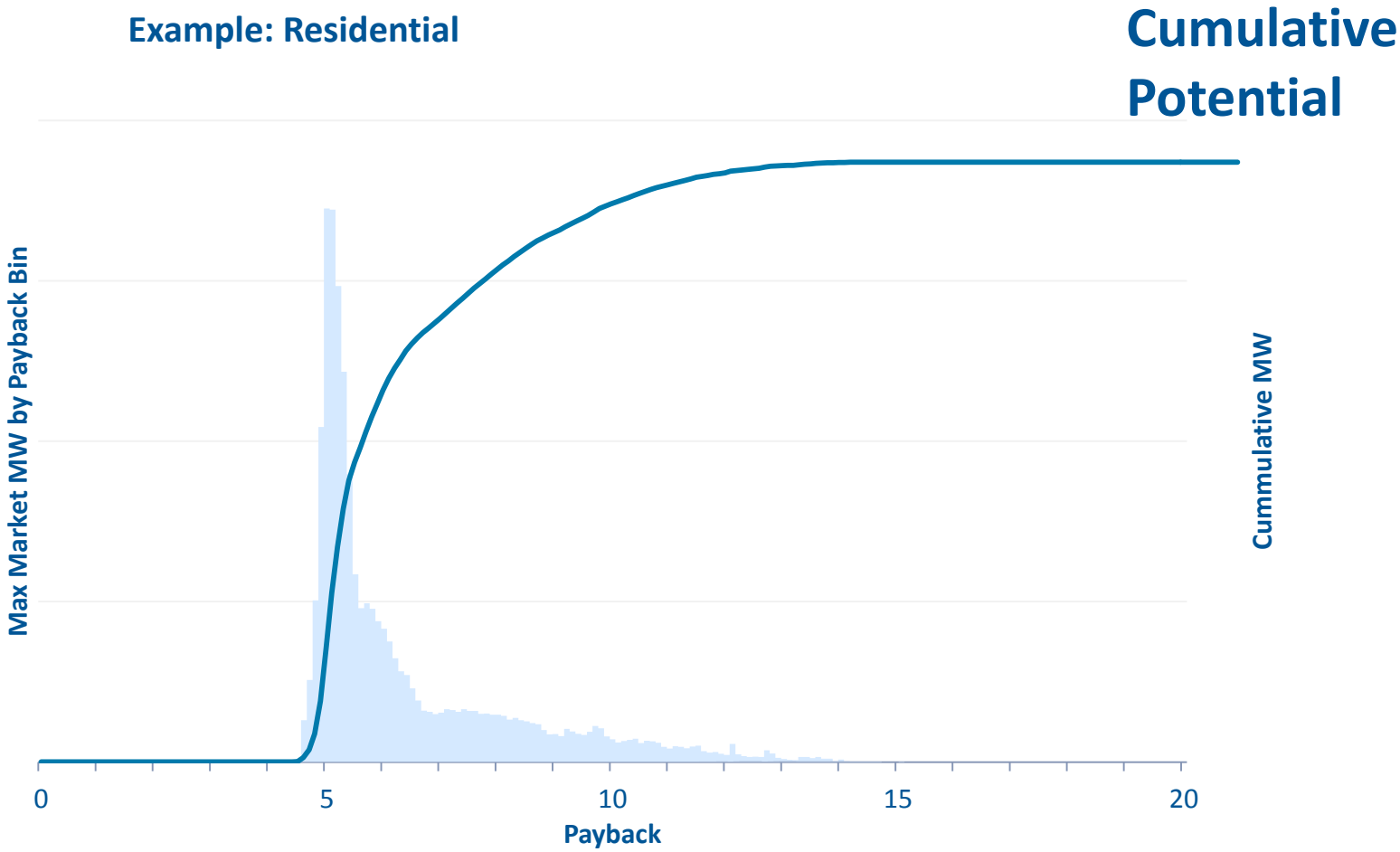


ILLUSTRATIVE MAXIMUM MARKET PENETRATION CURVE APPLIED TO PAYBACK DISTRIBUTION

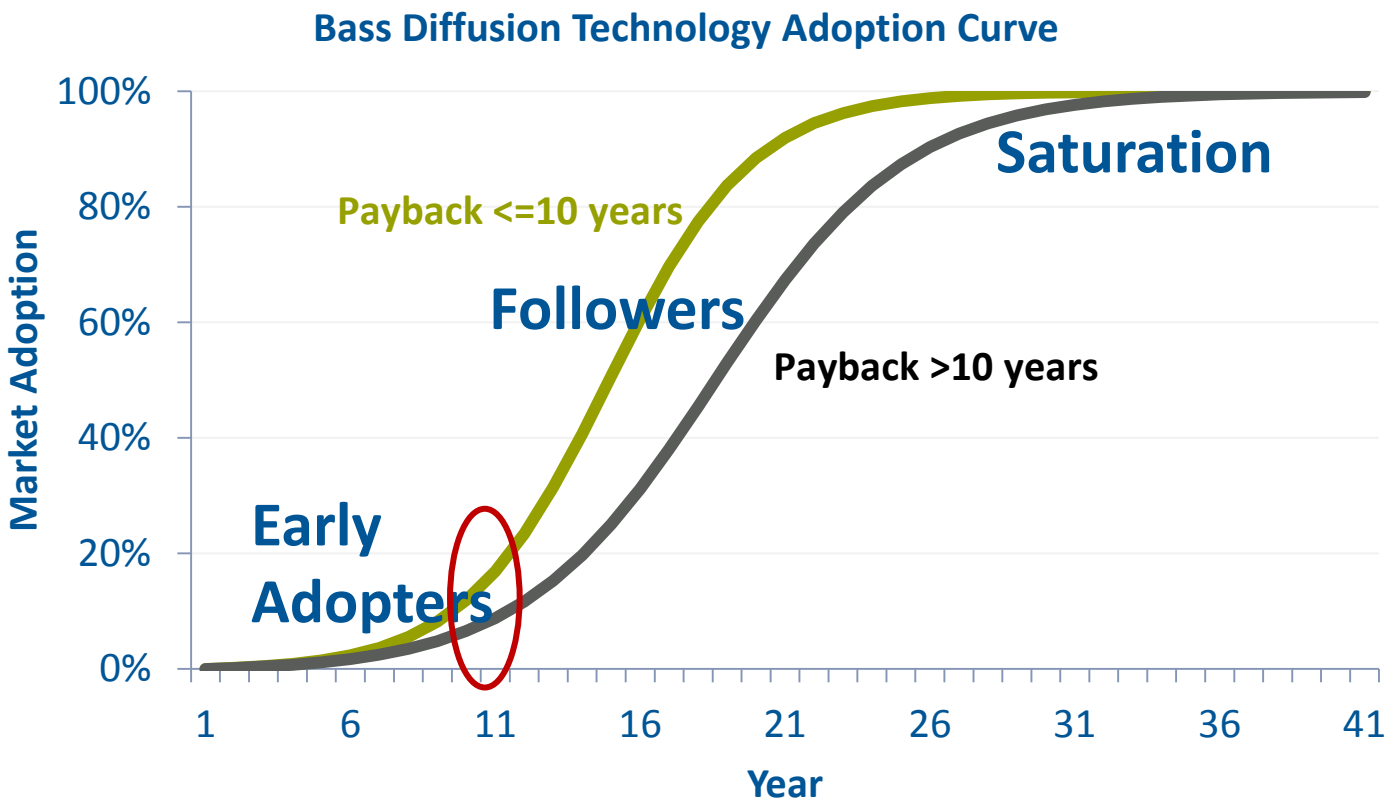


Multiply market penetration percentage by payback bin to calculate potential

RESULTING MAXIMUM MARKET POTENTIAL



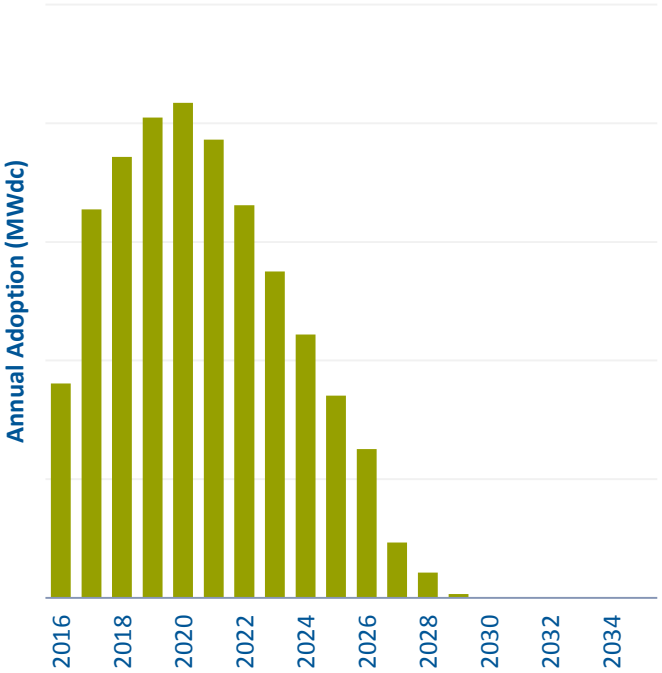
TECHNOLOGY ADOPTION CURVE CONSTRAINED APPROACH



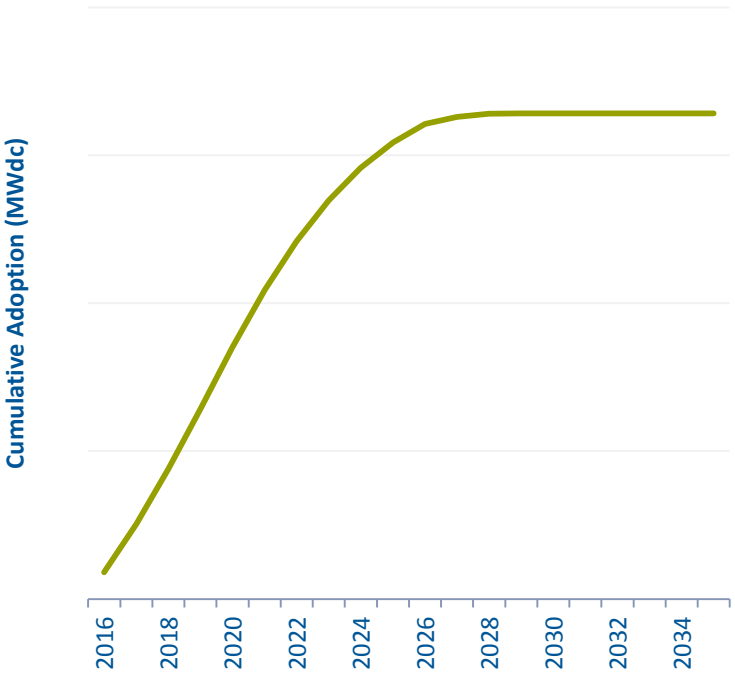
Current penetration in a market would establish where along the adoption curve it is

TECHNOLOGY ADOPTION CURVE ANNUAL ADOPTION RESULTS

Annual Adoption



Cumulative Adoption

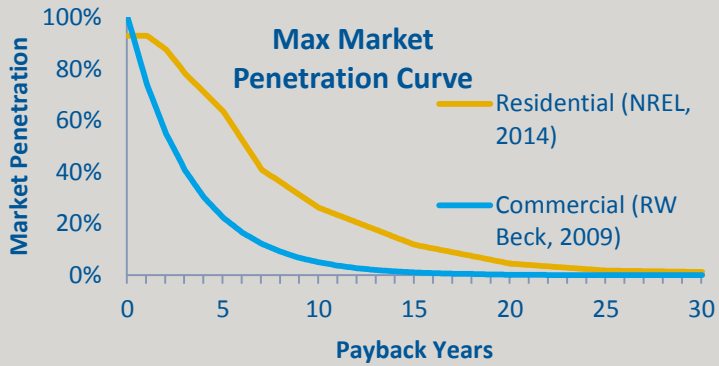


Adoption peaks in 5 years, then slows as the market becomes saturated

GIS Adoption Analysis

Process by "Site"

1. Assign Market Penetration % Based on Agg. Customer Type



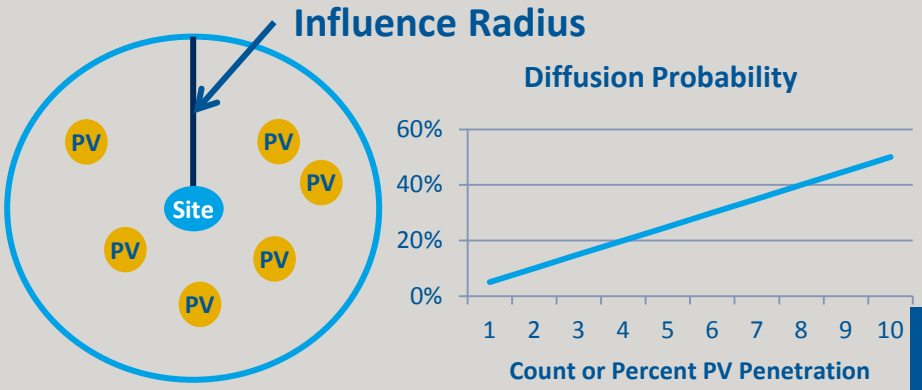
X

2. Assign Demographic Factor

Customer Demographic Group (PRIZM)	Demo %
Money and Brains	150%
Upper Crust	100%
