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USAID Distributed PV Building Blocks

Grid-Connected Distributed PV: Compensation Mechanism Basics

Presented by Naïm Darghouth, PhD
Lawrence Berkeley National Laboratory

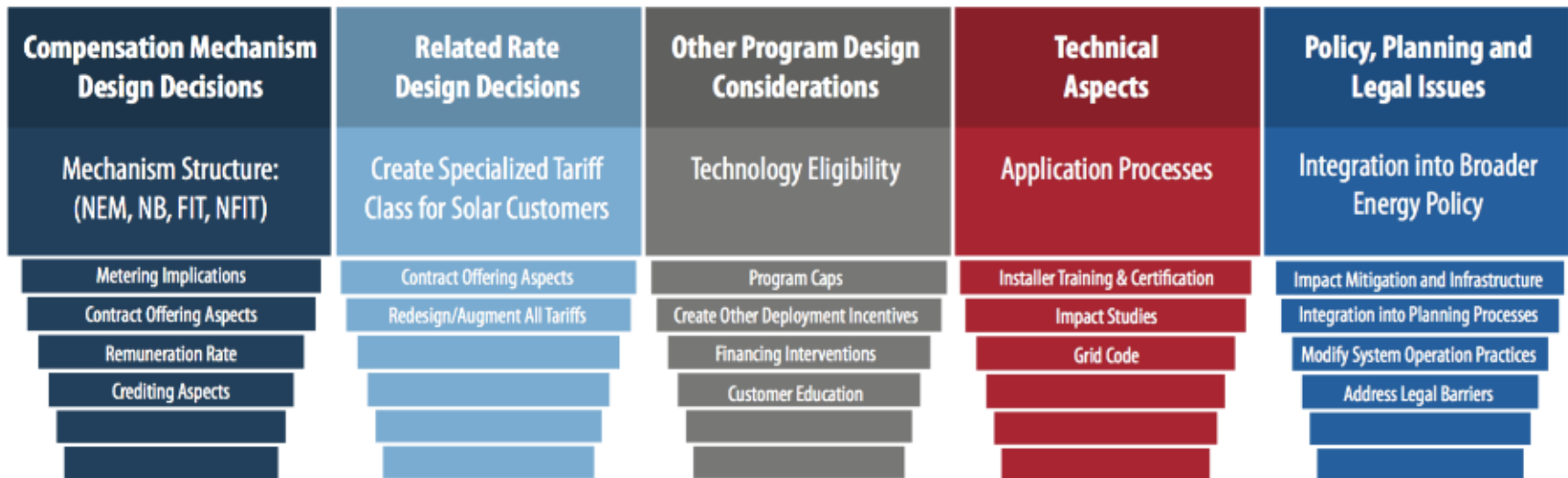
May 10 2018



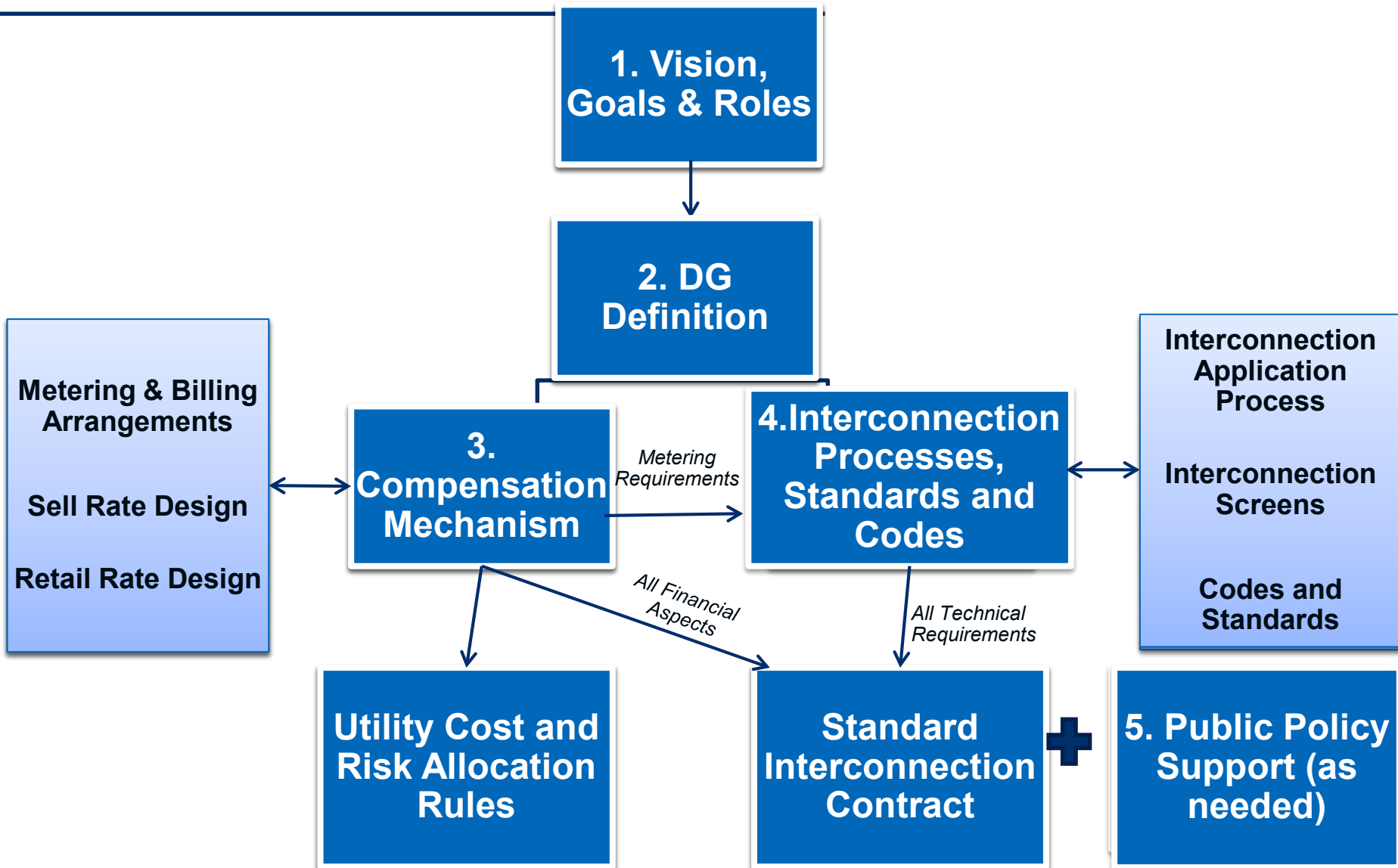
USAID Distributed PV Pilot Program

- A multi-year program to assist USAID partner countries across the DPV spectrum in developing and implementing pilot projects to accelerate DPV market development.
- Contact: Alexandra Aznar (alexandra.aznar@nrel.gov) or Jeff Haeni (jhaeni@usaid.gov)

