



Defining Bankability for Each Step of a PV Project Using IECRE

Sarah Kurtz

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Intersolar North America, San Francisco, California

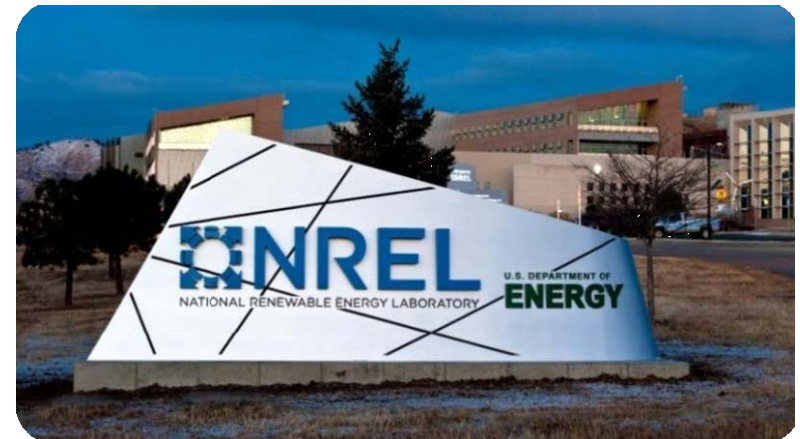
NREL/PR-5J00-66775

NREL

- Mission: *Develop clean energy and energy efficiency technologies and practices, advance related science and engineering, and provide knowledge and innovations to integrate energy systems at all scales*
- PV reliability: *Elucidate the science behind prioritized reliability issues and apply results to define and implement useful standards*



National Renewable Energy Laboratory
Golden, CO



OUTLINE

- Motivation for creation of IECRE: Have confidence that a PV plant will safely perform as promised and reduce cost at the same time
- Strategy (achieve confidence at minimal cost)
- Steps to confidence (each financial transaction)
- Status of implementation (available starting this fall)
- *Encourage you to begin to make use of IECRE!!*

WHY WAS IECRE CREATED?



- While IEC writes technical standards, IEC does not define how these are used
- IECRE was formed in 2014 to define how certificates can be issued at the system level
 - IECRE serves 3 sectors: Wind, **PV**, and marine energy
 - Defines requirements for certifying bodies, etc.
 - Identifies the technical documents (within IEC or other standards organizations) for each certificate
 - Initially, a single certificate was envisioned, but now plan a certificate at each stage of development



