SMART GRID INTEROPERABILITY PANEL

GREEN BUTTON INITIATIVE

PRESENTATION TO THE SGIP GOVERNING BOARD
DECEMBER 4, 2011

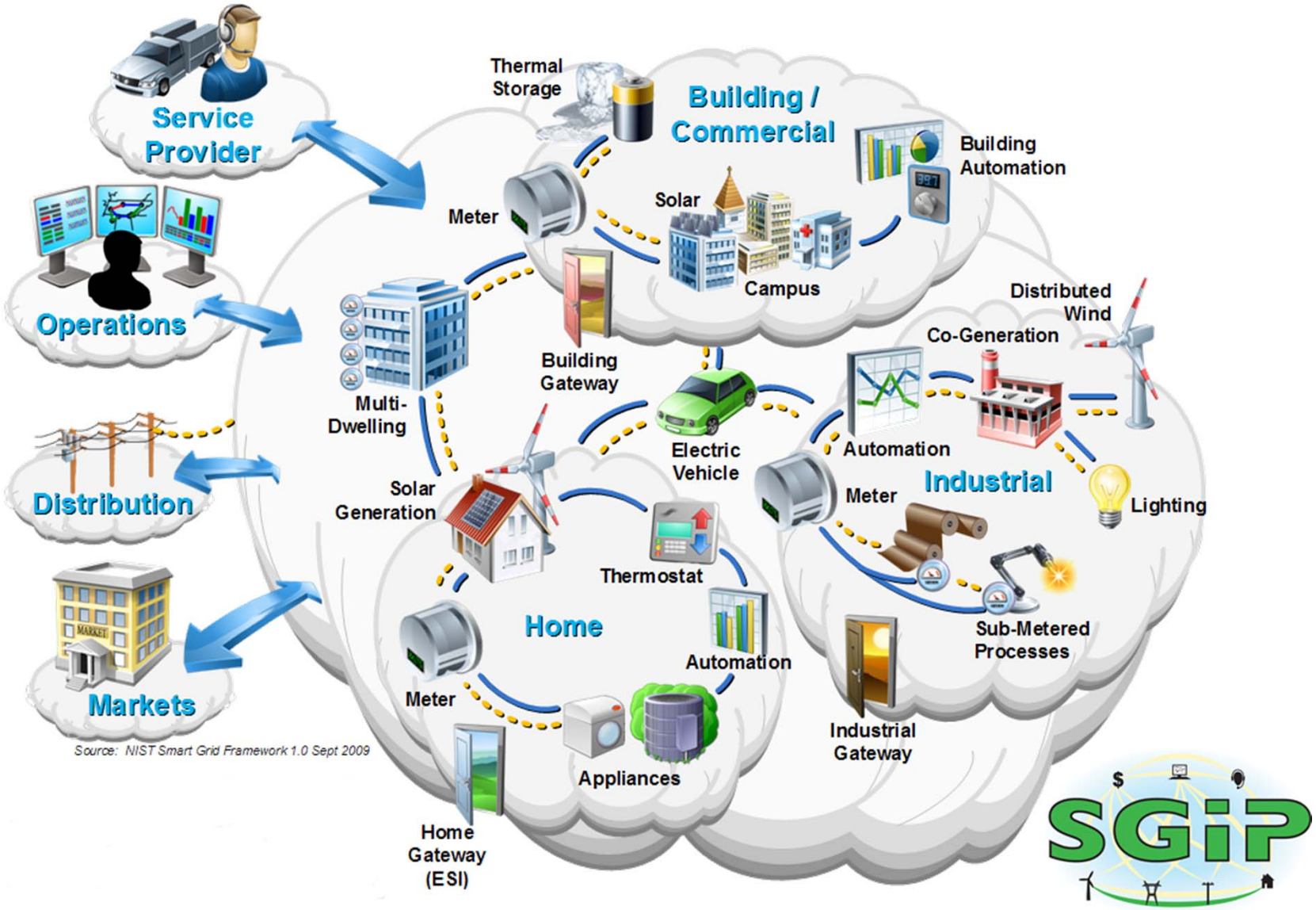
David Wollman NIST and Chris Irwin DOE

(with acknowledgements to Marty Burns, Hypertek)

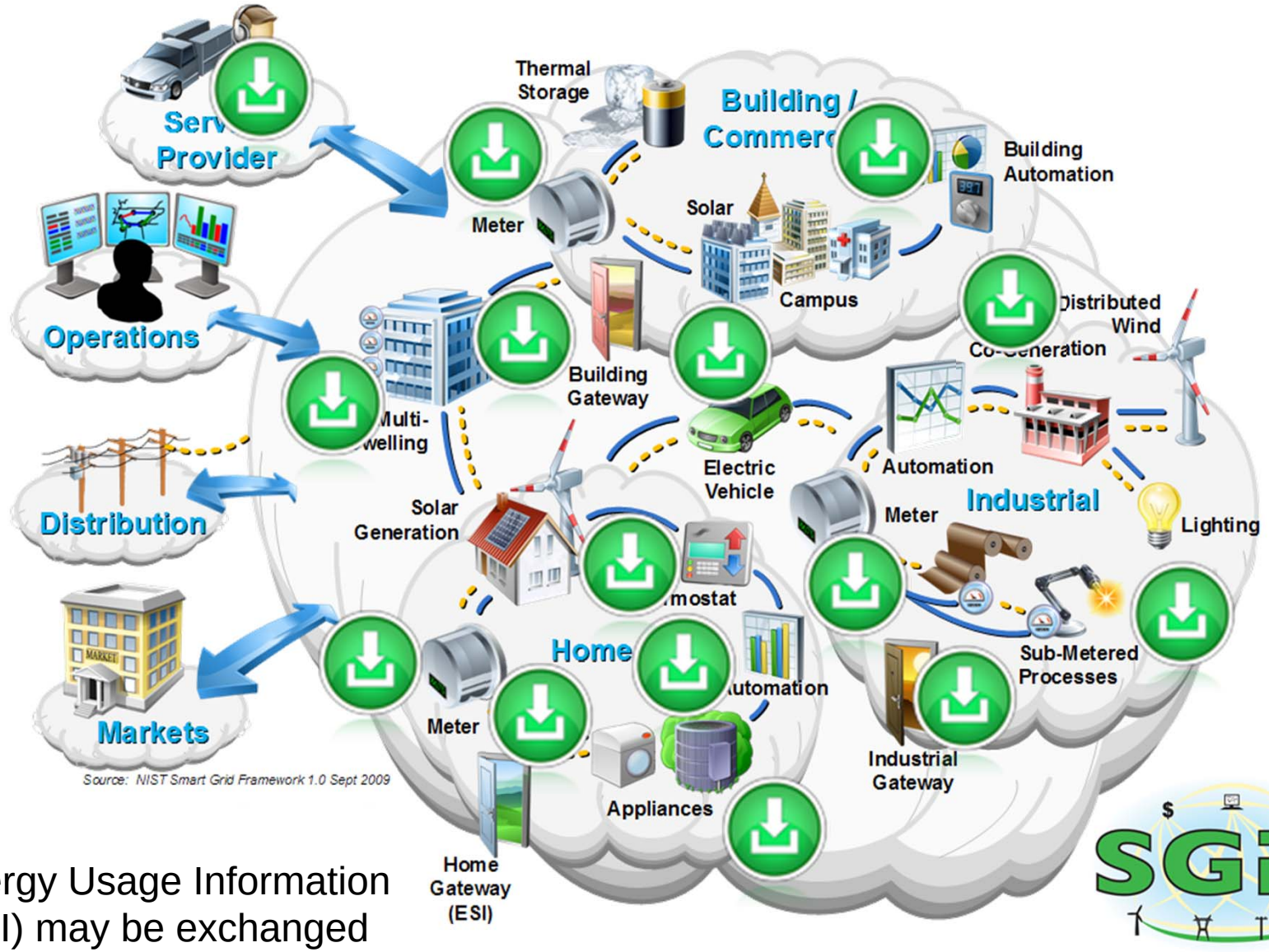
Agenda

- Green Button Initiative (Aneesh Chopra challenge)
  - Background and Big Picture
- Energy Usage Information (EUI) Basics
  - Information modeling, PAP10 and ESPI
- Green Button Current Status
  - California Utilities joint effort, with support of CPUC
  - Agreement on initial file format, see Twiki website
  - Initial demonstrations and implementations
- DOE Funding Opportunity Announcement
- Next Steps - SGIP
  - Outreach and opportunities