← THE LANDSCAPE OF DISTRIBUTED GENERATION DESIGN →



Building Blocks for DPV Deployment



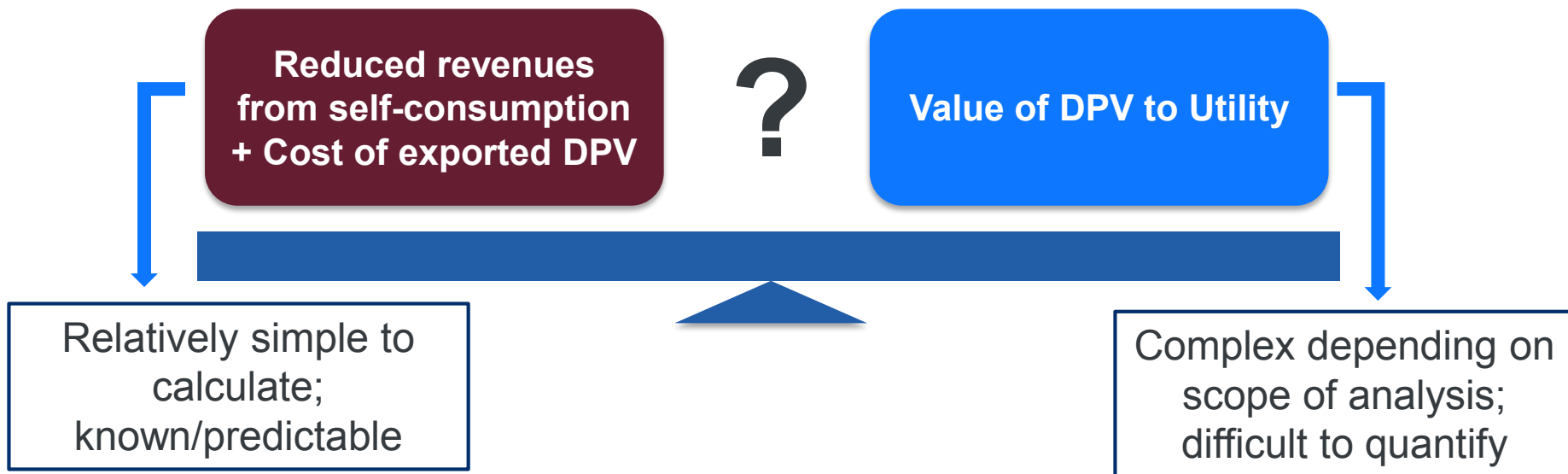
Learning Objectives

- Understand why distributed PV compensation mechanisms are key to the customer economics of PV, utility finances, and retail electricity rates
- Assess the three core elements of PV compensation mechanisms
- Describe the key metering and billing arrangements
- Compare the benefits and challenges associated with the metering and billing arrangements

Compensation mechanisms determine how distributed PV generation is remunerated

- A compensation mechanism is the instrument designed to pay for the distributed PV customer for their PV generation. This includes PV generation which is:
 - Self-consumed – instantaneously used to serve the customer's electricity load (i.e. stays behind the meter)
 - Exported to the utility grid – any PV generation not consumed on-site and sent to the electric grid
- It strongly influences the *value* proposition of distributed PV to the customer and *costs* to the utility
 - It determines the average **customer value** for PV generation
 - ... conversely, this is equal to the **reduced revenues from self-consumption + cost of exported DPV generation to the utility**

Compensation mechanisms also determine whether DPV impacts rates and utility earnings



- If these two elements are not equal, there are:
 - Utility earnings impacts, and/or
 - Retail electricity rates changes

Compensation mechanisms have three primary components

1. Metering and Billing arrangements
 - Defines how consumption and generation-related flows are measured and billed
2. Sell rate design
 - Determines the level of compensation for DPV generation exported to the grid
3. Retail electricity rate design
 - Determines how the customer is charged for their consumption