Movers and Shakers	75%
The Cosmopolitans	150%
American Dreams	100%
Etc....	

X

3. Assign Diffusion Factor (Develop Heat Map)



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4. Probability of Adoption

GIS Adoption Analysis

Process by "Site"

3. Assign Diffusion Factor (Heat Map)

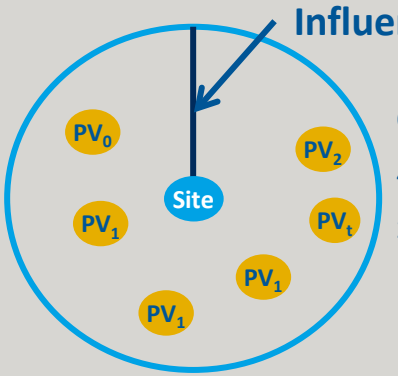
=

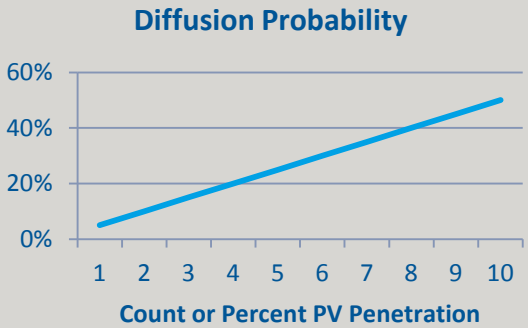
4. Probability of Adoption

YR_t

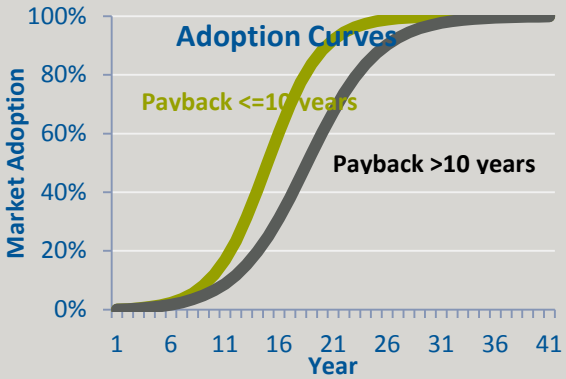
5. Random Draw Simulation of Adoption for Yr_t

6. "Install" selected PV projects





Random draw based on probability of selection, capped by Yr_t Aggregated Adoption Level



SUMMARY CONCLUSIONS & TAKE-AWAYS

- "Economic" projects do not necessarily translate to adoption, as each customer's decision to adopt may be different
- Incentives, cost assumptions and in some cases rate class significantly impact results.
- Maximum Market and Adoption Curves can be specific to client/territory

WHAT NEXT?