Consumer Domain



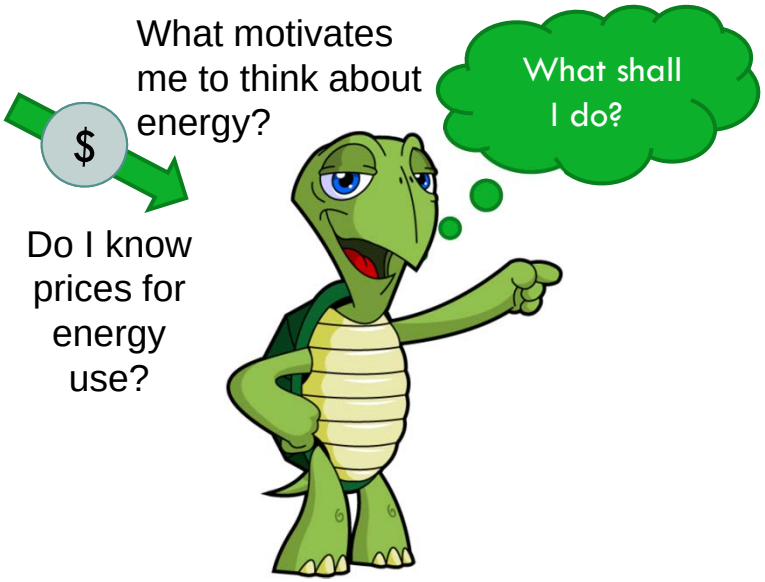
Consumer Domain



Energy Usage Information (EUI) may be exchanged

Consumer Perspective

Consumer Perspective



Consumer Perspective

What motivates me to think about energy?

$

Do I know prices for energy use?

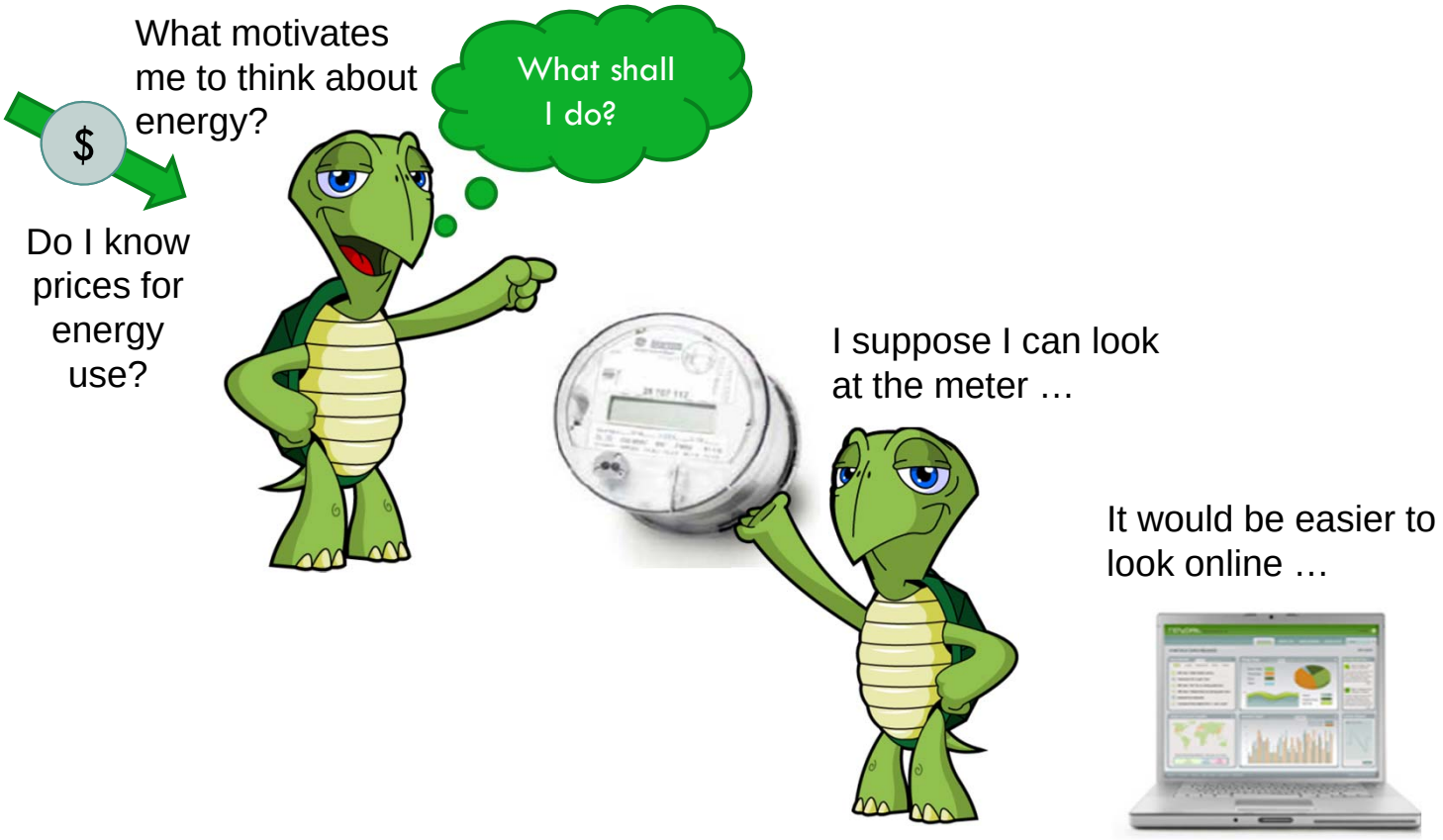
I really don't know much about my energy usage ….

The electricity bill will come like usual next month, I can wait for it and I'll do something then ….

Maybe …. I think I'll take a nap

Consumer Perspective

Consumer Perspective



Consumer Perspective

What motivates me to think about energy?

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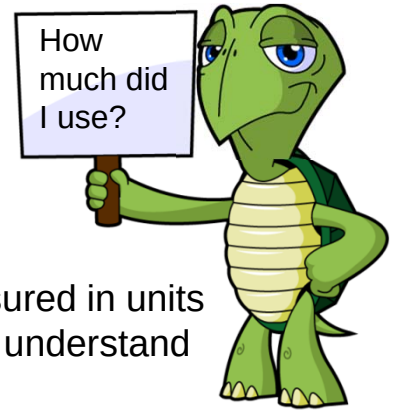
Do I know prices for energy use?

What shall I do?

How much did I use?



Measured in units that I understand

Consumer Perspective

What motivates me to think about energy?

$

Do I know prices for energy use?

What shall I do?

How much did I use?

Measured in units that I understand

Do I need to shut off extra lights, turn down the thermostat, weatherproof, or buy new efficient appliances?