Technical standards



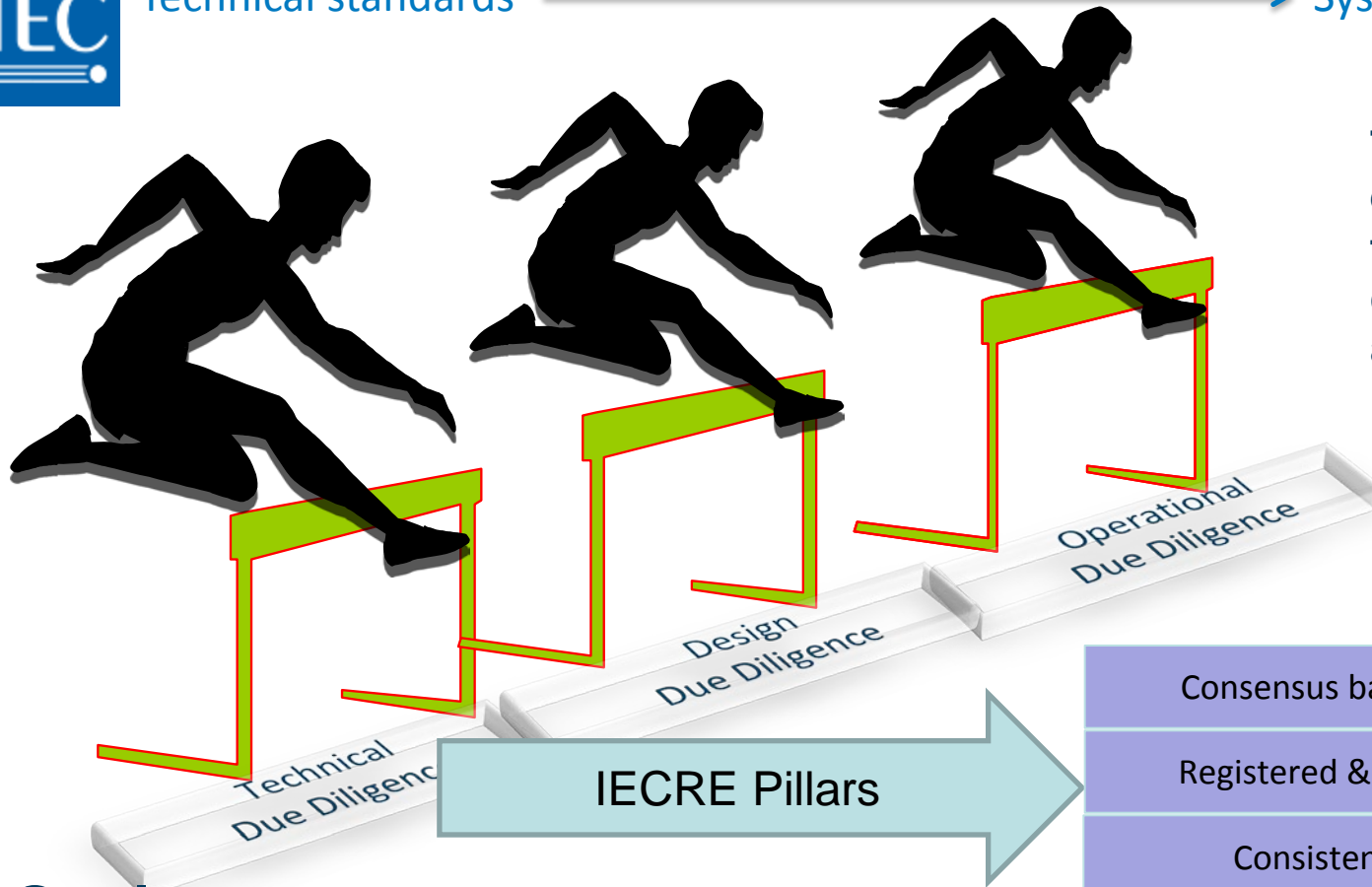
Certificates for system

Investors want zero risk plus lower prices



Technical standards

System certificates



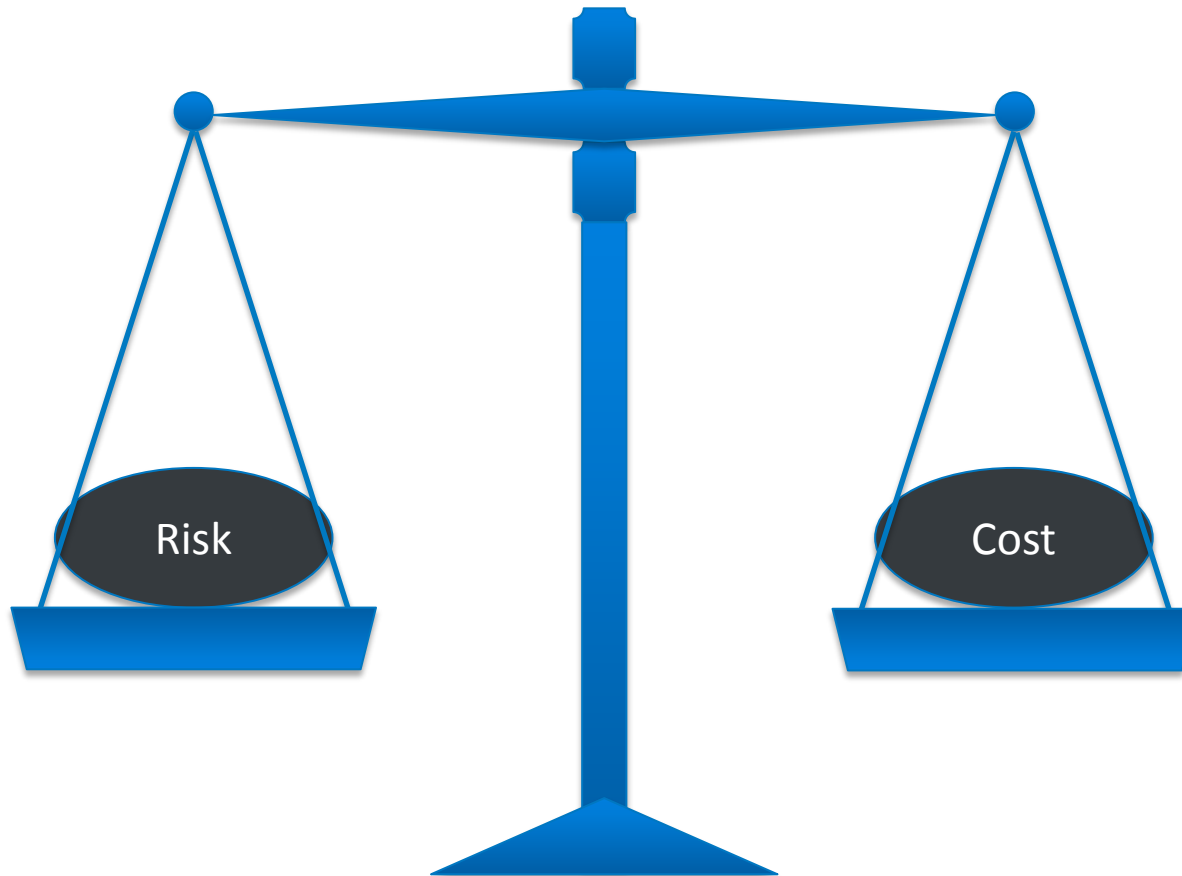
The IECRE process ensures that technical due diligence hurdles are cleared.

