The Solar Endowment: A Solar Deployment Roadmap for US Colleges and Universities

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Solar University Network

mrea midwest renewable energy association

Second Nature

TurningPoint Energy

MREA Overview

- RE Education and Demonstration
- 3000 Midwest members
- **27th Annual Energy Fair**
- Net Zero Campus
- Midwest Grow Solar Partnership
- The Solar Endowment
- Accredited Certificate Training

Our Strategy

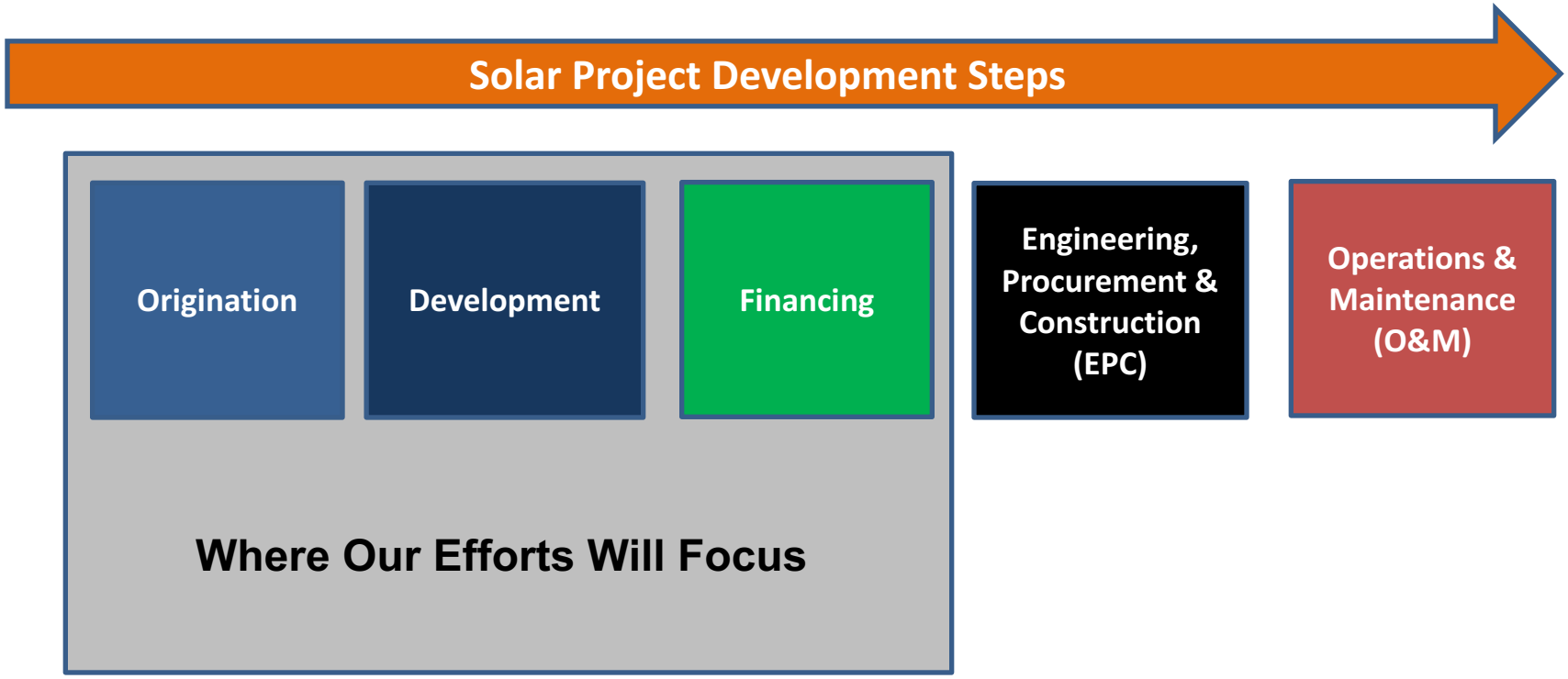
1. Campus Deployment Teams
2. Solar Technical Assistance Team (STAT)
3. Applied Course in Campus PV Development
4. PV Design and Sales Certificate and Internship
5. PV Development Roadmaps
6. Solar University Network (SUN) Delegations

