

*Analysis of U.S. Residential Water
Heater Stakeholder System and
Decision Making Process*

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Background

- Every year between 7-8 million water heaters are replaced (8% of US homes) (DOE)
- Another 1-2 million water heaters are installed in new homes (DOE)
- With an average service life of 10-15 years (NEEA), water heater retrofits provide an opportunity for enormous economic and environmental savings

Unintended consequences?

- Mechanisms such as policy mandates, education campaigns and product trials may help adoption of “green technologies” – not all are equally effective
- What about unintended consequences?
 - Low flow fixtures
 - Insulation

Leverage Points

- Places within a complex system where a minor change can create significant changes in other parts of the system (ripple effect)
- In this context, a system is a set of elements forming a whole, with a net behavior different or greater than the sum of parts

Who is the target for information?

- Our research team was tasked with the development of a decision support tool (DST) to promote more effective water heater system design
- Proposed target was homeowners
- Exploring the information around water heating revealed that homeowners may not be the best leverage point

Theoretical Foundations

- Decision Theory
- Agency Theory
- Diffusion of Innovation Theory

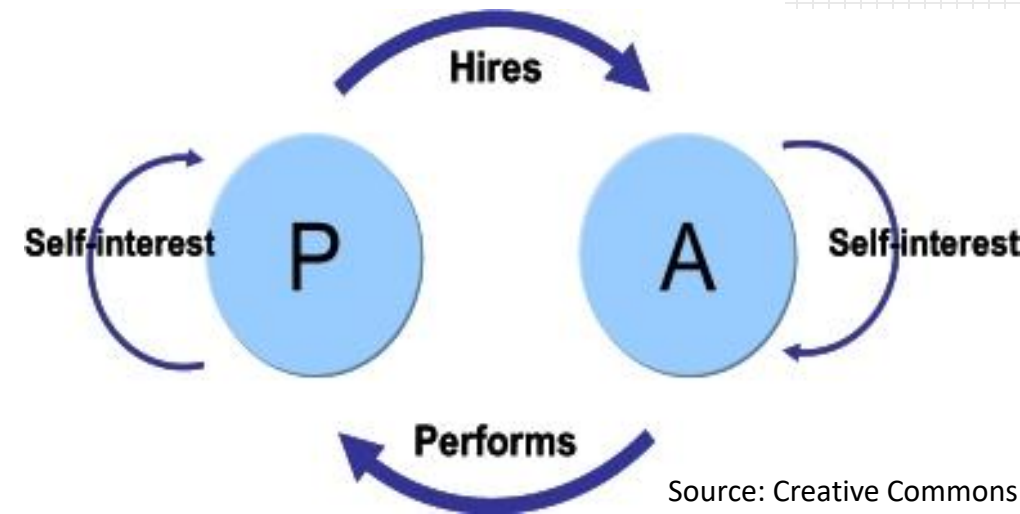
Decision Theory

- Provides insights into naturalistic decision behavior of stakeholders
- Provides models for decision useful to predict decision-making on a larger scale
- Early work characterized decision makers as rational actors (Simon 1959)
- Subsequent work in the past decades provided insights into ways in which actual decisions may differ from the rational bounds (Tversky & Kahneman 1981)