- Consensus based standards worldwide
- Registered & Peer review accreditation
- Consistent/transparent process

Goals:

- Streamline the due diligence process
- Leverage what has been learned by others
- Increase confidence at reduced cost

Investors want zero risk, but at low cost: Need balance



Challenges:

We want everything to be perfect, but we also need to minimize cost;
Each customer asks for a different balance and has slightly different goals

Different systems need different requirements

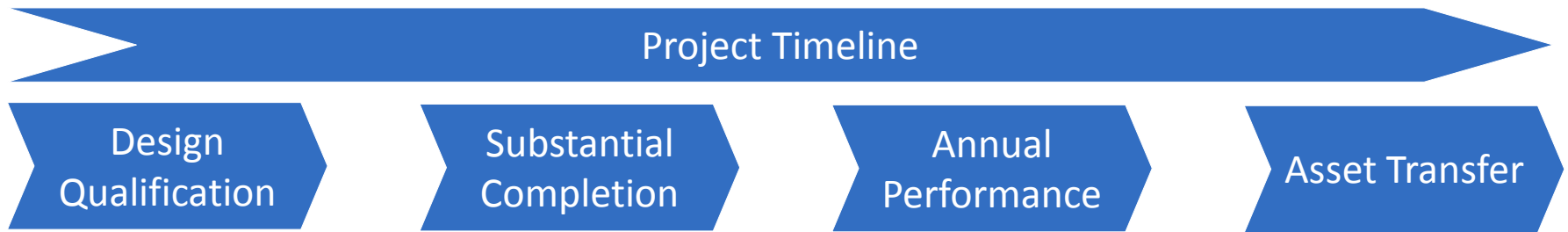
- Accuracy requirements defined in IEC 61724-1*
 - Class A – highest accuracy: (on site POA irradiance measurements required with sensor cleaned periodically)
 - Class B – medium accuracy
 - Class C – lowest accuracy: (OK to use satellite data for irradiance)
- IECRE system types
 - U1: Utility – *Focus discussion on this today*
 - U2: Residential
 - U3: Commercial
 - U4: Aggregate (collection of small systems)

*Details under discussion

Principles for balancing risk and cost

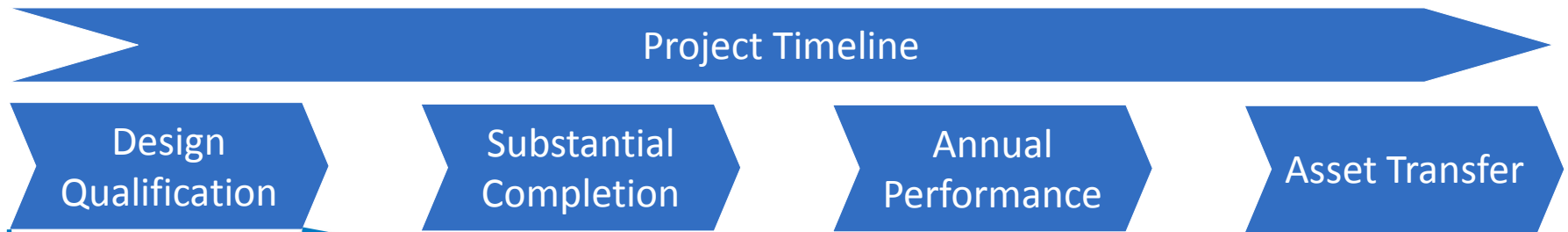
- Benefit from standardization
 - Create and adopt international standards (only one set)
 - Learn from each other (define best standards more quickly)
- Oversight at every stage
 - Design and planning
 - Construction
 - Operation
- Emphasize consistent quality control:
 - Require continuous learning
 - Don't assume that *a single* success implies future successes
- Efficient implementation
 - Don't duplicate inspections
 - Leverage internal quality management actions