COMPENSATION MECHANISM COMPONENTS

METERING AND BILLING ARRANGEMENTS

- NEM • Buy all, Sell all • Net billing

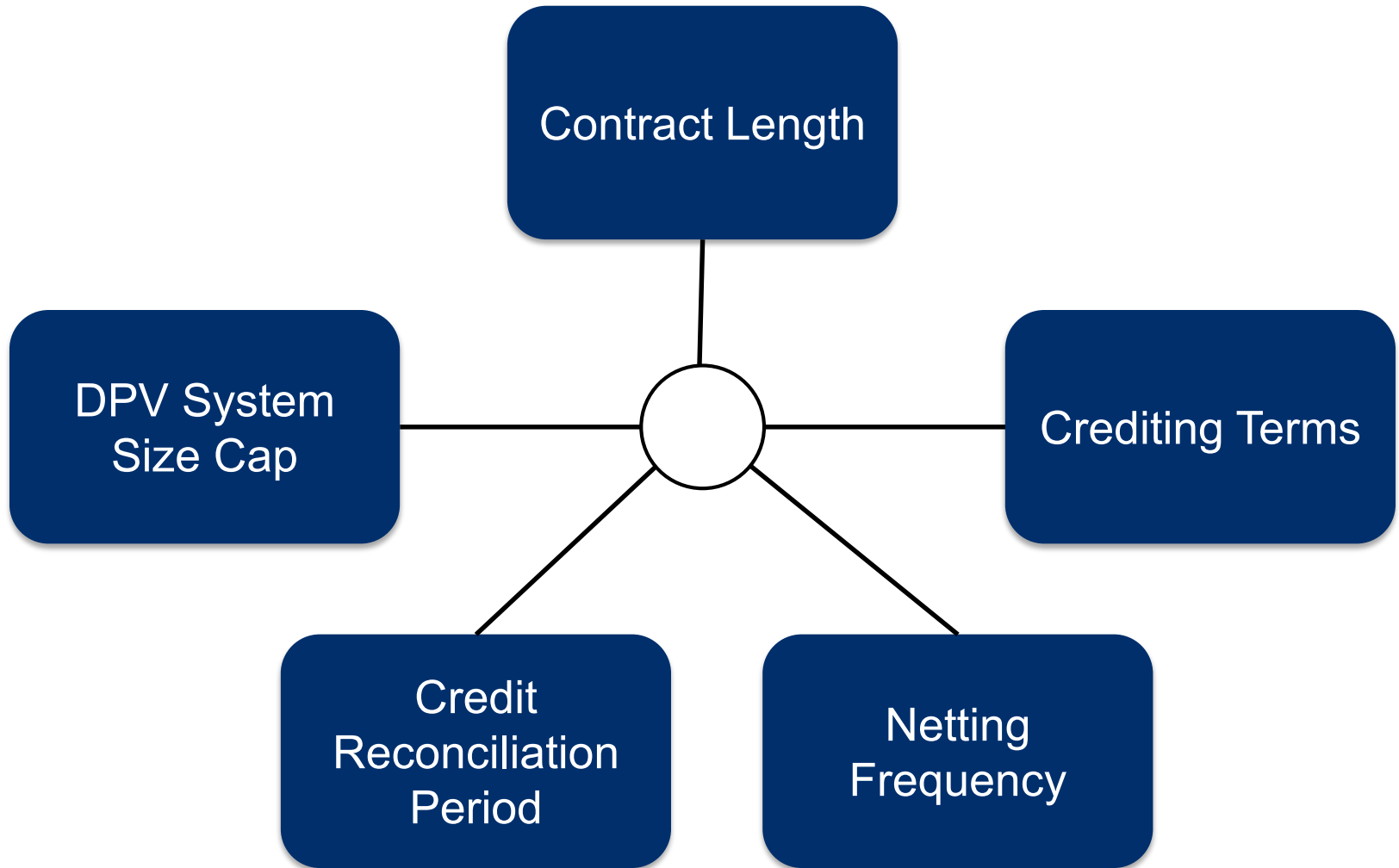
SELL RATE DESIGN

- Static rates • Dynamic rates