Theory of Change

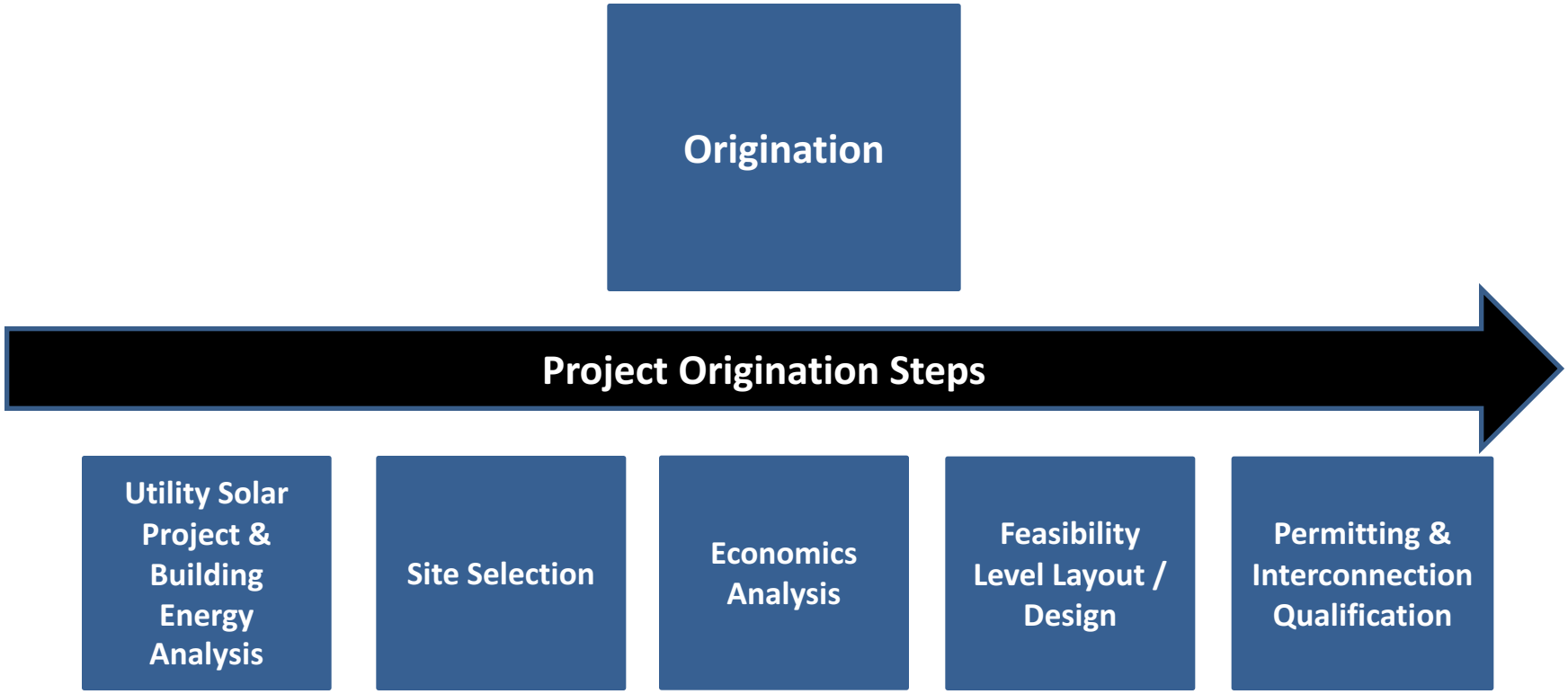
1. Issue visibility = learning moments
2. Working investment models exist
3. Valuable as part of a diversified portfolio
4. Donor and alumni support