PV System Timeline and Certificates (simplified – more later)



- Need confidence that *each step* during a project is completed correctly
- For simplicity, today we will discuss four steps:
 - Design qualification (ready to proceed with construction)
 - Substantial completion (ready to operate)
 - Annual performance (final completion, or annual check up)
 - Asset transfer (define health of plant as basis for acquisition)

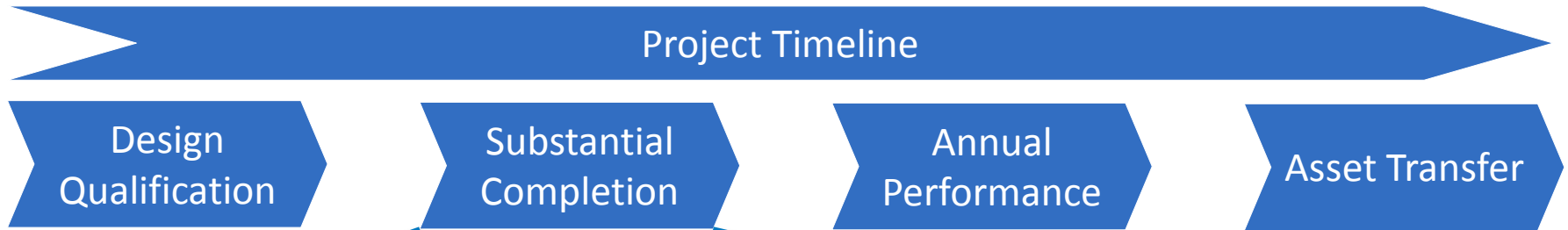
PV System Timeline and Certificates (simplified – more later)



Example considerations

- Local code requirements met
- **Component selection**
 - **Qualified for application**
 - **Quality control during manufacturing**
- **Safety:**
 - Restricted access if appropriate
 - Continuously monitored
 - Overcurrent protection
- **Good design**
 - Shading considered
 - Trenching

PV System Timeline and Certificates (simplified – more later)



Example considerations

- Local code requirements met
- Commissioning completed
- **Component quality verified**
- **Quality management during installation**
 - **Workers trained with oversight**
 - **Any design changes reviewed**
 - **Continuous improvement**
- **Performance check**
 - **Does power output match the design?**

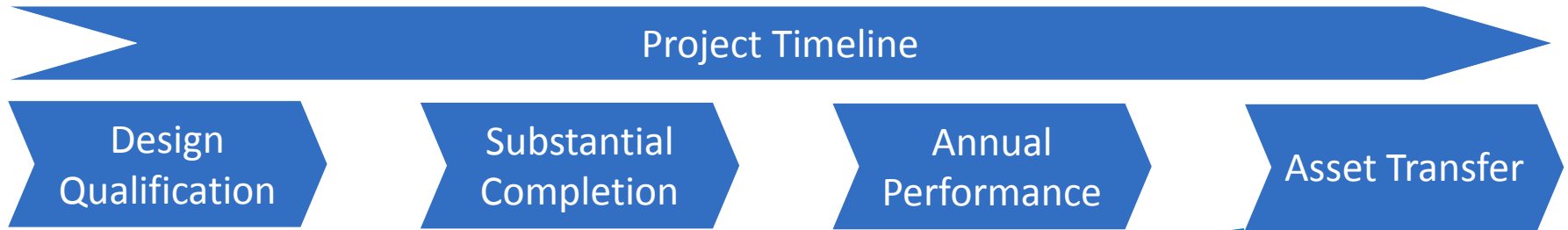
PV System Timeline and Certificates (simplified – more later)



Example considerations

- **Based on measured weather and original model, does plant perform as expected?**
 - **Energy availability** (e.g. if inverters break, the plant could be “off line” and unavailable)
 - **Performance index** (measured performance divided by expected performance based on measured weather)
- **O&M costs**
 - Relative to planned cost, how much did it cost to keep the plant running?