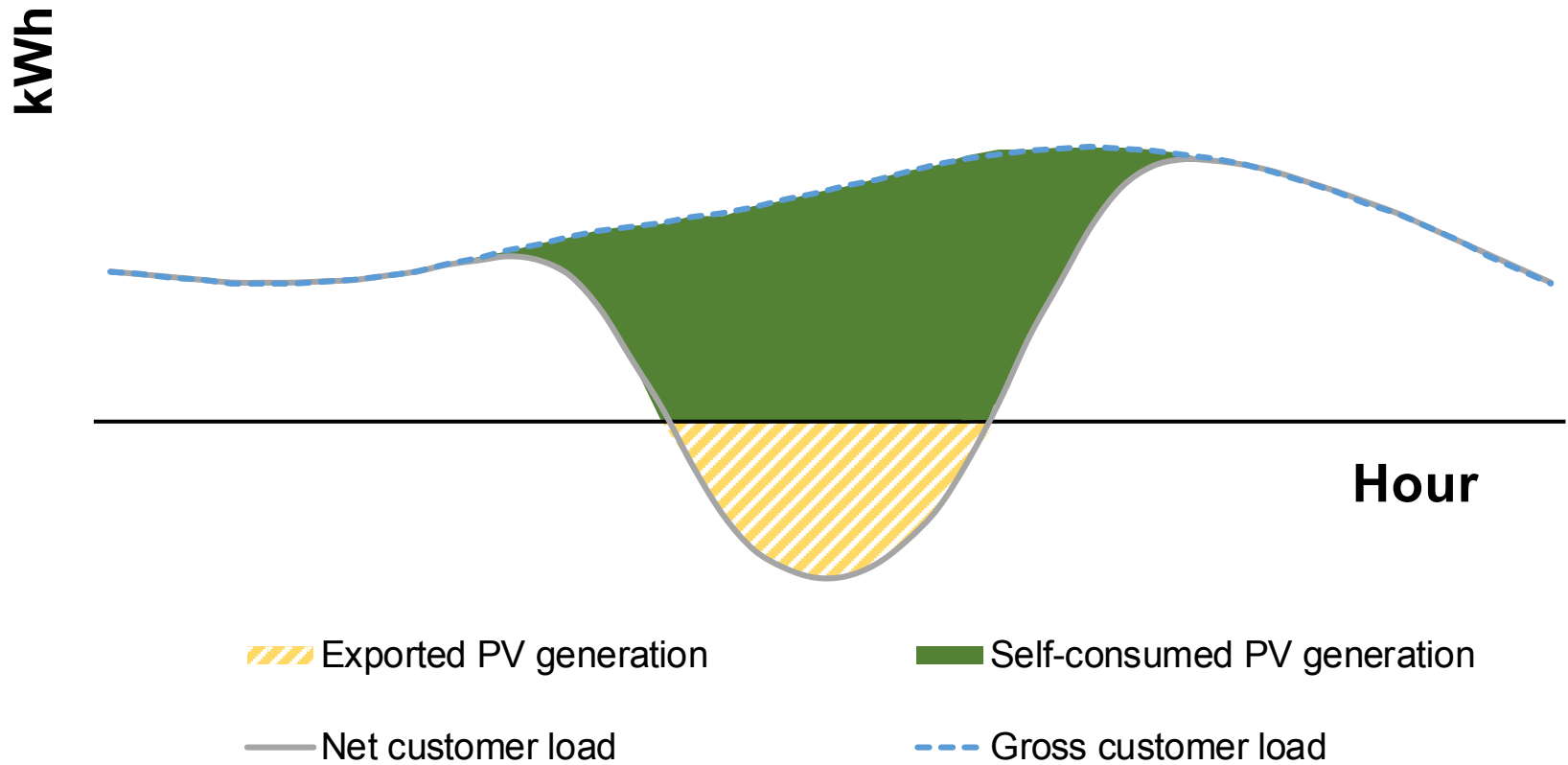
RETAIL RATE DESIGN

Large diversity of options

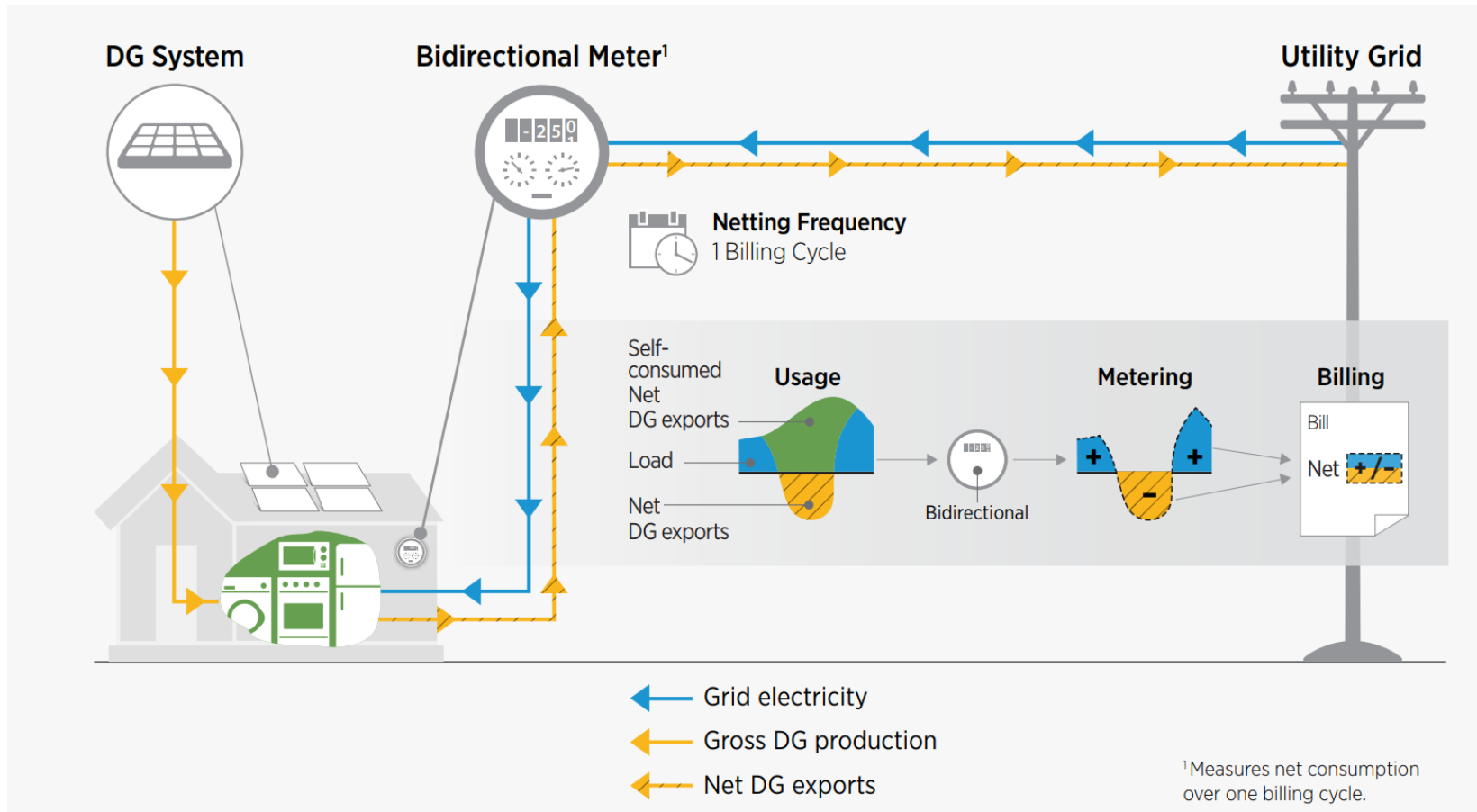
... and many other details to consider



What is Happening Behind the Meter?