SMART DG DEPLOYMENT - POWERED BY ASSET360

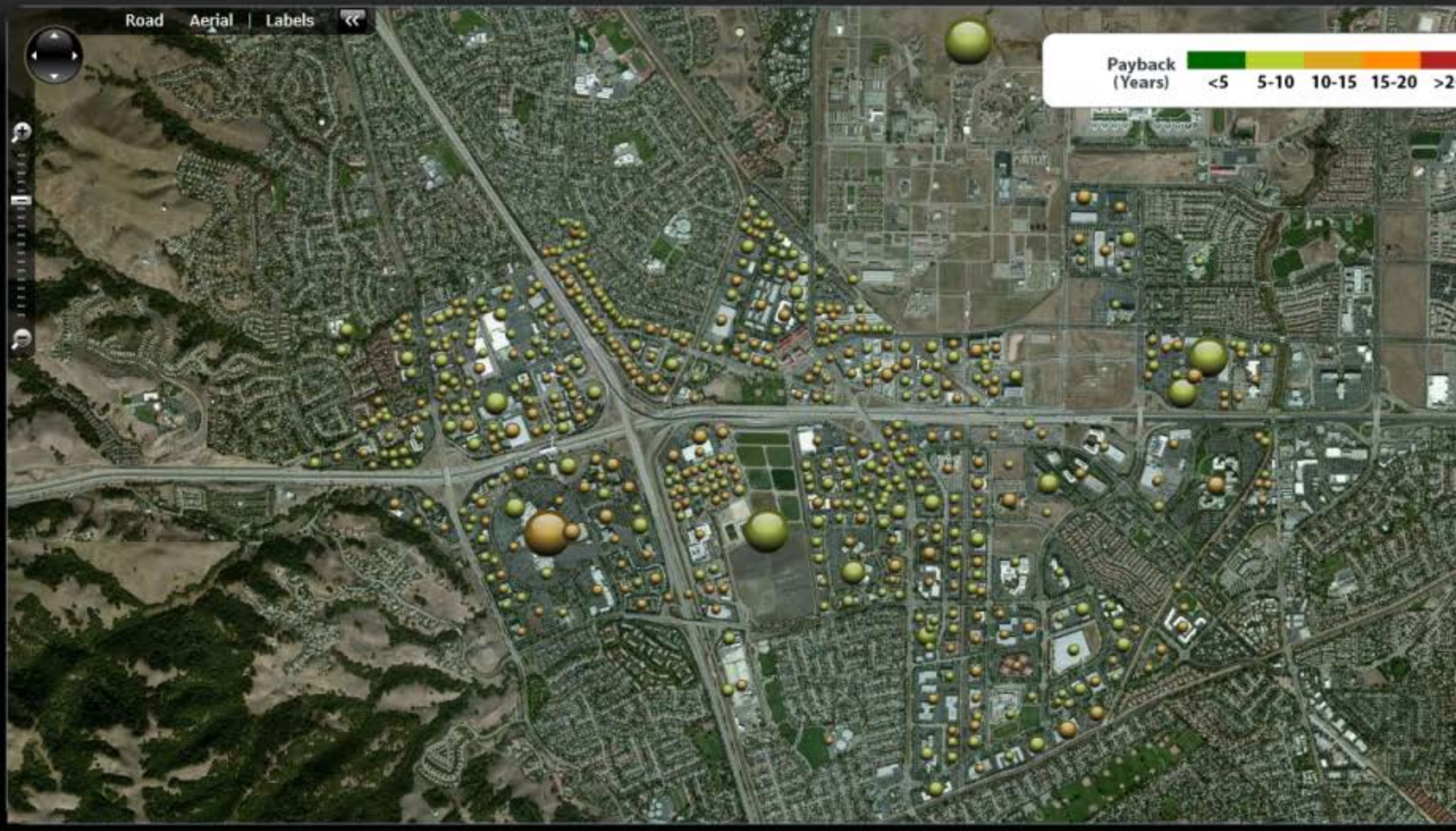
Solar Capital Cost ($/kW)

120% 100% (Base) 80% 60% 40%

Solar Potential (kW)

Rooftop Parking Lot Rooftop And Parking Lot

Payback Analysis Model Results



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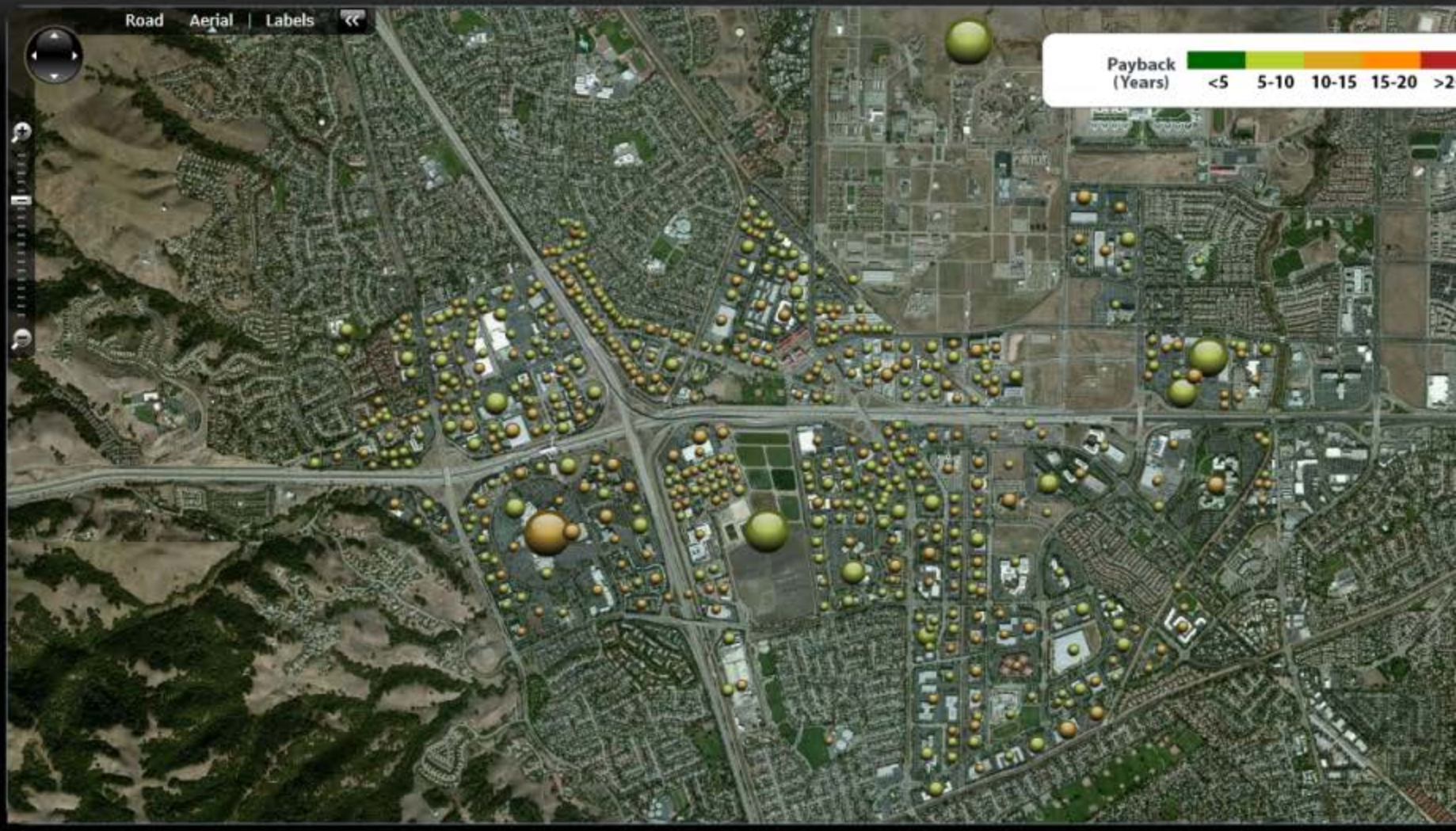