Our Focus

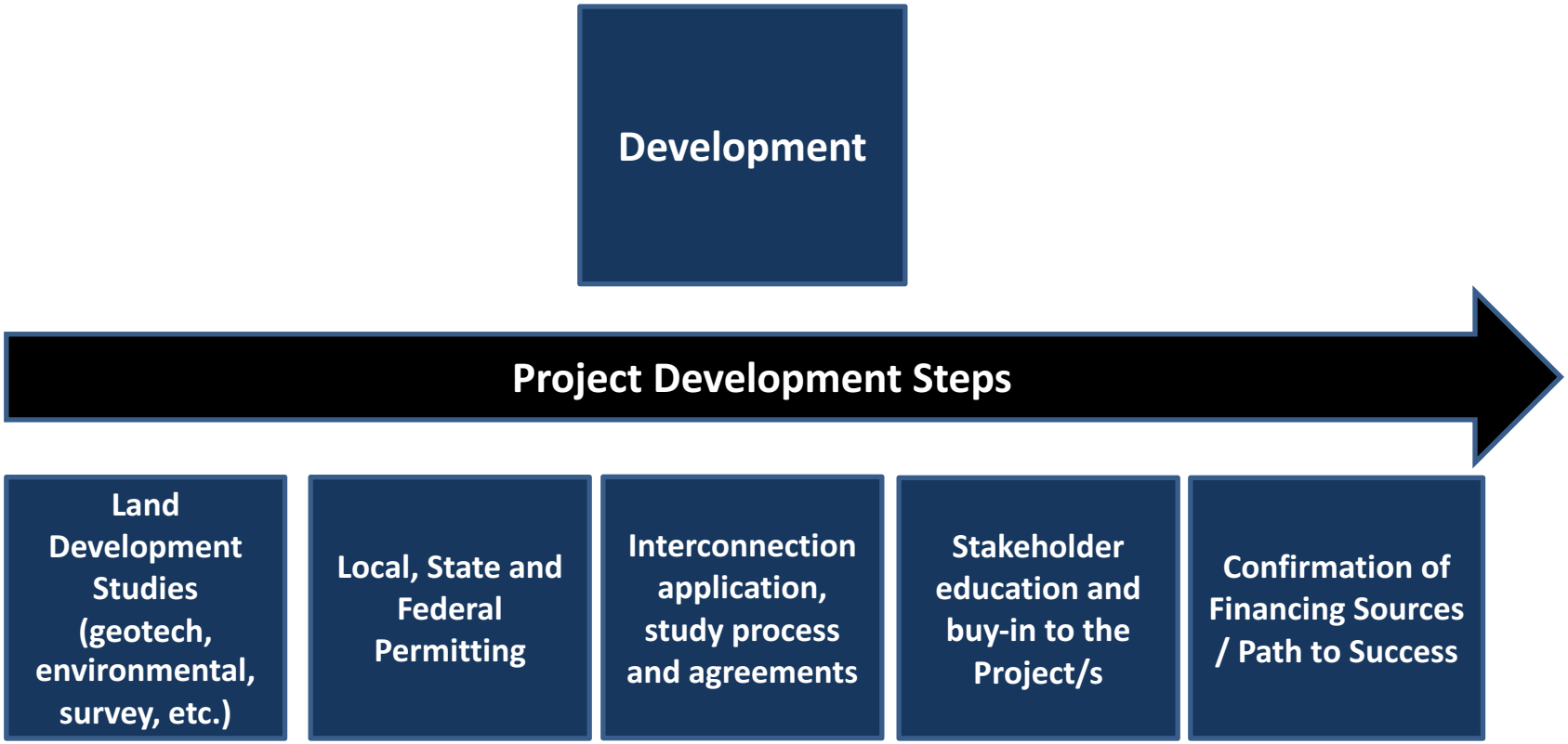
Origination, Development & Financing



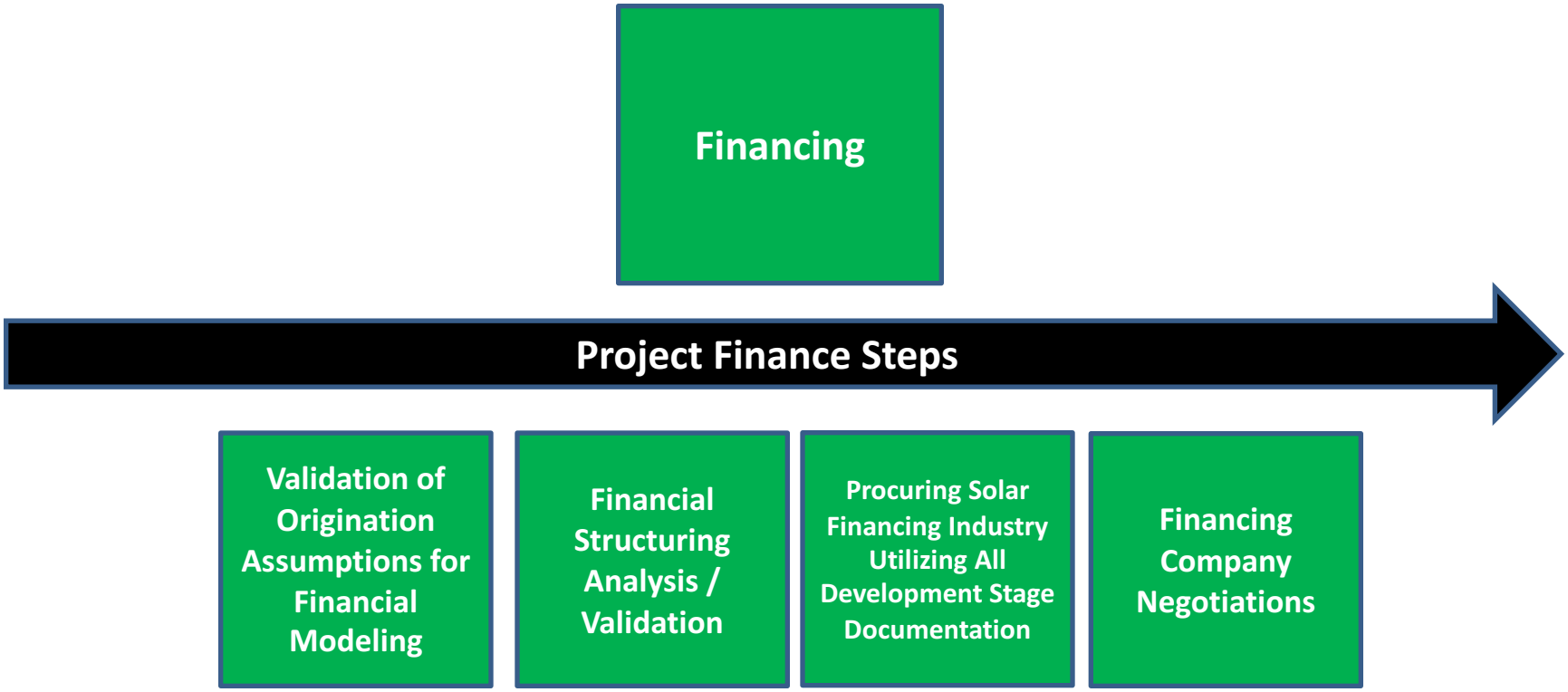
Origination



Development



Financing


Financing
Project Finance Steps
Validation of Origination Assumptions for Financial Modeling
Financial Structuring Analysis / Validation
Procuring Solar Financing Industry Utilizing All Development Stage Documentation
Financing Company Negotiations

PV Development Roadmaps

1. Student Engagement Strategy
2. Stakeholder Mapping
3. Legal, Regulatory, and Approvals
4. Campus Site Prioritization, Assessment, and Financial Modeling
5. Contractor Solicitation/Selection
6. Financial Considerations and Investment Opportunities

Solar Technical Assistance Team (STAT)

1. Site assessment tech mentor network
2. Legal and regulatory analysis
3. Campus stakeholder engagement
4. Project financial analysis and design
5. PV investment value/risk

Progress

1. Working Roadmaps for Each Pilot University
2. New Campus Roadmap Development
3. Campus PV Development Course free and open to public August 2016www.solarendowment.org/courses
4. PVDS Certificate and Internships

Campus Deployment Teams

- On-site teams made up of different campus stakeholders
- Pilot campuses – led by graduate student & student teams
- Skills:
  - Project Management
  - Engineering
  - Site Layout & Feasibility Design
  - Interconnection
  - Permitting & Land Development
  - Energy Analysis
  - Business and Finance
  - Legal
- Student incentives:
  - MREA courses, certificates, and potential internships
  - Professional development and experience

Applied Course in Campus PV

- Guides universities through roadmapping process
- Hosts work plans, templates, guides, and webinars designed around eight topic areas
- Still posting resources; all pilot and new university campuses have access
- Coming Soon!!!