Here is what I'll plan to use in future

I may need help from third parties that I trust

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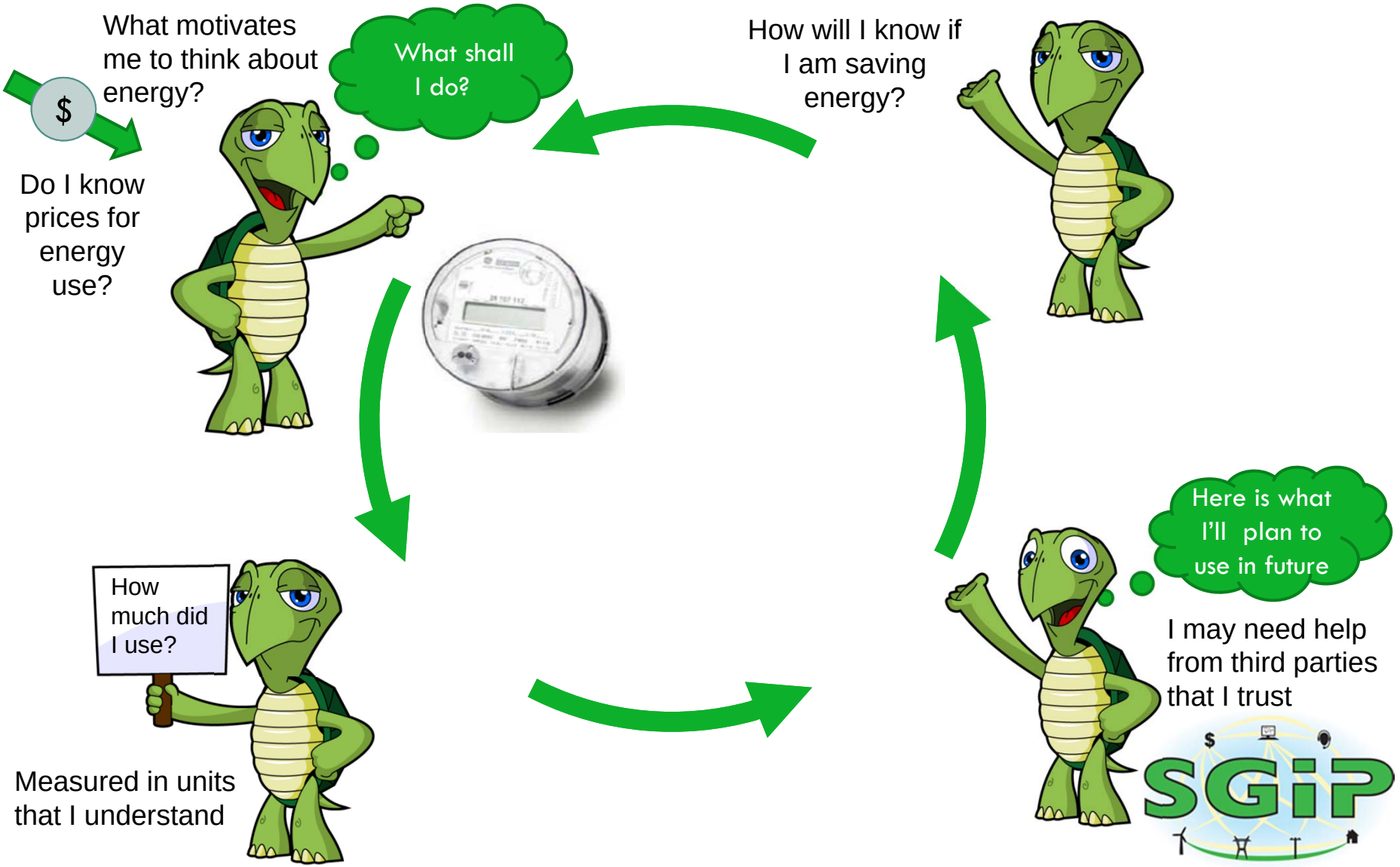
Consumer Perspective



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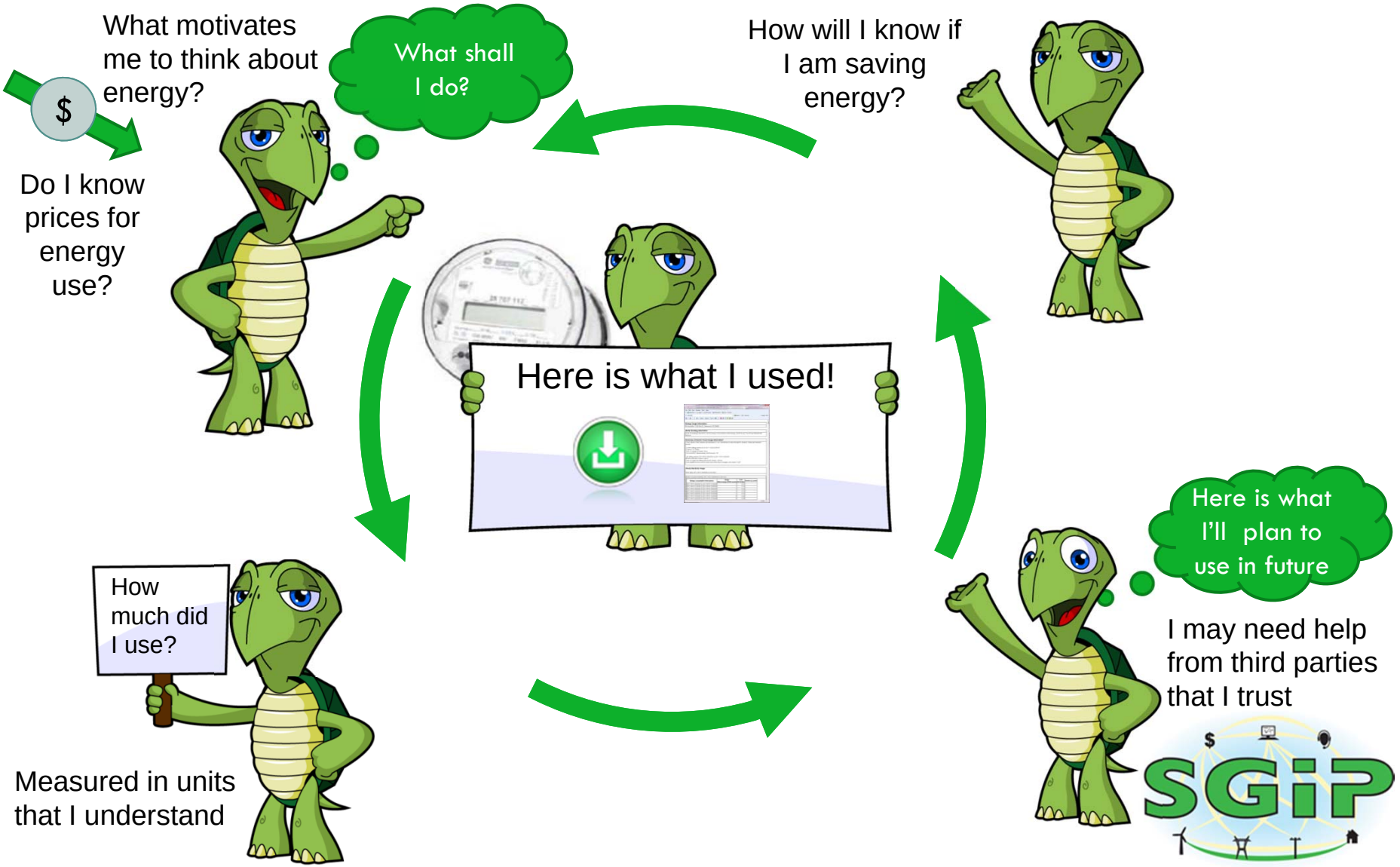

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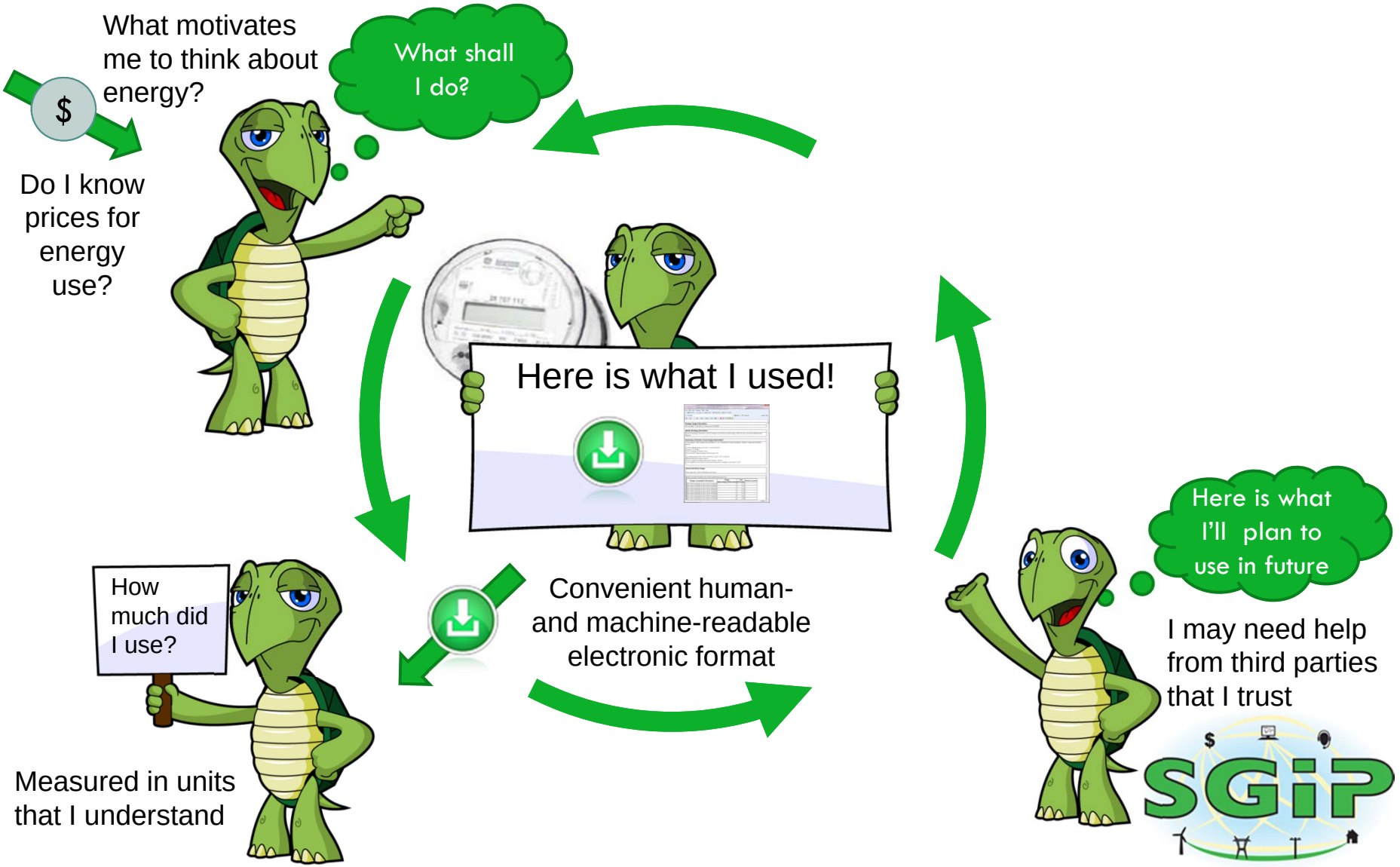