Metering and Billing Arrangements: Net Metering



The benefits and challenges of net metering

Benefits

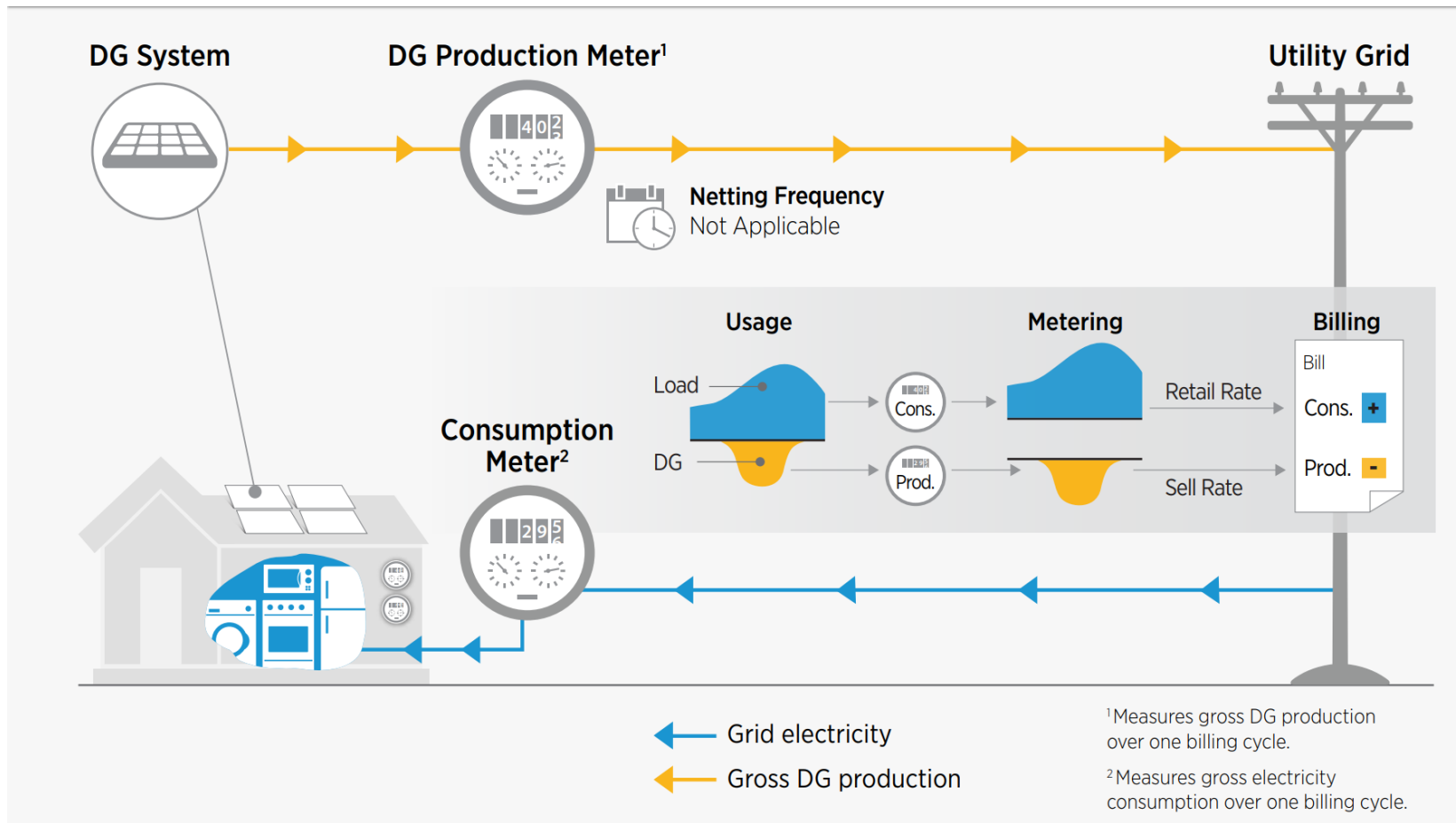
- Simple to understand and implement
- Only requires minor regulatory changes
- Makes use of existing retail rate designs, no new rates necessary
- Can often use existing metering infrastructure, with single meter
- Can promote market growth