Updates: www.solarendowment.org/courses

Other MREA Training Courses

- Basic Photovoltaics – PV 101
- PV Site Assessor Training – PV 201
- PV System Design – PV 202
- PV Sales and Finance – PV 203

Solar University Network

www.solarendowment.org

Certificates

MREA Photovoltaic Site Assessment Certificate

PV 101

PV 201

Skills Assessment: Two Practice Site Assessment Reports

Exam

Photovoltaic Site Assessment Certificate

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IREC Interstate Renewable Energy Council ACCREDITED CERTIFICATE PROGRAM ™

MREA Photovoltaic Design and Sales Certificate

PV 101

PV 201

Skills Assessment: One Practice Site Assessment Report

PV 202

PV 203

Skills Assessment: One Practice Design & Sales Proposal

Exam

Photovoltaic Design and Sales Certificate

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Credentialing Pathways

NABCEP PV ENTRY LEVEL EXAM

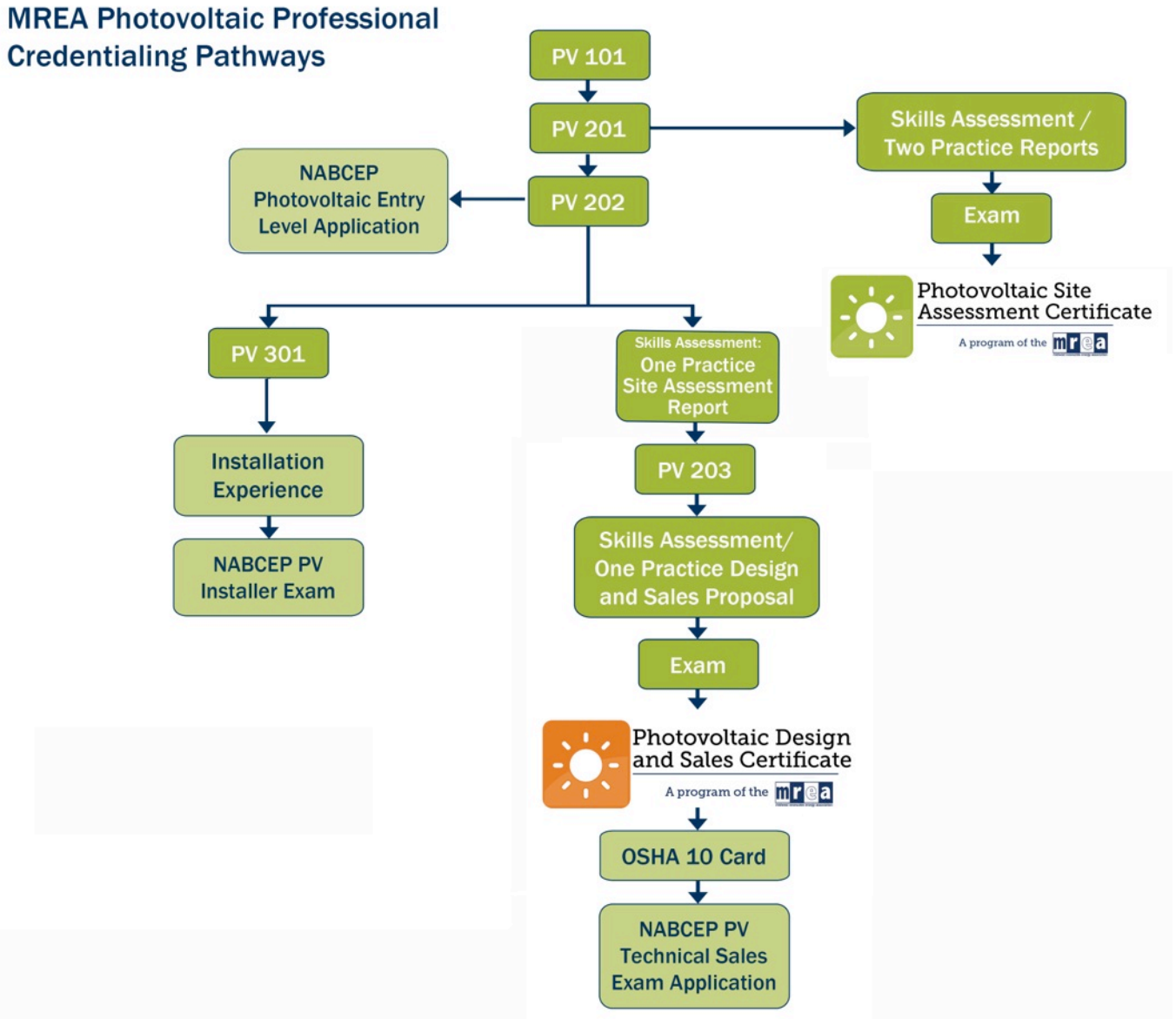
NORTH AMERICAN BOARD OF CERTIFIED ENERGY PRACTITIONERS

NABCEP CERTIFIED

PV Installation Professional

NABCEP CERTIFIED

PV Technical Sales Professional



Internships

Photovoltaic Site Assessment Certificate

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Photovoltaic Design and Sales Certificate

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<u>Site Assessor Internship</u>

- ✓ Pre-screening
- ✓ Lead generation
- ✓ Site assessment

<u>Design and Sales Internship</u>

- ✓ Site assessment
- ✓ Engineering/design
- ✓ Proposal development

Campus Teams: University of Minnesota

- Two Campuses
  - Twin Cities Campus: 46 students
  - Duluth Campus: 6 student
- Graduate student lead
- Five teams
  1. Site Assessment – Twin Cities
  2. Site Assessment – Duluth
  3. LiDAR Group
  4. Finance Group
  5. Campus Outreach Group
- Renewable Energy Pathways – Grand Challenge Curriculum

Stakeholder Mapping