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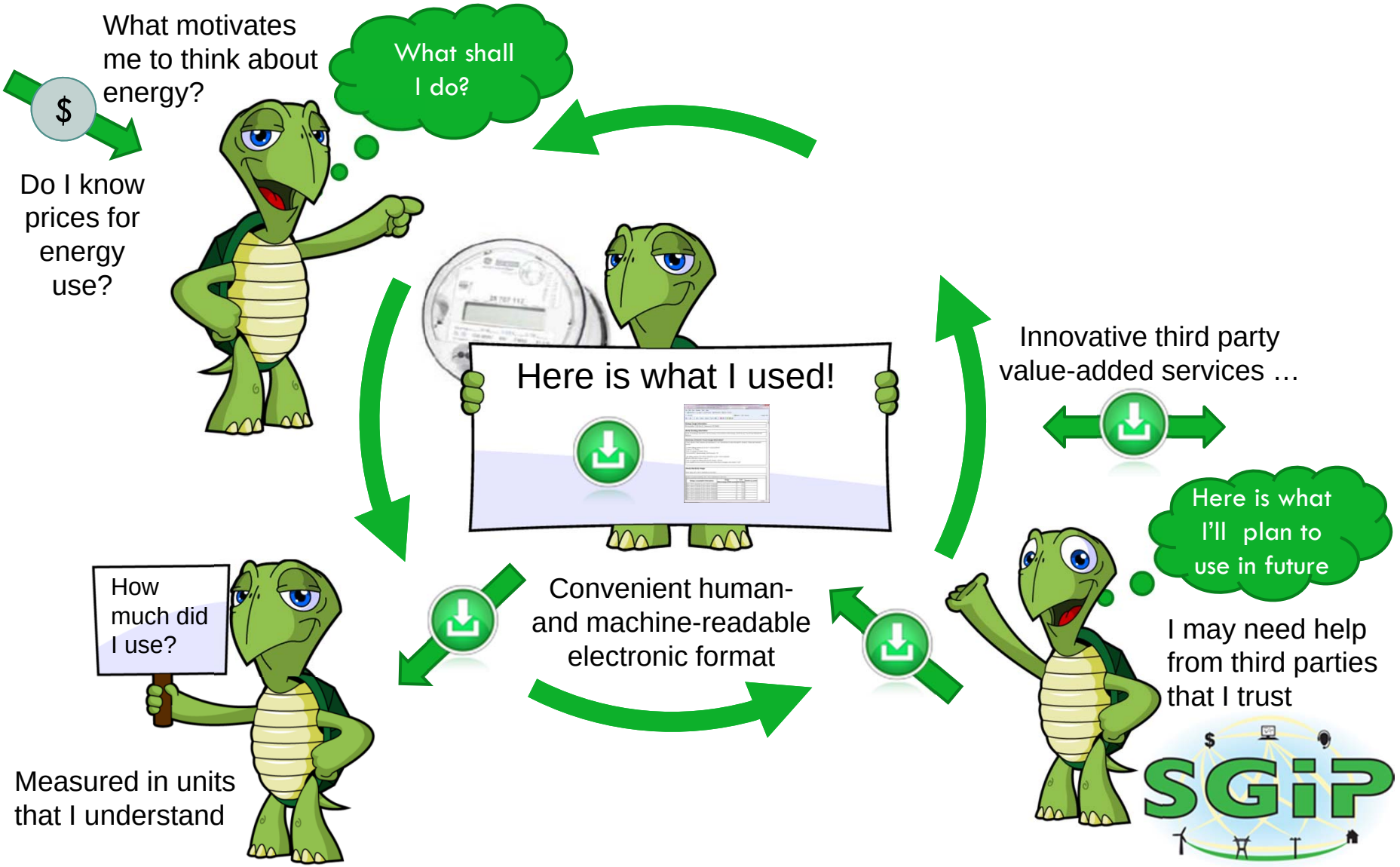

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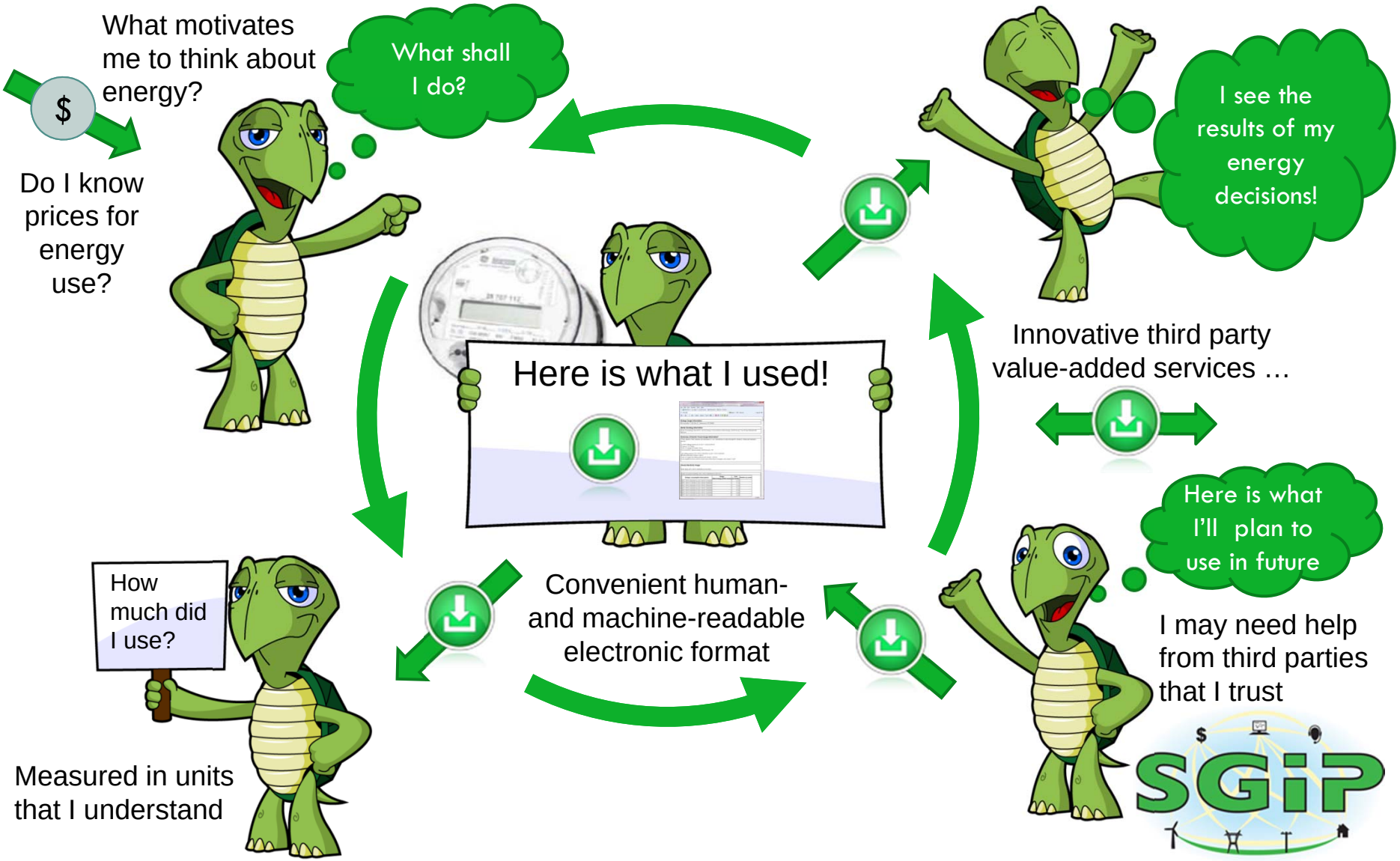