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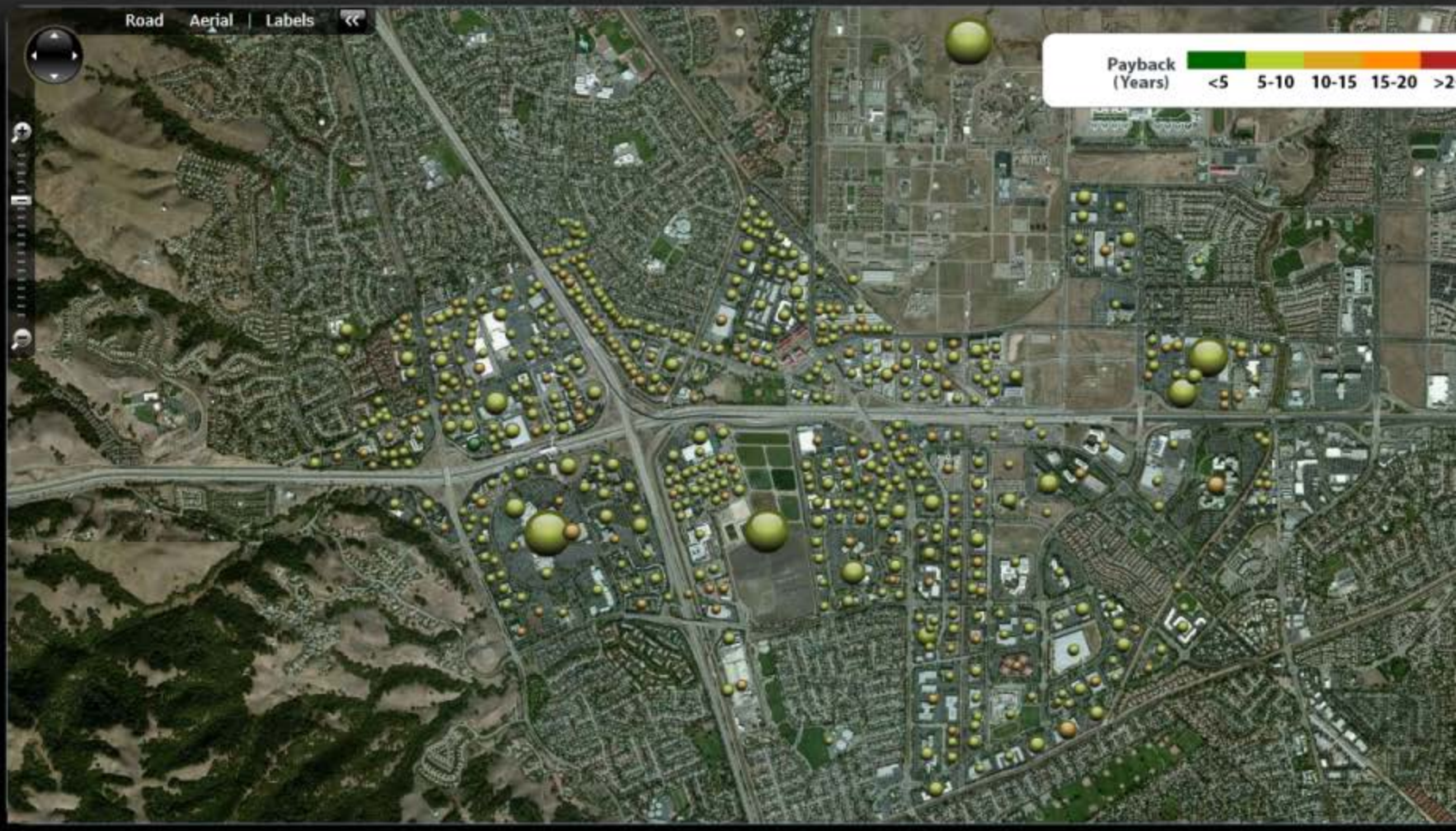

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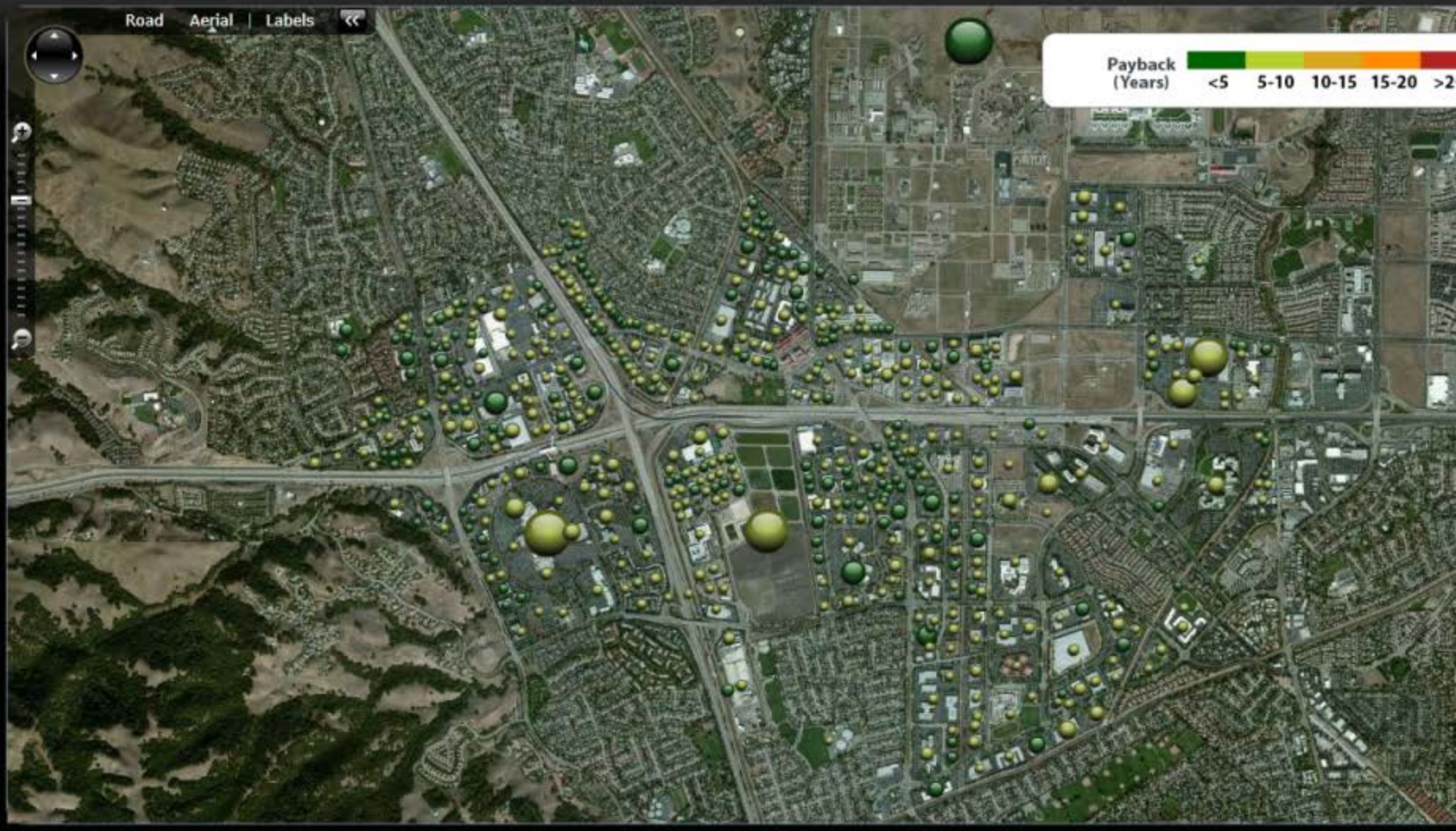