- Goal: Know your audiences, get ahead of the process, gather support, and publicize
- Identify and analyze perspectives of key offices, positions, committees, and individuals
- Learn what you don't know you don't know
- Key stakeholder groups (not all listed):
  - Energy Office
  - Master Planners
  - Investment Office
  - Sustainability Office
  - Faculty and Student Organizations
  - Local Utility
  - Campus Land Owners
  - University Departments – academic programming
  - Utility Regulatory Commission
  - Campus Leaders

Stakeholder Mapping: Purdue

Figure 2.1 – Decision Making Hierarchy at Purdue

Tier 1

Key Concerns	Key Responsibilities
• Future Land Development • Interconnection Locations • PV Mounting Styles	• PV Priority Site Selection • Obtaining Stakeholder Input • Consulting Third Party Contractors for Expertise

Tier 2

Key Concerns	Key Responsibilities
• Educating on Solar Endowment Project • Expressing the Difficulty of PV at Purdue • Addressing Any Concerns	• Promotion of PV Deployment to Student Body • Input on PV Selected Sites

Tier 3

Key Concerns	Key Responsibilities
• Addressing Interconnect Issues • Approval of Selected Site(s) • Acceptance of Financial Structuring	• Approval from Each Organization

Tier 4

Key Concerns	Key Responsibilities
• Financial Justification of Project • Approval of PV Site(s) • Acknowledging Student Body Support	• Confirmation of Financing Model • Agreement of Selected Site(s) • Progressing Project to Next Tier

Tier 5

Key Concerns	Key Responsibilities
Financial Justification of Project Approval of PV Site(s) Acknowledging Campus Support	Determining if Project Will Progress Establishing a Meeting with Board of Trustees

Tier 6

Key Concerns	Key Responsibilities
• Financial Justification of Project • Approval of PV Site(s) • Acknowledging Campus Support	• Determining if Project is Justifiable • Implementation of Project