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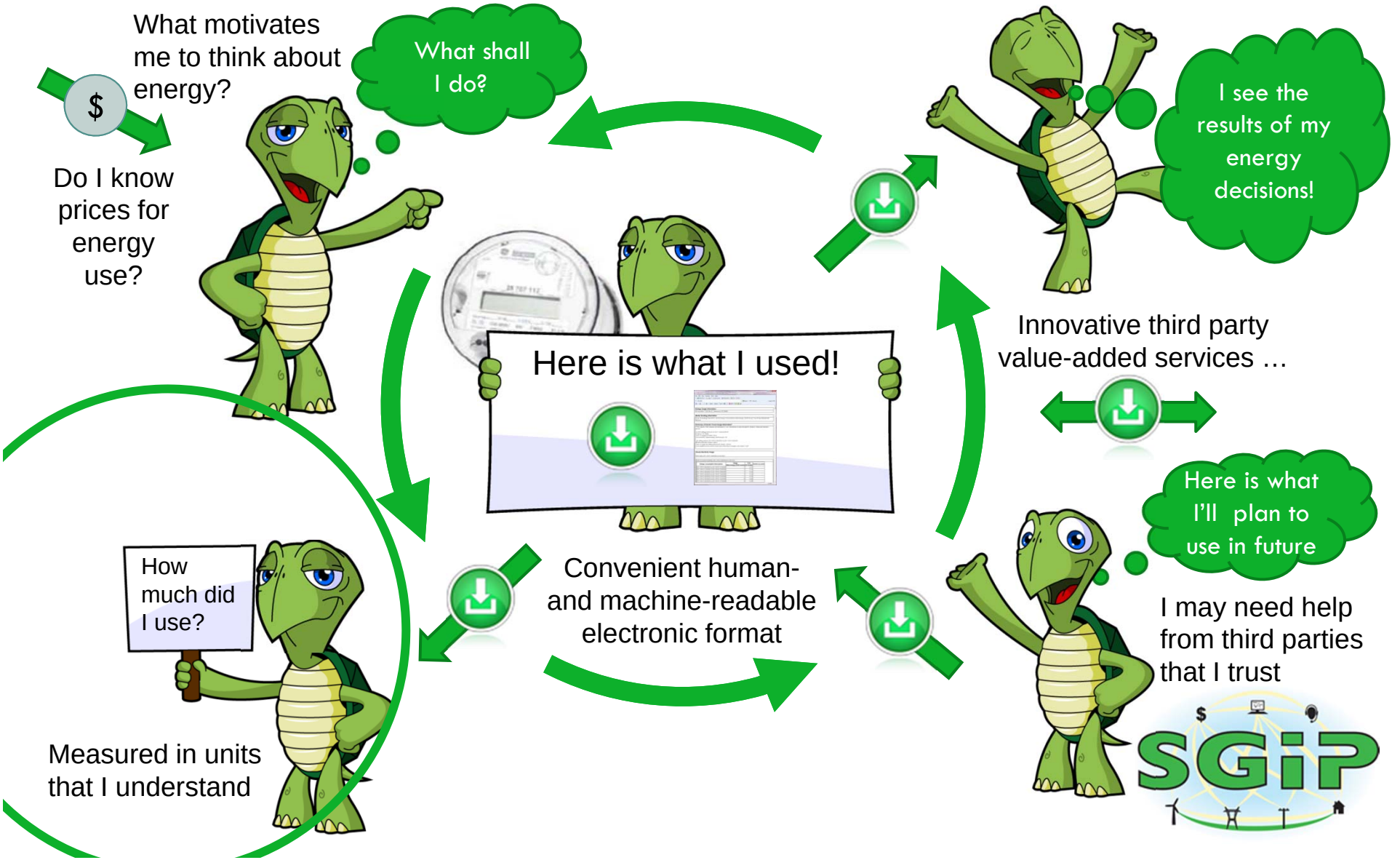

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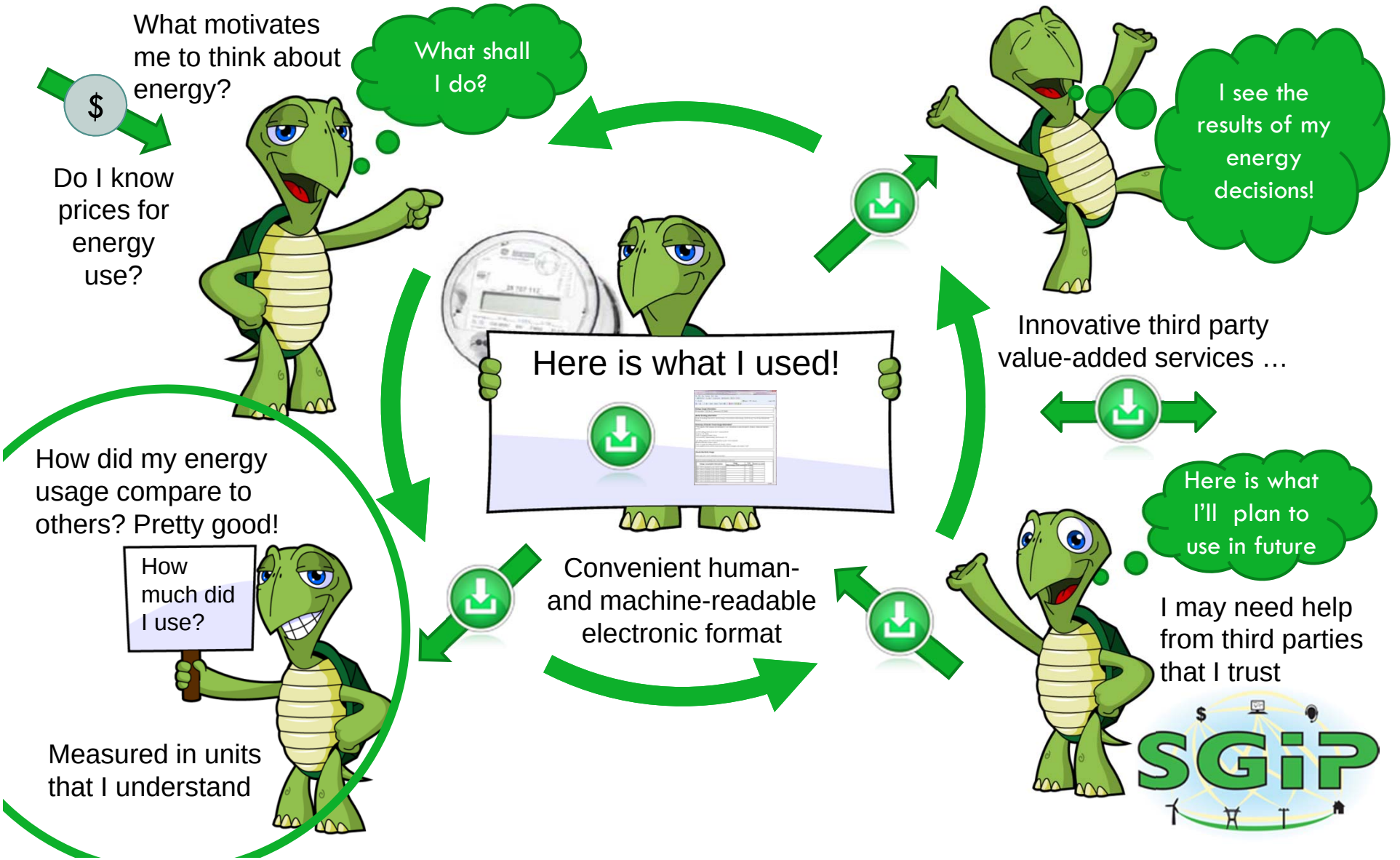
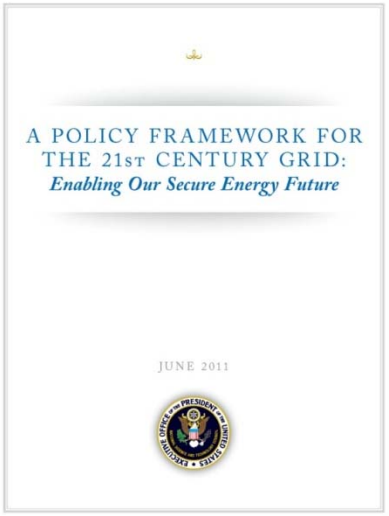


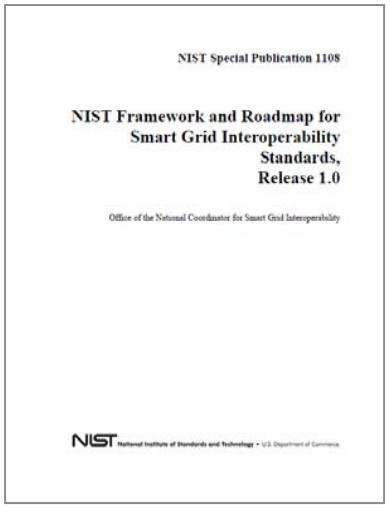
Consumer Perspective - Goal

Press the Green Button to download your energy usage data and make good things happen!