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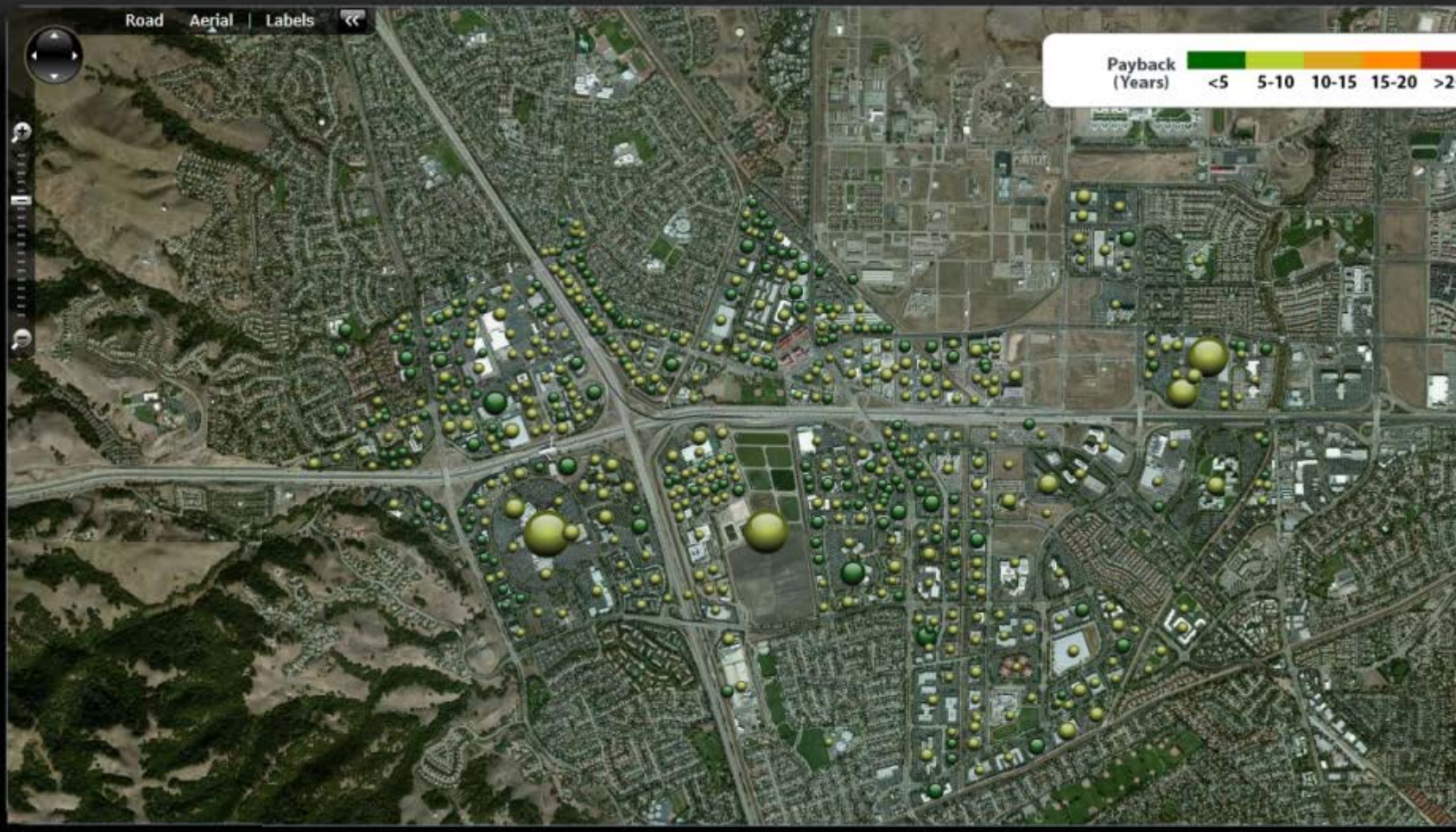

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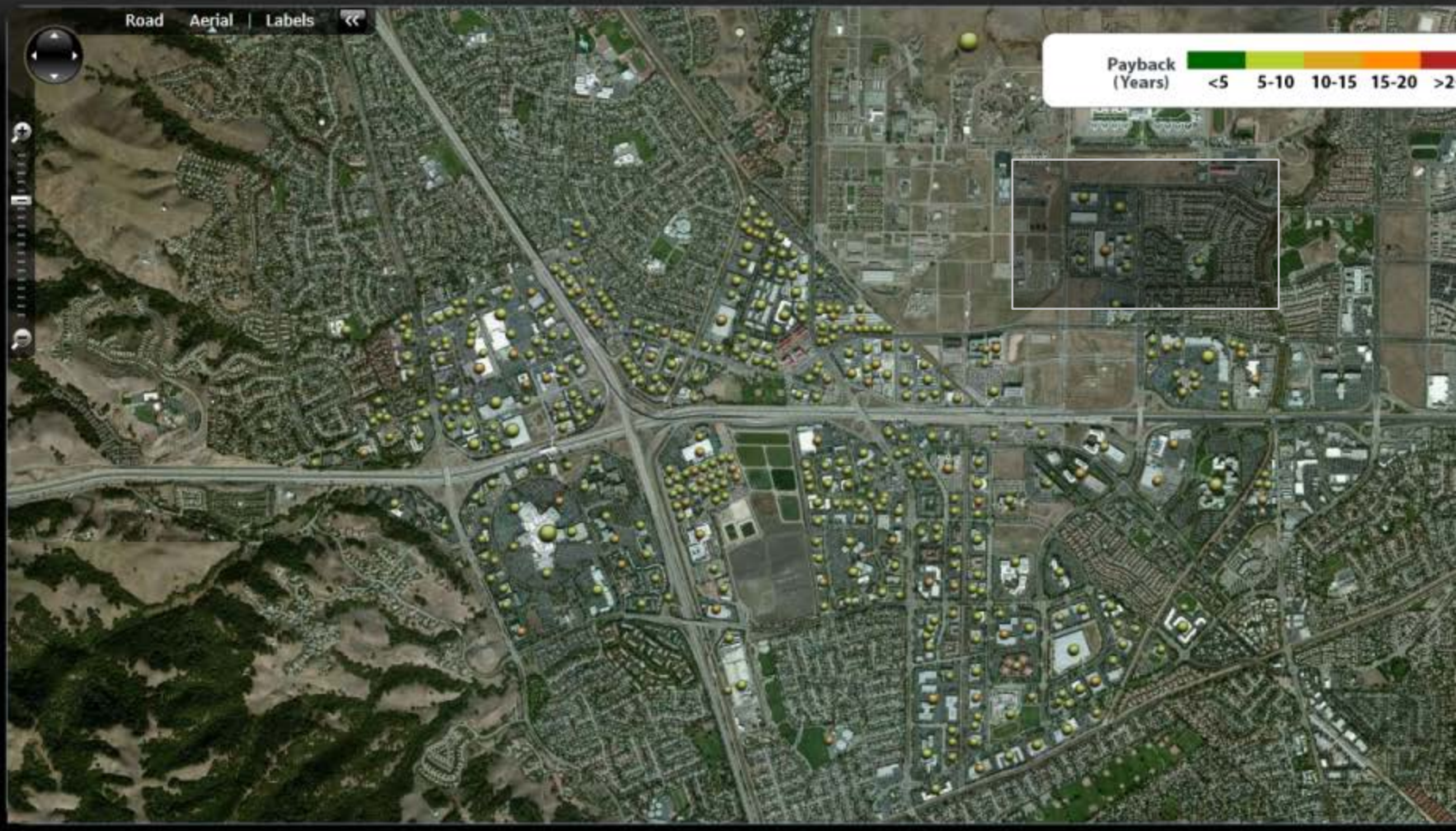