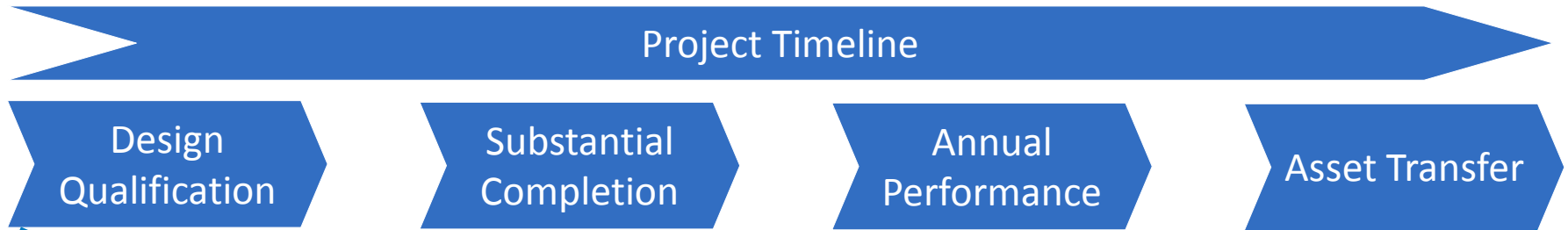
PV System Timeline and Certificates (simplified – more later)



Example considerations

- Has plant output been consistent with original model?
- Have O&M costs been consistent with original model?
- Is there evidence of problems to come? (Cracked cells, weeds growing through the modules, hot spots)

Data documentation from steps in timeline



Data documentation – propose to align with XBRL

- Model assumptions
- **Annual performance**
 - **Energy availability**
 - **Performance index**
 - **Annual O&M costs**
- Many other details (current list includes over 200 items, including information from each certificate, dates of completion, local information, and financial details)

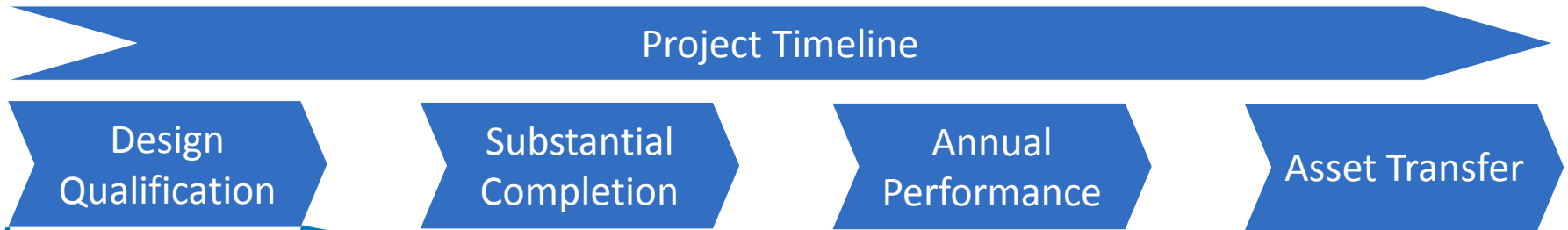
Implementation of IECRE

- Effective implementation requires:
 - Defining WHAT will be implemented (*technical details*)
 - Defining HOW it will be implemented (who has *authority* to say ‘yes, this meets the requirement’?)
- Consistent implementation in all countries is required for an IECRE certificate to have meaning
- Once implemented, statistics will help to define the outcomes associated with using this approach

Status of IECRE Implementation – who can participate?

- Progress of implementation can be tracked at <http://www.iecre.org/documents/refdocs/> (OD-401, OD-402, etc. are PV-specific documents)
- First, define who has authority to do *PV plant inspections*:
 - OD-406: Provides application form to become an IECRE Certification Body or an IECRE Inspection Body
 - Applicants must agree to follow IECRE documents
 - Applicants must agree to peer-review process
- Requirements for *inspectors of PV module factories* are described in OD-405