Full Purdue and ISU Roadmaps at www.solarendowment.org/resources

Approvals and Legal/Regulatory Considerations

- Goal: Identify rules, regulations, procedures, and other risk factors that influence design, siting, and financing of a PV project on campuses and association properties
- Includes (not all listed):
  - Utility interconnection requirements and fees
  - Permitting and inspection requirements and fees
  - Planning/zoning restrictions
  - State policies and incentives
  - Utility tariffs and incentives
  - Campus rules and procedures
  - Equipment warrantees, O&M, and safety requirements
  - Liens, restrictions, and agreements re: property use

On Campus PV Site Prioritization

- Goal: Identify and describe priority sites for PV deployment on campus and associated properties
- Includes (not all listed):
  - General site descriptions and maps
  - Current site use and development plans
  - Description of electrical infrastructure with details on potential interconnection sites
  - Analysis of electricity rates associated with interconnection
  - System size estimate
  - Estimation of system production
  - Cost estimates

Site Assessment Template and Guidance

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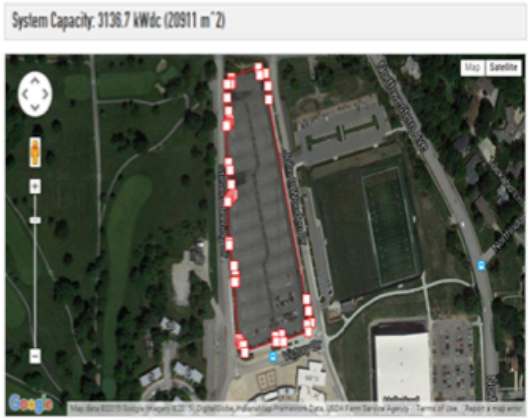
Site Prioritization: Purdue

Mackey Arena Parking Area:



PV Characteristics

Mounting Style	System Size (kWDC)	Annual AC Energy (kWh)	Area (m^2)	$/WDC	System Cost
Canopy Style	3,137	4,181,811	20,911	$2.75 – $3.25	$ 5,960,300

Land and Interconnect Characteristics

Current Use	Development Plans	Possible Interconnection Location
Parking Lot	None	Substation Interconnect

Electrical and Mechanical Integration

- Designing and implementing canopy style; including pole locations.
- Running interconnects underground to substation.