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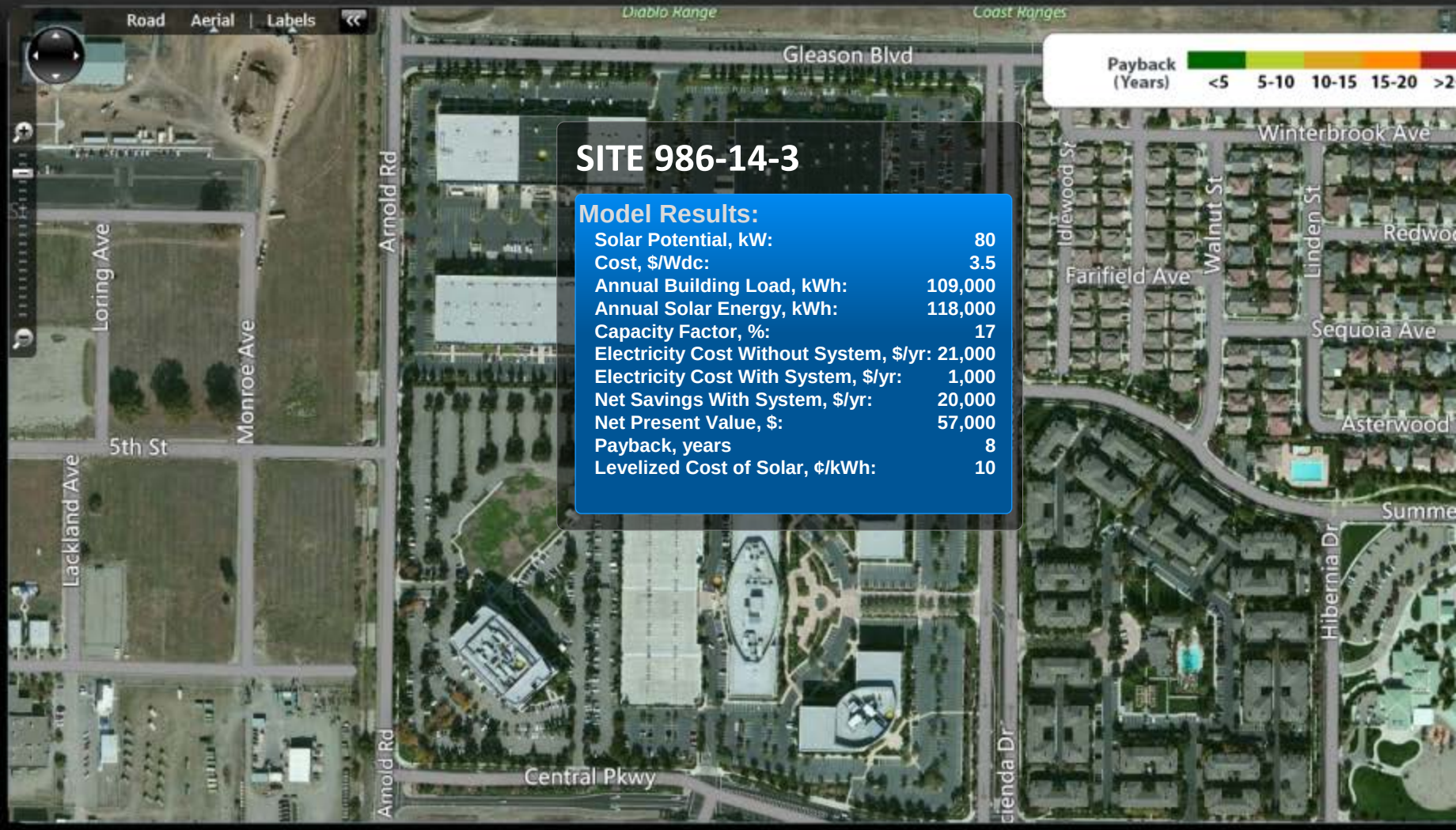


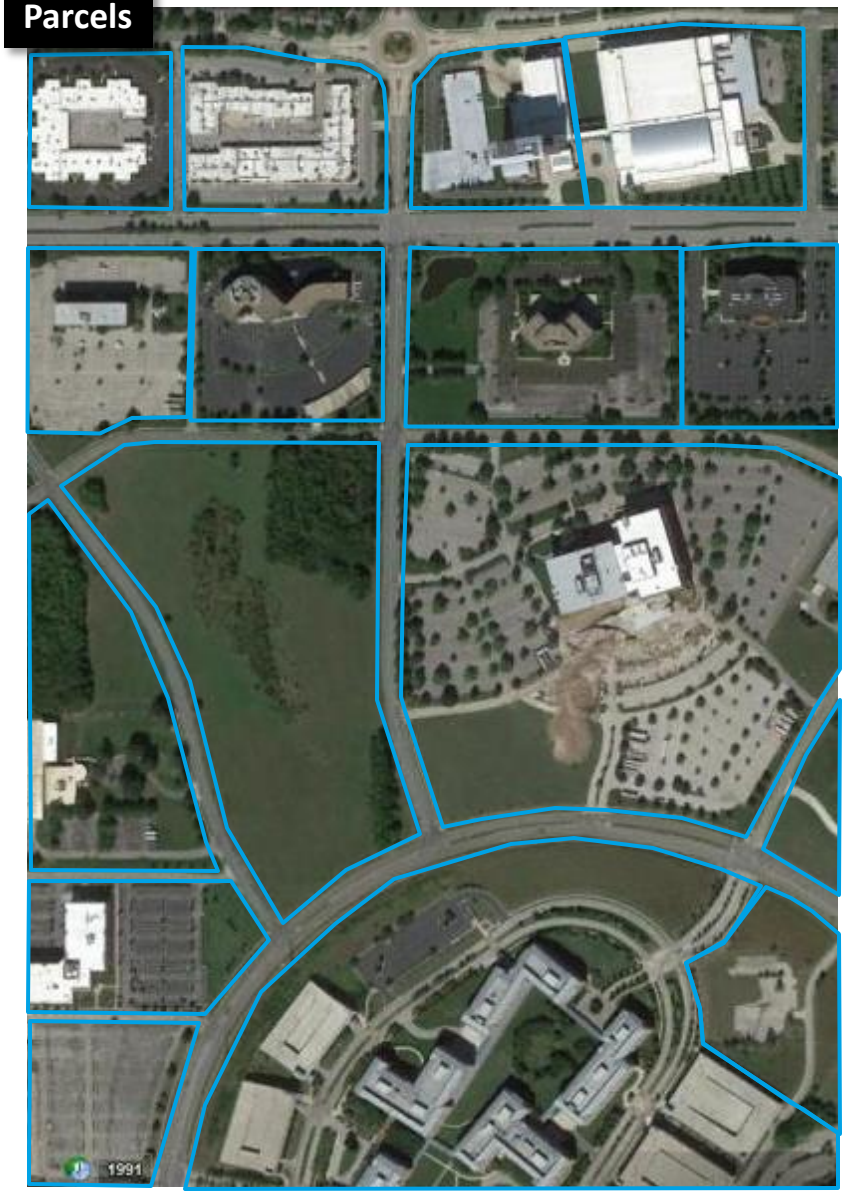
SITE 986-14-3

Model Results:

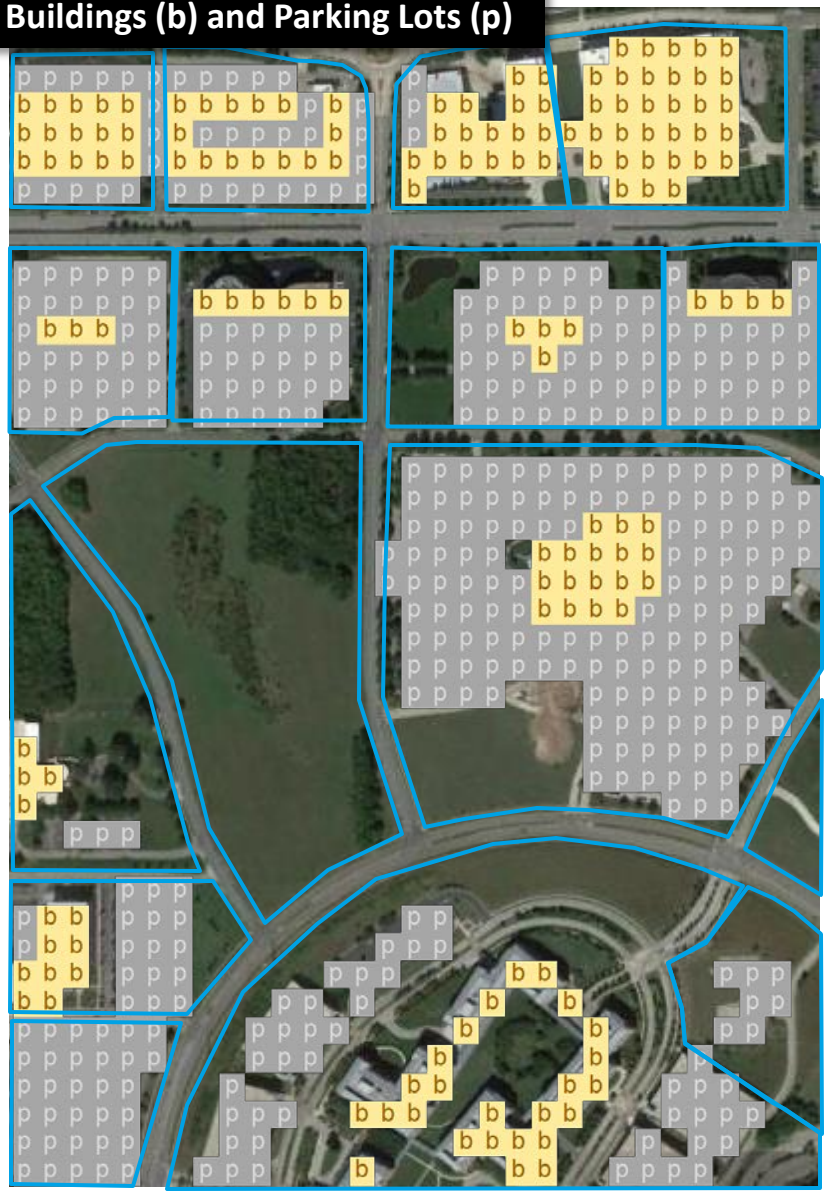
Solar Potential, kW:	80
Cost, $/Wdc:	3.5
Annual Building Load, kWh:	109,000
Annual Solar Energy, kWh:	118,000
Capacity Factor, %:	17
Electricity Cost Without System, $/yr:	21,000
Electricity Cost With System, $/yr:	1,000
Net Savings With System, $/yr:	20,000
Net Present Value, $:	57,000
Payback, years	8
Levelized Cost of Solar, ¢/kWh:	10

Overland Park, KS

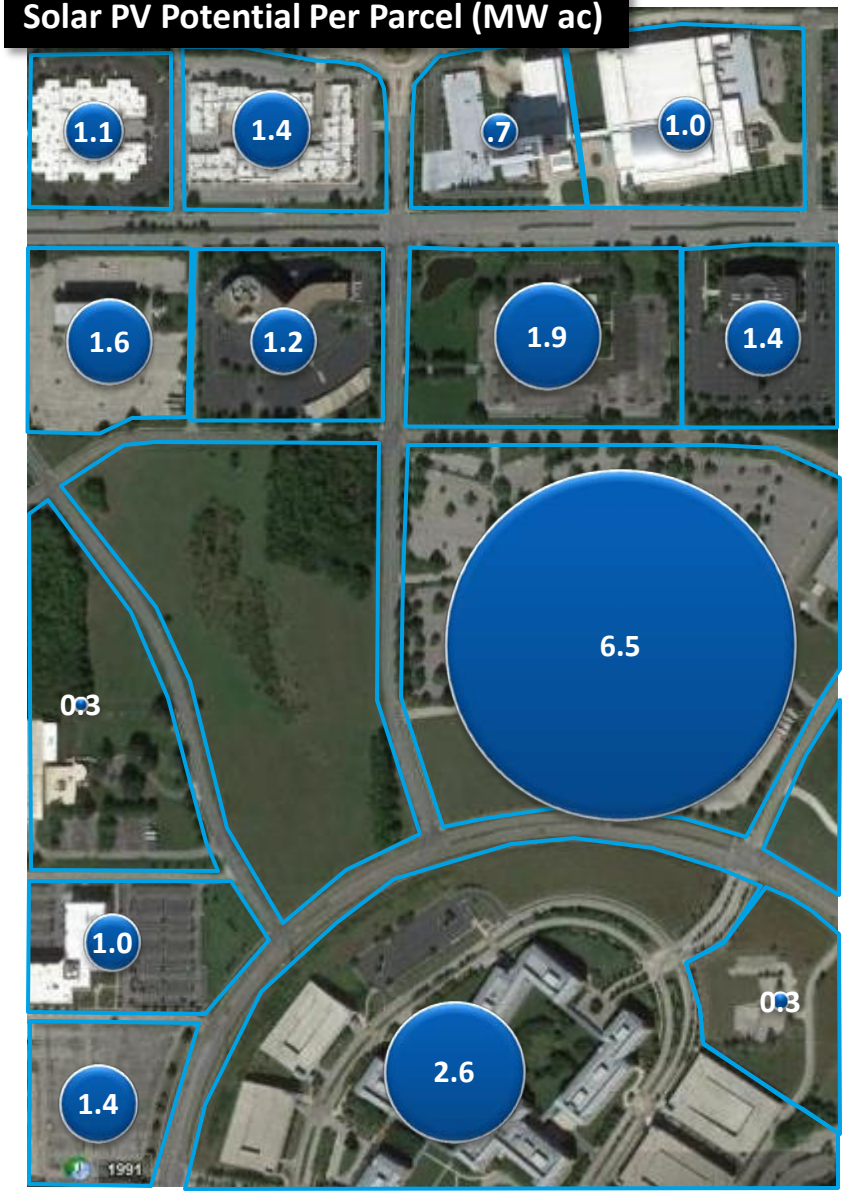
Parcels



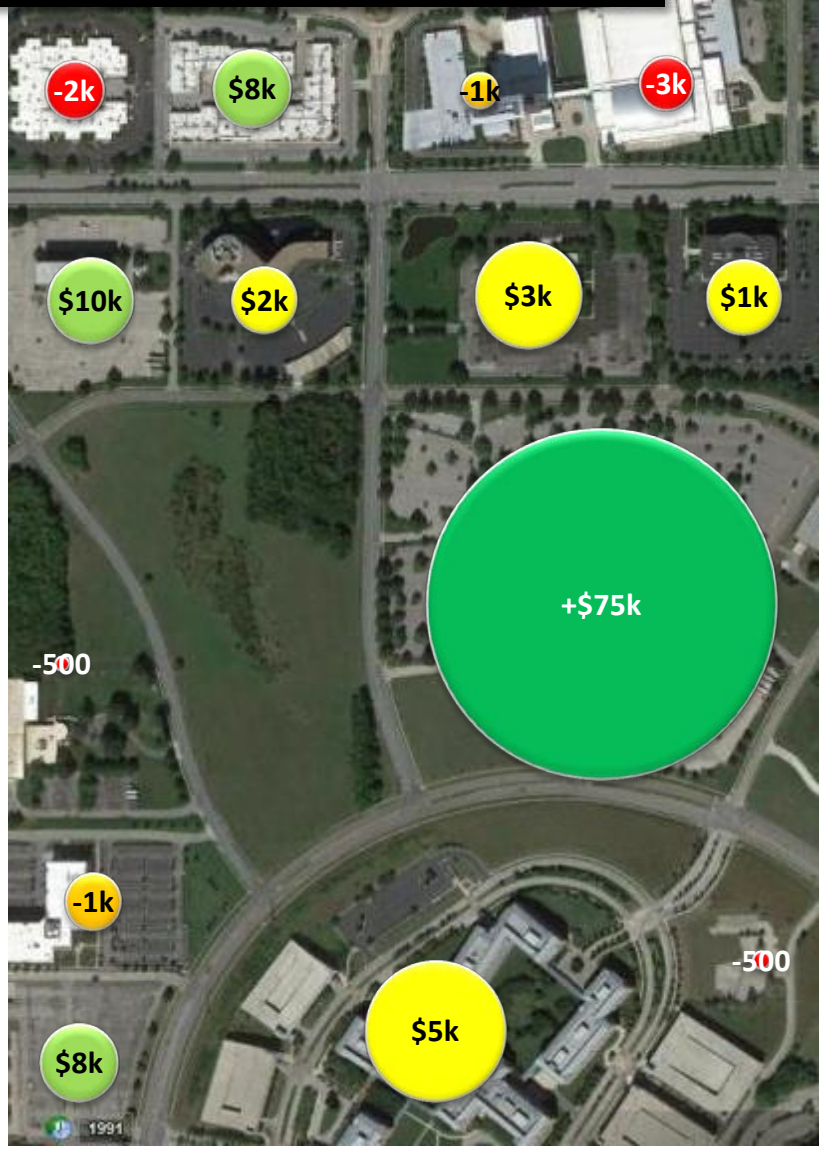
Buildings (b) and Parking Lots (p)