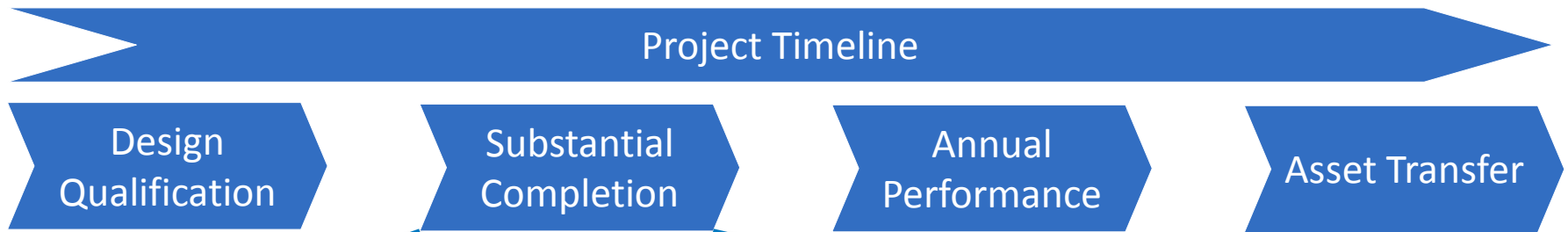
Status of Design Qualification Certificate Implementation



Status

- Technical requirements are being defined:
- **Module selection**
 - **IEC 61215 – Qual. Test: new edition just published**
 - **IEC 61730 – Safety Test: new edition will be published this fall**
 - **Additional changes are in the works**
 - **IEC 62941 – Quality control during manufacturing: published**
- PV plant design guidelines:
 - IEC 62548 – Small systems guidelines – published by end of 2016
 - IEC 62738 – Utility-scale systems guidelines – published in 2017
- IECRE documents – under development

Status of Substantial Completion Certificate Implementation



Status

- **IEC 62446-1 – Commissioning – new edition published**
- **IEC 63049 – Quality management for installation process – in development, will be published in 2017**
- **IEC 61724-2 – Capacity test – planned to be published by end of 2016**
- **IECRE OD-401 – Published – will be updated soon**

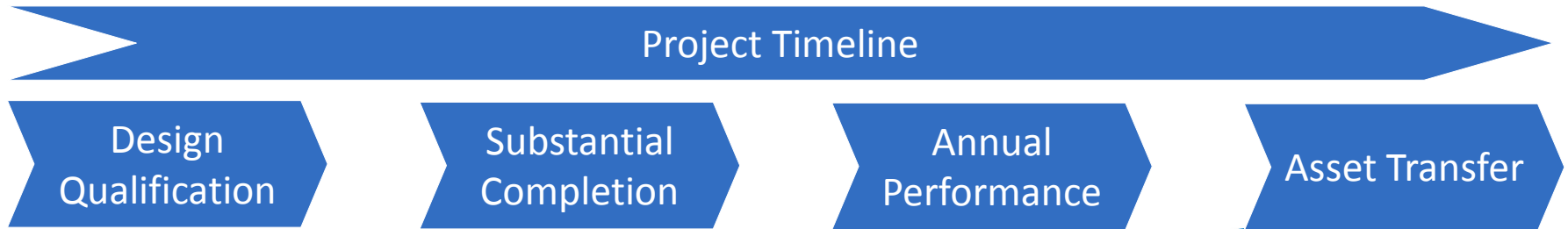
Status of Annual Performance Implementation



Status

- **IEC 61724-3 – Energy test – in press**
- **IECRE OD-402 – Published; revision will be published soon**

Status of Asset Transfer Implementation



Status

- **Development at concept stage**
- Some of the pieces are completed, but the pieces have not all been defined

Plans for standardized data base

- Orange Button – Solar bankability data to advance transactions and access (SB-DATA) Funded by DOE
 - Smart Grid Interoperability Panel (SGIP)
<http://www.sgip.org/orange-button/>
 - SunSpec Alliance <http://sunspec.org/sunspec-osdx/>
 - kWh Analytics <http://www.kwhanalytics.com/kwh-selected-for-department-of-energys-orange-button-initiative/>
 - NREL <http://www.orangebuttondata.org/>
- Data set for solar asset performance metric
<http://www.xbrl-cet.com/international-electrotechnical-commission.html>
- Will be meeting in person in San Francisco *July 13-14, 2016*

Summary – IECRE value and status

- IECRE international standards are being developed to
 - Increase confidence in PV plant performance and safety
 - Reduce costs
- First certificates may be issued by end of 2016 – ***it's time to start including these requirements in new procurements***
- Development will be ongoing, but the foundational pieces should all be available in 2017
- To track progress, monitor documents (no cost) at: <http://www.iecre.org/documents/refdocs/>
- Your suggestions and support in writing/reviewing documents would be welcome!

Thank you!

Sarah.Kurtz@nrel.gov

www.nrel.gov