Policy and Interoperability Frameworks Align

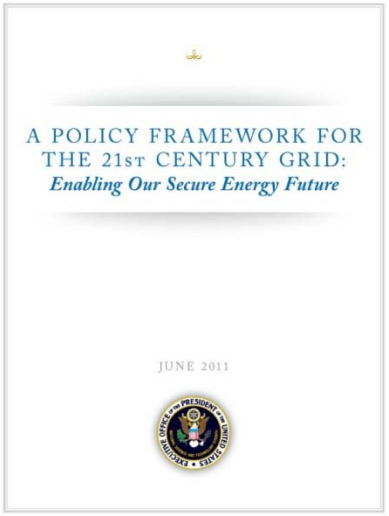


- **NSTC Subcommittee on Smart Grid June 2011 Report includes 4 key Federal policy recommendations:**
  - Enable cost-effective smart grid investments
  - Unlock innovation
  - Empower and inform consumers
  - Secure the grid



- **Interoperability Framework and Roadmap**
  - Priority Action Plans to fill standards gaps
  - 3.5 Interface to Customer Domain
  - PAP10 Energy Usage Information
  - NAESB PAP10 EUI (and follow-on ESPI) complete

Policy and Interoperability Frameworks Align



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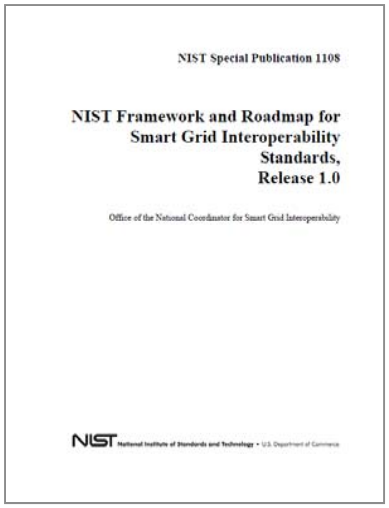

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Let's Empower Consumers with Data

A Challenge – Design a "Green Button"

A Challenge to Industry: How can we safely and securely provide customers electronic access to their energy information, thereby supporting the continuing development of innovative new products and services in the energy sector?

Key Principles

- Use SGIP standards
- Open, Collaborative
- Multi-Stakeholder
- "Lean Startup"
- Easy-to-use

Sept 2011 OSTP Blog: Modeling a Green Energy Challenge after a Blue Button

Aneesh Chopra – U.S. CTO – GridWeek 2011

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How SGIP Inspired Green Button Format

- PAP10 was formed at the start of the SGIP to facilitate the standardization of Energy Usage Information
  - Resulted in NAESB REQ18/WEQ19 PAP10 EUI standard in December 2010
- PAP10 EUI was taken up by NAESB REQ21 Energy Services Provider Interface
  - Based on UCAIug OpenADE and NAESB PAP10 standards
  - Ratified in October 2011
- Together these define a flexible file format for Green Button based on ratified standards from NAESB
- The initial implementations of Green Button are narrowing in on a specific subset of ESPI and EUI for its realization

Energy Usage Information - PAP10

Usage Profile

Overall Usage

Economic

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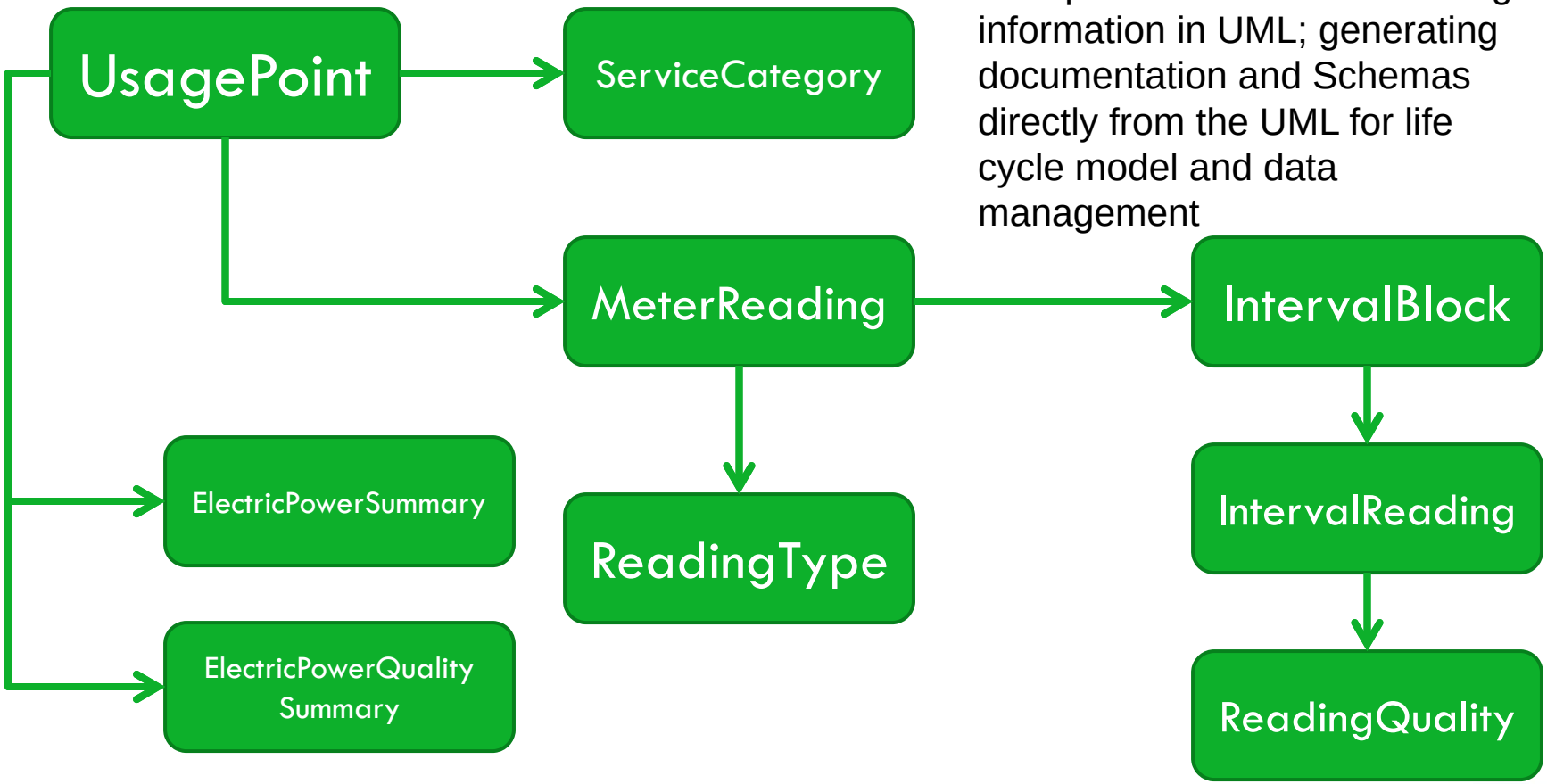
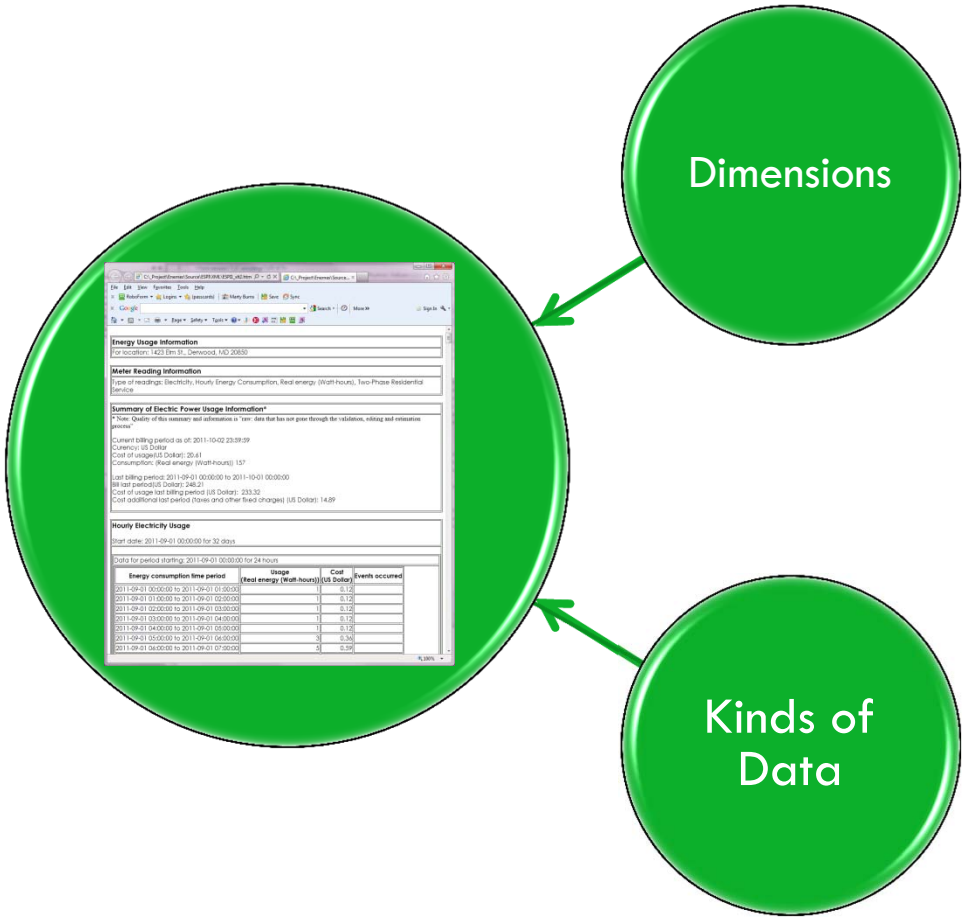
Composition of Energy Usage Information