Challenges

- Bill savings from DPV can be difficult to estimate for complex rate designs
- Revenue reduction may be higher than avoided costs from DPV generation, leading to reduced earnings*
- May lead to cross-subsidies from non-DPV households to DPV households*

* effect is insignificant at low DPV adoption levels

Metering and Billing Arrangements: *Buy all, Sell all*



The benefits and challenges of Buy all, Sell all

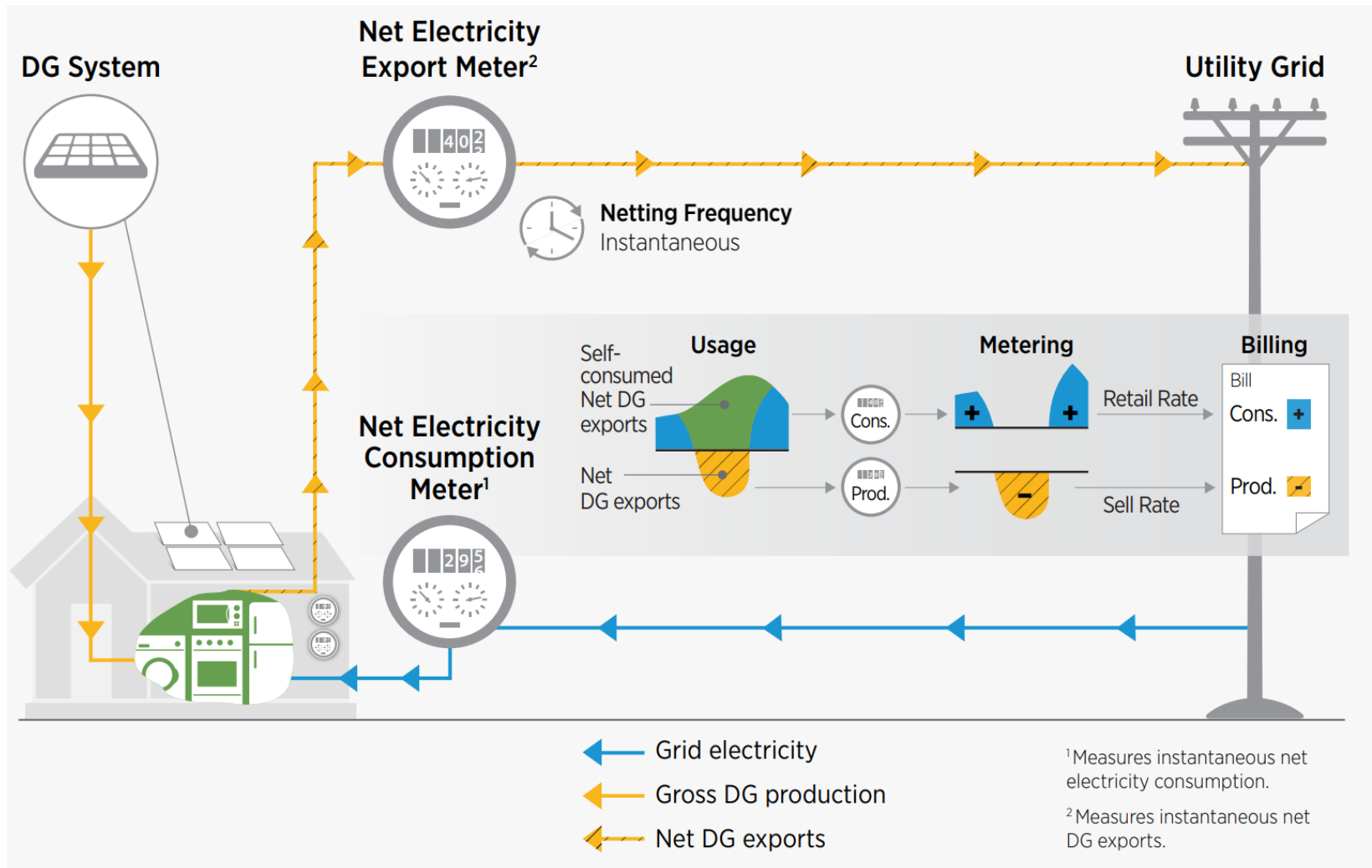
Benefits

- Simple & predictable value proposition for DPV system owners
- Simple accounting for utility
- Feed-in tariff can be adjusted (for new customers) to steer market towards desired deployment

Challenges

- Feed-in tariff rate can be set too high or too low, either growing the market unsustainably fast or stifling it
- No incentive for customer to self-consume since metered separately
- Additional meter needed to measure DPV generation

Metering and Billing Arrangements: *Net billing*



The benefits and challenges of Net Billing

Benefits

- The sell rate can be calibrated to match the avoided costs of the exported PV generation
- Can encourage self-consumption of PV generation, if desired

Challenges

- Self-consumption leads to reduced utility revenues and potentially earnings/rates, even if export compensation level matches avoided costs
- Less attractive to the customer than net metering with potential implications on market growth

For More Information



Grid-Connected Distributed Generation: Compensation Mechanism Basics

Owen Zinaman,¹ Alexandra Aznar,¹ Carl Linvill,² Naim Darghouth,³ Timon Dubbeling,⁴ and Emanuele Bianco⁴

This short report defines compensation mechanisms for grid-connected, behind-the-meter distributed generation (DG) systems as instruments that comprise three core elements: (1) metering & billing arrangements, (2) sell rate design, and (3) retail rate design. This report describes metering & billing arrangements, with some limited discussion of sell rate design. We detail the three possible arrangements for metering & billing of DG: net energy metering (NEM); buy all, sell all; and net billing.

Introduction

Deployment of grid-connected DG systems can be enabled through public policies and regulatory mechanisms, including well-designed *compensation mechanisms*. Compensation mechanisms are the instruments designed to reward the DG system owner for electricity that is self-consumed (if applicable) and/or exported to the utility grid.⁵ Compensation mechanisms impact DG deployment because they strongly influence the value proposition of a DG investment for individual customers. A compensation mechanism is composed of three core components:

1. Metering & billing arrangements. This element defines how consumption- and generation-related electricity flows are measured and billed. The three options for metering & billing are net energy metering, buy all, sell all, and net billing. The selection of a metering & billing arrangement does not in itself imply an amount of compensation for the DG system owner.⁶

1. National Renewable Energy Laboratory
2. Regulatory Assistance Project
3. Lawrence Berkeley National Laboratory
4. International Energy Agency

5. We chose to classify clean energy certificates and other volumetric performance incentives as financial incentives rather than compensation mechanisms; therefore, these are outside the scope of this report.

6. NEM is an exception to this statement—the customer is by definition credited at the full volumetric retail rate for any electricity exported within a given billing period.

Why Do Compensation Mechanisms Matter?

A well-designed compensation mechanism can help minimize the negative impacts and maximize the value of DG to all stakeholder groups, including distribution utilities, the DG system owner, and other ratepayers (non-DG-system owners). Different compensation mechanisms have been tested in different country contexts, revealing useful lessons for utilities, regulators, and policymakers. Because the distinctions and design elements of different metering & billing arrangements can be easily misunderstood, this brief aims to clarify the options available to stakeholders interested in using compensation mechanisms to facilitate DG deployment around the world.

Public Policy and Regulatory Mechanisms to Address DG

Compensation mechanisms are one of several policy and regulatory options that can address challenges associated with deploying DG systems. Others include:

- Direct financial incentives (e.g., cash rebates, tax credits)
- Low-interest financing programs
- Clean electricity standards (for clean DG systems)
- Streamlined interconnection processes and standards
- Revenue decoupling.

- Download the NREL report:

<https://www.nrel.gov/docs/fy18osti/68469.pdf>

- Email the authors:

Alexandra Aznar

alexandra.aznar@nrel.gov

Naim Darghouth

ndarghouth@lbl.gov

Naïm Darghouth: ndarghouth@lbl.gov

Alexandra Aznar: Alexandra.Aznar@nrel.gov

Jeff Haeni: jhaeni@usaid.gov



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