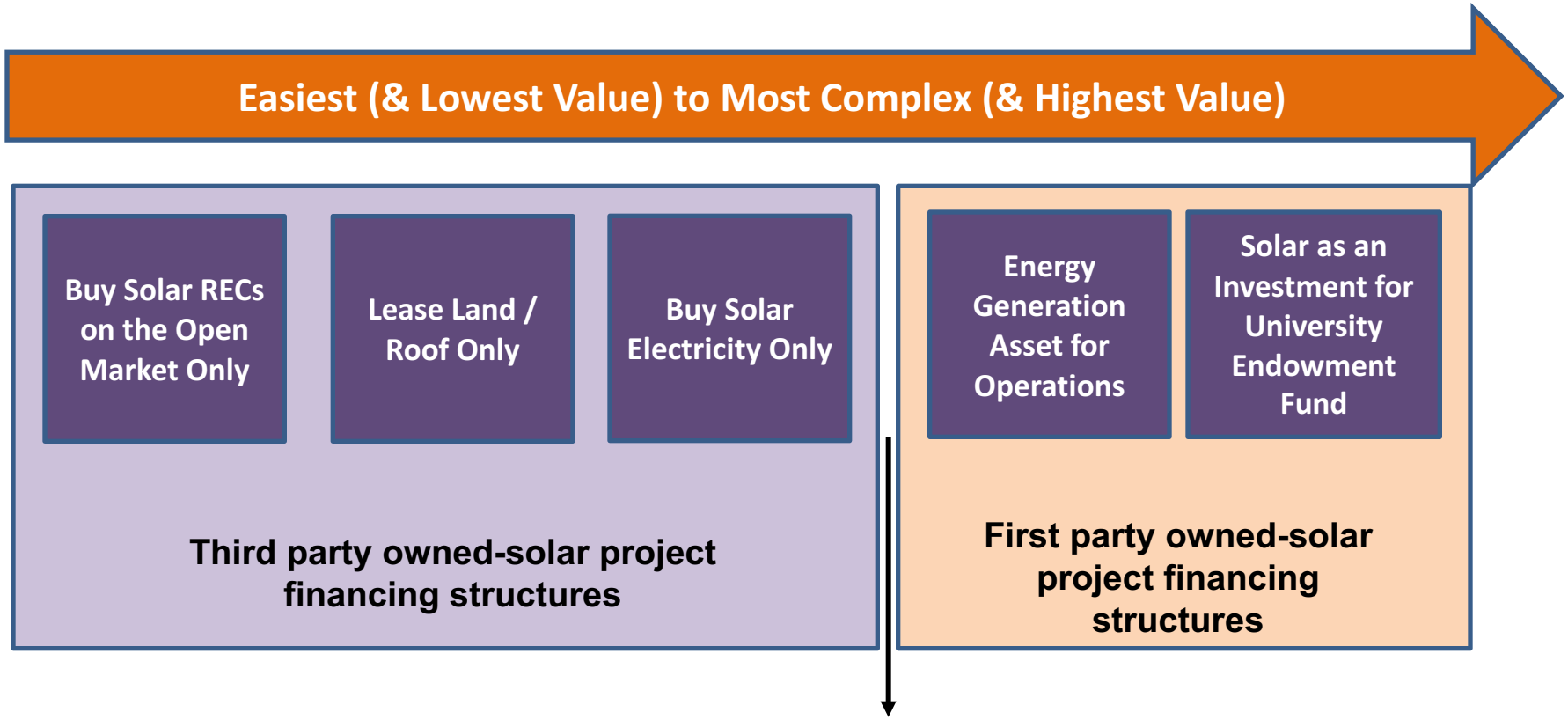
Non-Financial Benefits

- Shading
- Great Aesthetic Visualization
- High Power Generation
- Single Location

System Financial Analysis

- Goal: Define financial structures and model performance of proposed projects
- Tools:
  - MREA PV Finance Tool
  - NREL System Advisor Model (sam.nrel.gov)
  - NREL Renewable Energy Planning & Optimization (www.nrel.gov/tech_deployment/tools_universities.html)
  - Key Metrics (not all listed):
    - Electricity cost with and without RE system
    - Electricity savings
    - Net present value
    - Payback period
    - Levelized cost of energy
    - Internal rate of return
    - Utility inflation rates
    - Installation costs
    - O&M costs

Project Financial Design: On and Off Campus



*First big decision is ownership decision and what level of complexity and risk the culture will allow for.

University Solar Procurement Models

1. **On-Site: Direct Ownership**
   - Load reduction
   - Utility Power Purchase Agreement (PPA)
2. **On-Site: Partnership**
   - Third-Party PPA
   - Donor Lease
   - Land Lease
3. **Off-Site**
   - Direct PPA (De-regulated)
   - Virtual PPA/ Contract for Differences (Regulated)
   - Shared Solar Subscription
   - Project Equity Investor

Challenges to Greater Adoption

1. Complexity of campus energy purchases and contracts
2. Density of university governance and decision-making: treasurer and comptroller vs operations vs investments
3. Tax Equity Partner adds complexity/risk for on-campus installations
4. Direct equity investments by endowment have yet to occur (to our knowledge)

Project Financial Design: On and Off Campus

- Goal: Identify and pursue financial structures that maximize benefits and meet university requirements
- Options
  - Land lease: Purdue, UofM, and VCU
  - Third party PPA: MREA, ISU, MS&T, UofM
  - Donor PPA: Luther College
  - Shared solar: UofM, MREA
  - Utility Partnerships: MS&T, Purdue, VCU
  - Large-Scale PPA: ISU
  - Virtual PPA: All
  - Equity Investment: TBD

University Solar Procurement

Goal: Develop model and recommendations for competitive procurement that meet university requirements and satisfy contractor needs

- Engage stakeholders to define objectives and outcomes
- Develop model RFI, RFQ, RFP
- Define criteria for review and selection
- Guides and Tools
  - https://www.epa.gov/greenpower/gpp-webinar-solar-procurement-templates-and-tools-higher-education

Thanks!

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