Best practices include modeling information in UML; generating documentation and Schemas directly from the UML for life cycle model and data management

Note: This information is multidimensional. Many different reading types, summaries, and readings possible. i.e. not “flat”

Diversity of information in EUI



- Measurements of power, energy, gas, water, …
- Quality: Raw, validated, estimated, …
- Source: Meter near real-time, utility back end, third party
- Economics: Consumers need to know the cost of their consumed power (but we did not construct a pricing model)
- Identification: by customer, device, location

- Readings
- Interval data
- Summary Information
- Power Quality Metrics

Web Technologies for definition and presentation of EUI file format

XML Schema (XSD)

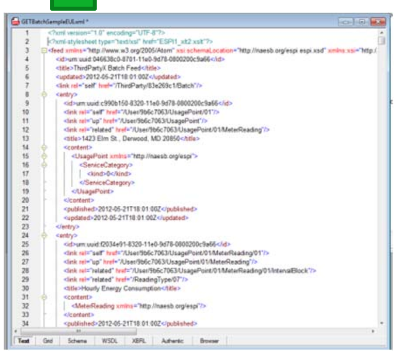
- Describes the rules of file format

XML

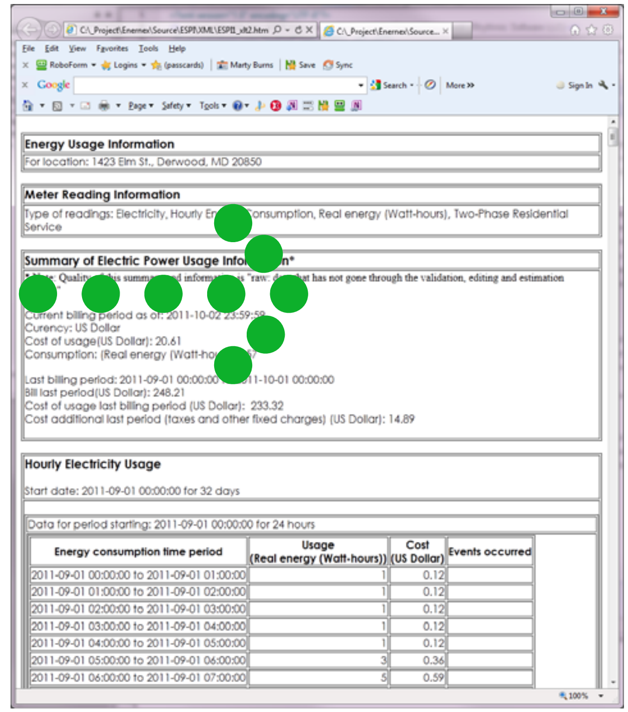
- Contains customer EUI data in standard file format and references to XSD and XSLT

XSLT

- Defines how to transform for humans



Standard EUI File Format



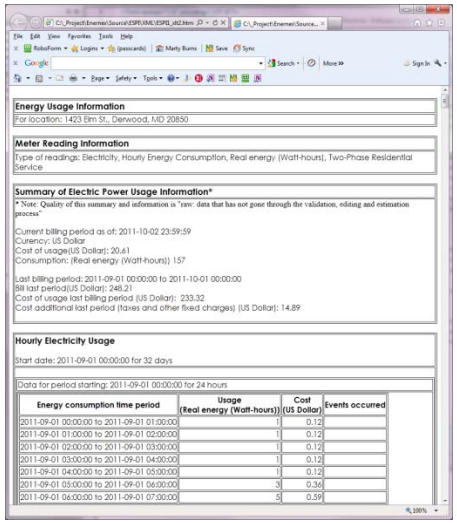
Alternate paths to EUI – single format

Sources of EUI

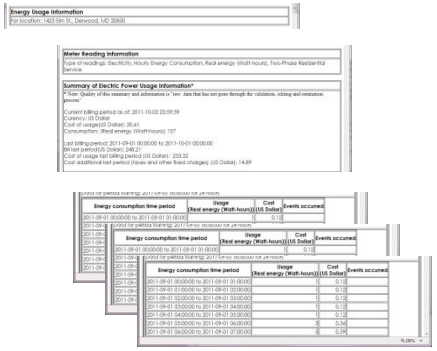
Power Utility

Via: ESPI, SEP2, Web Portal

Single Data Format: all at once



Single Data Format: as sequence



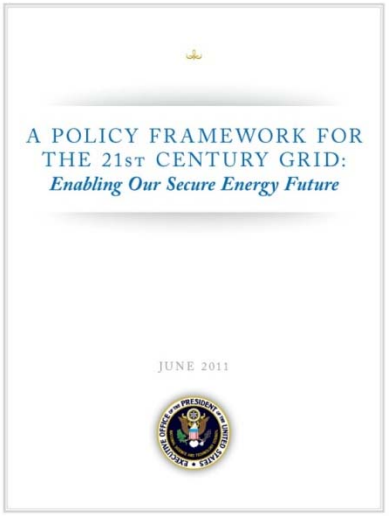
Uses of EUI

Acknowledgements to graphics owners

California IOUs Get Involved

- PGE SAN RAMON—California's three largest utilities agreed to work together to create a "green button"
  - Enable customers to go online to click a Green Button and access their energy usage information
- October 4: Aneesh Chopra and OSTP/NIST/DOE team met with executives of Pacific Gas & Electric, Southern California Edison and San Diego Gas & Electric, with follow-up public event organized with help of Silicon Valley Leadership Group
- Subsequent meetings of CA utilities (and their vendor partners) with OSTP/NIST/DOE contributions leads to initial data format agreement based on subset NAESB PAP10 and ESPI, see Twiki: http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/GreenButtonInitiative

DOE Smart Grid Data Access FOA (DE-FOA-0000579)



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- **FOA Supports NSTC recommendation & Implementation of Green Button Initiative**
  - Requires a standardized data format be made available to residential customers and designated third parties
  - Specifies NAESB PAP10 EUI and ESPI standards

DOE FOA Overview
(Application due March 1, 2012)

Empower residential consumers to better manage their electricity consumption by allowing them and authorized third parties access to their electricity usage information on demand through a standardized data access architecture

Phase I

- **Demonstrate** third-party consumer-oriented information tool that creates a value-added service for a minimum of 1,000 residential consumers
- Estimated Number of Awards: 12
- Anticipated Maximum DOE Award Size for Individual Award: $500,000 (plus 50% cost share)
- Period of Performance: 15 months