Solar PV Potential Per Parcel (MW ac)

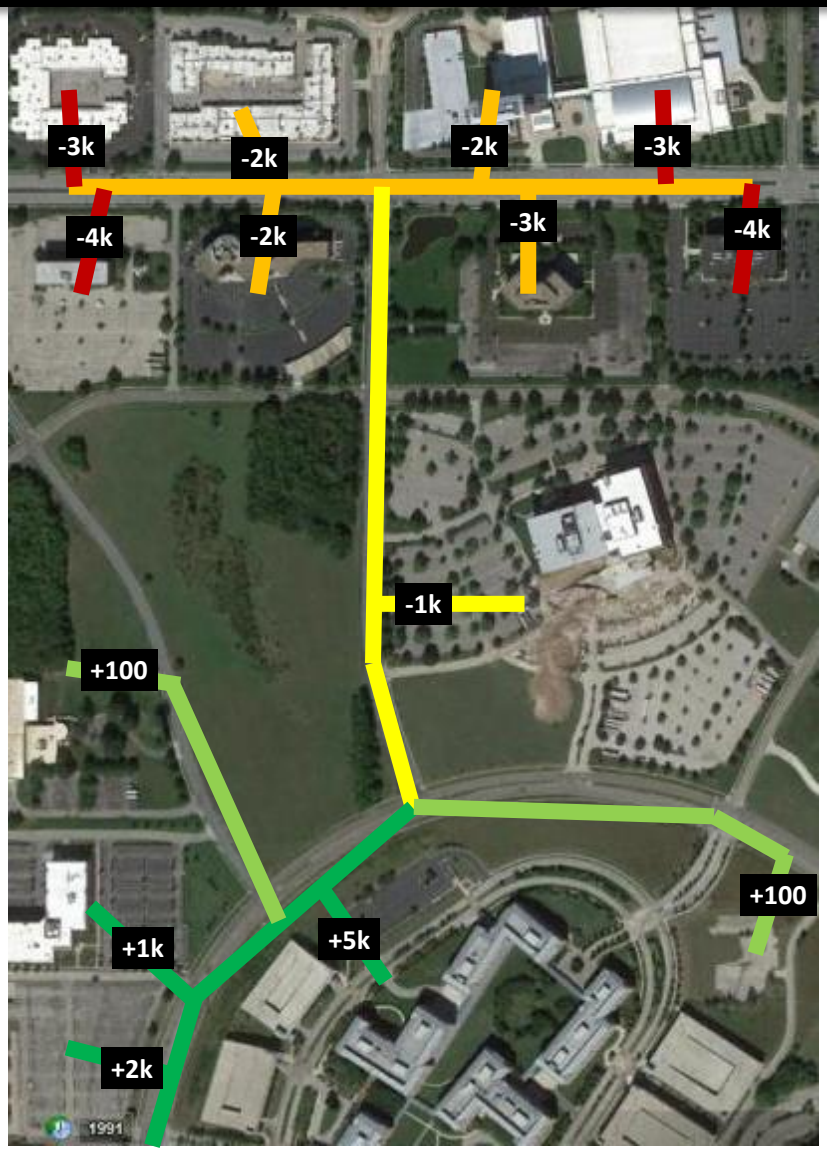


Potential Annual Ratepayer Solar Savings

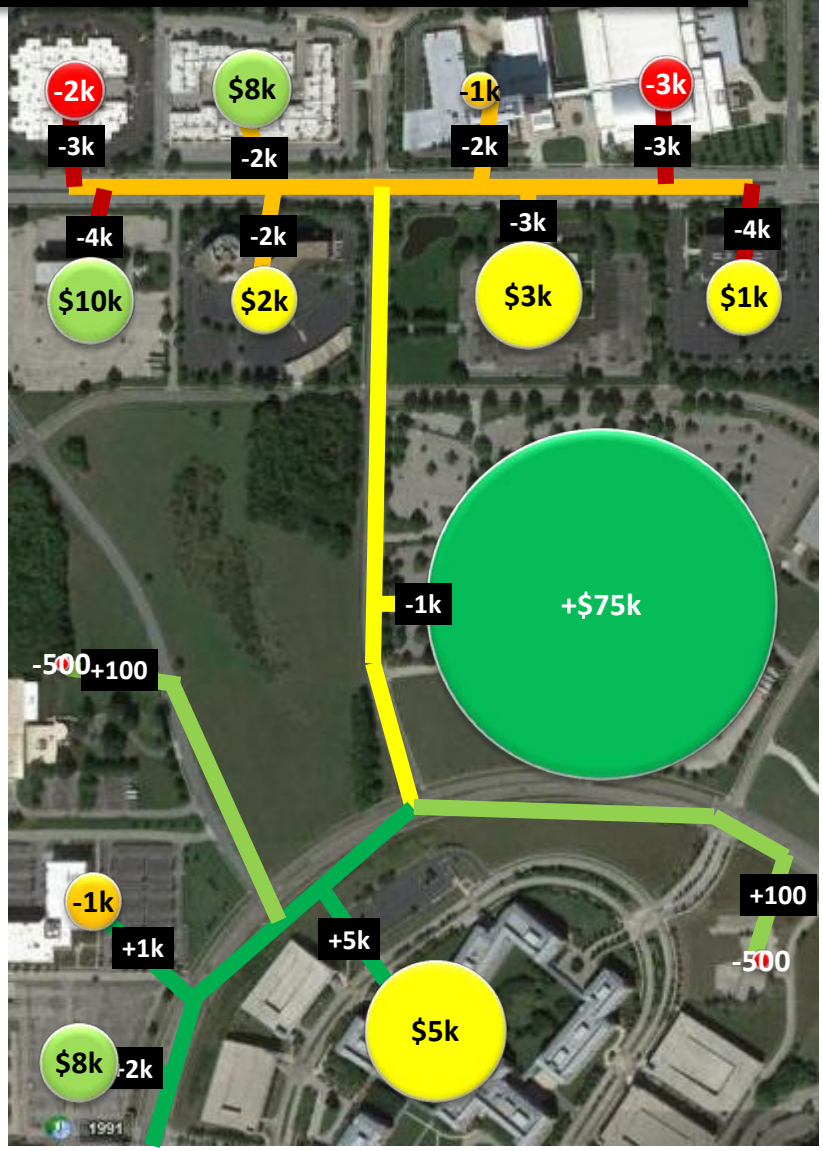


Distribution System

Annual PV Benefit (Cost) to Utility Distribution System



Combined Utility and Ratepayer PV Economics



FINAL CONCLUSIONS

- Lots of site specific data
- Can be utilized in multiple, powerful ways

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Together

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