Phase II

- **Adopt** the data access tool demonstrated in Phase I across an entire service territory, region or community
- Estimated Number of Awards: 1 (to be downselected from Phase-I awards)
- Anticipated Maximum DOE Award Size : $2,000,000 (plus 50% cost share)
- Period of Performance: 9 months

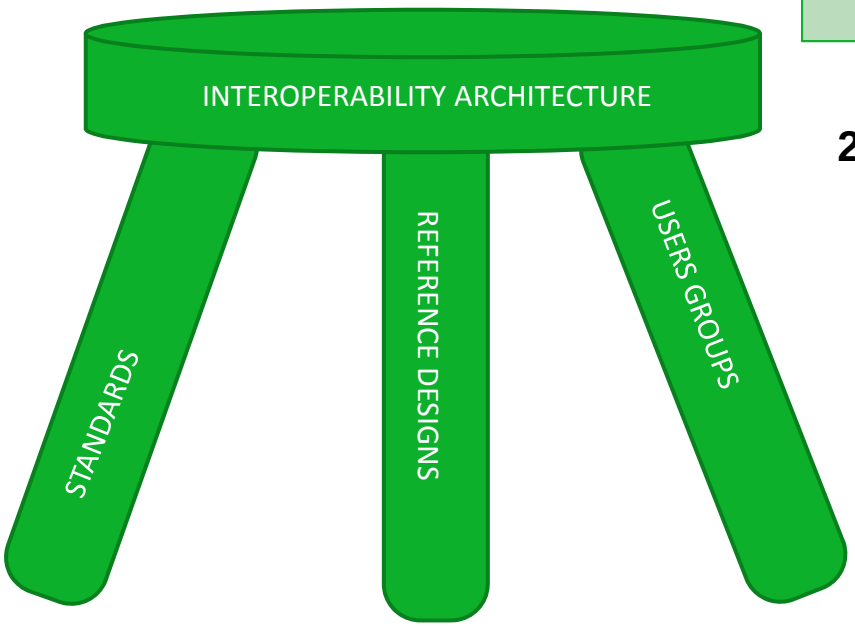
Next Steps - SGIP

- SGIP Grid Interop – Monday Green Button brainstorming, Wednesday Roundtable
- Engagement with utilities
  - California utilities implement and share experiences
  - Add national-perspective evolutionary improvements
  - ????
- Engagement with vendor community
  - Short Demo – Monday Green Button brainstorming
  - Plug-In – Wednesday
  - Follow-up dialog, work items, profile development …
  - How to maintain trust with consumers?
  - ????

Step Stool to Interoperability

NAESB REQ18 EUI, REQ21 ESPI

1) Open Mature standards (SSO): Protocols, test schemas, object models



UCAlug OpenADE Conformance

2) Involved User Group: Interoperability Agreements, Labeling, Testing, Issues Resolution

3) Running Code : Focused Development Projects, Developer Tools, Standards Implementations and test implementations, Open Source

EnergyOS OpenESPI

Next Steps - SGIP

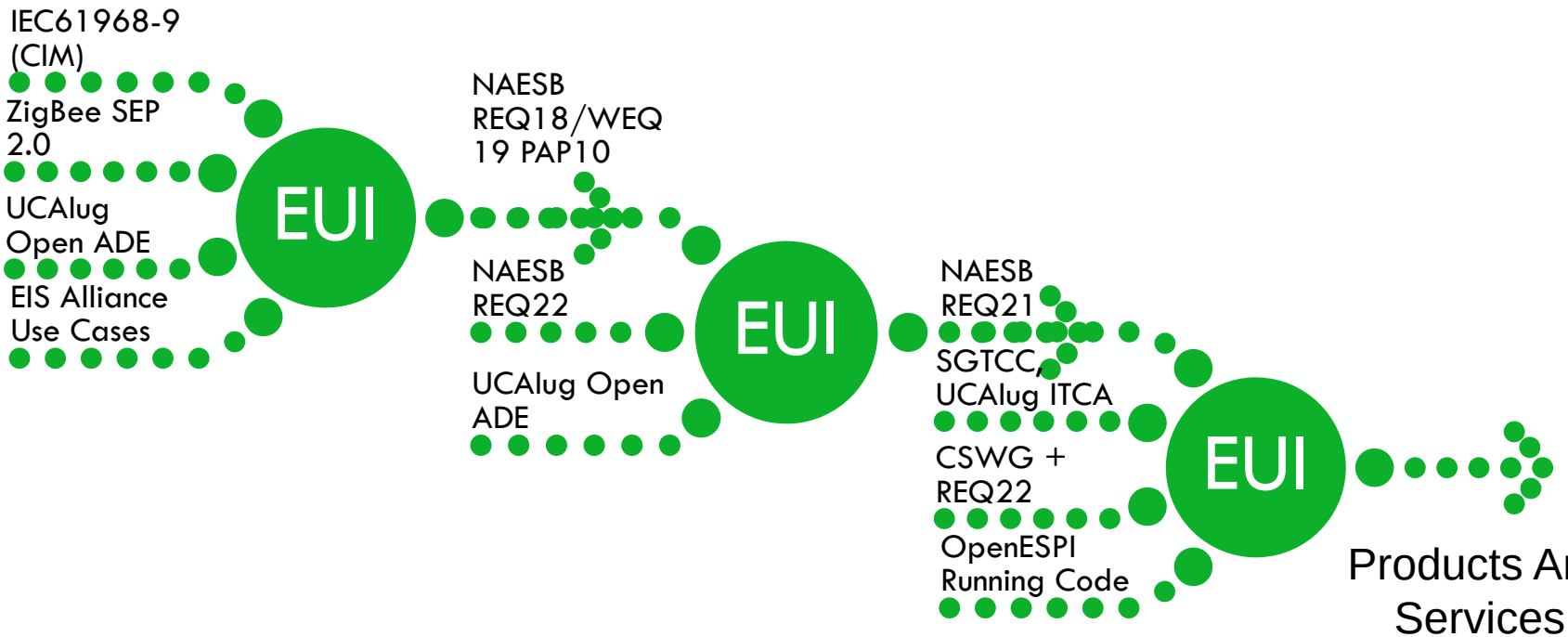
- Engagement with regulatory community
  - CPUC support important for initial effort with CA utilities
  - What level of engagement is desired?
  - Business and Policy DEWG will discuss Thursday
- Engagement with consumers
  - Demonstrate value, positive experience, protect trust
  - www.greenbuttondata.org
- Other DEWGs? PAPs?
- In general, what processes (if any) are needed for following and encouraging SGIP PAP output through steps into implementation? (not one size fits all approach)

Additional Slides

Links

- GREEN BUTTON INITIATIVE WEBSITES
  - Aneesh Chopra on Green Button Initiative: http://youtu.be/NRZoSz0EwBU
  - http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/GreenButtonInitiative
  - http://www.greenbuttondata.org/
- NIST SGIP PAP10
  - http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PAP10EnergyUsagetoEMS
- NAESB REQ21 ESPI, REQ18/WEQ19 PAP10 EUI
  - http://www.naesb.org/espi_task_force.asp
  - http://www.naesb.org/smart_grid_PAP10.asp
- EnergyOS
  - Web Site: http://www.openespi.org
  - Repository: https://github.com/energyos/OpenESPI
  - Mail List: energyos_espi@googlegroups.com
- UCAIug OpenADE:
  - http://osgug.ucaiug.org/sgsystems/OpenADE/default.aspx

Evolution of Interoperability For EUI



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Steps Towards Green Button

Milestones

EISA 4Q2007

NIST Three Phase Plan 2Q2009

NAESB PAP10 EUI 4Q2010

Policy Framework for the 21st Century Grid 2Q2011

NAESB ESPI 4Q2011

Green Button Initiative 4Q2011

- NIST given "primary responsibility to coordinate development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems."
- NIST established Smart Grid Interoperability Panel (SGIP) and Priority Action Plans including PAP10 for standard Energy Usage Information (EUI)
- NAESB Completed REQ18/WEQ19 PAP10 EUI in October 2010
- From Policy Framework: “Key Action 8. Building on recent efforts, state policymakers should continue to consider how to develop policies and strategies to ensure that consumers receive timely access to, and have control over, machine-readable information about their energy consumption in a standard format.”
- NAESB Completed REQ21 ESPI in September 2011, ratified October 2011
- U.S. Chief Technology Officer Aneesh Chopra challenged utilities across the country to develop a “Green Button”—detailed customer usage information available for download in a simple, common format.
- CA IOUs collaborate on SGIP PAP10 NAESB EUI + ESPI Implementation of Green Button

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