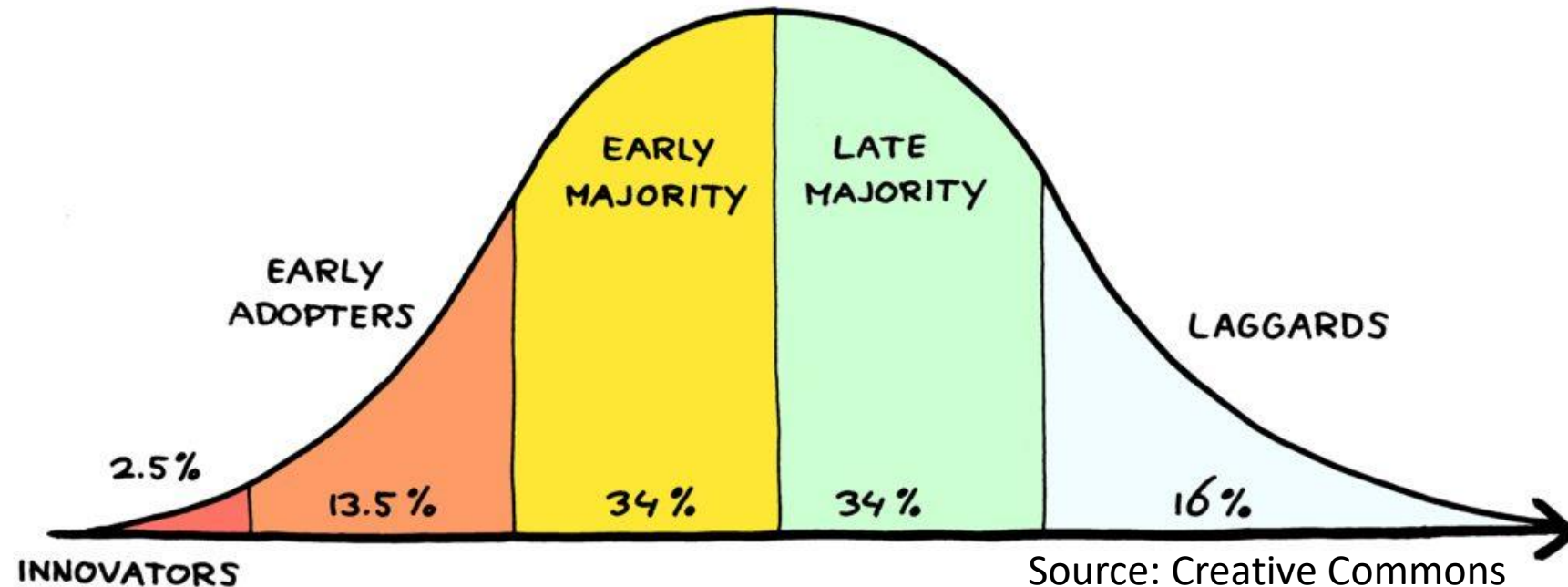
Agency Theory

- Helps understand cases where decisions are made by agents acting on behalf of homeowners – plumbers, contractors
- Explains what happens when agents and principals have differing goals and attitudes towards risk
- Provides a basis to understand how stakeholders with asymmetric levels of knowledge can interact in the built environment



Diffusion of Innovation Theory

- Explains how a technology may go from prototype to widespread adoption
- Which characteristics allow for adoption acceleration





Objective

To analyze the US residential water heater stakeholder system to identify leverage points to focus efforts to influence selection of sustainable technology

Research Approach

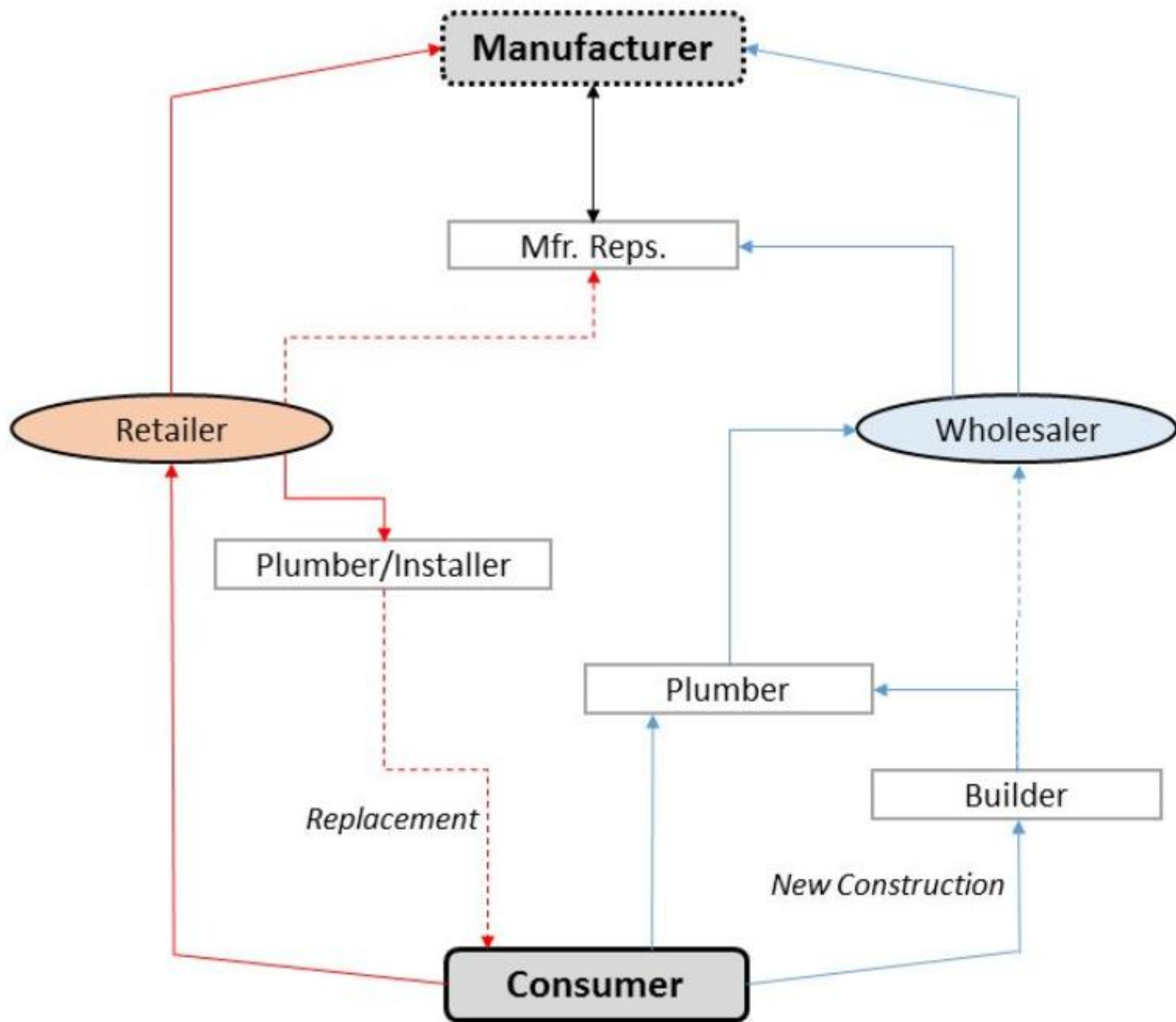
1: Identify Key Stakeholders

2: Map interactions among stakeholders

3: Identify decisions, roles, and influences

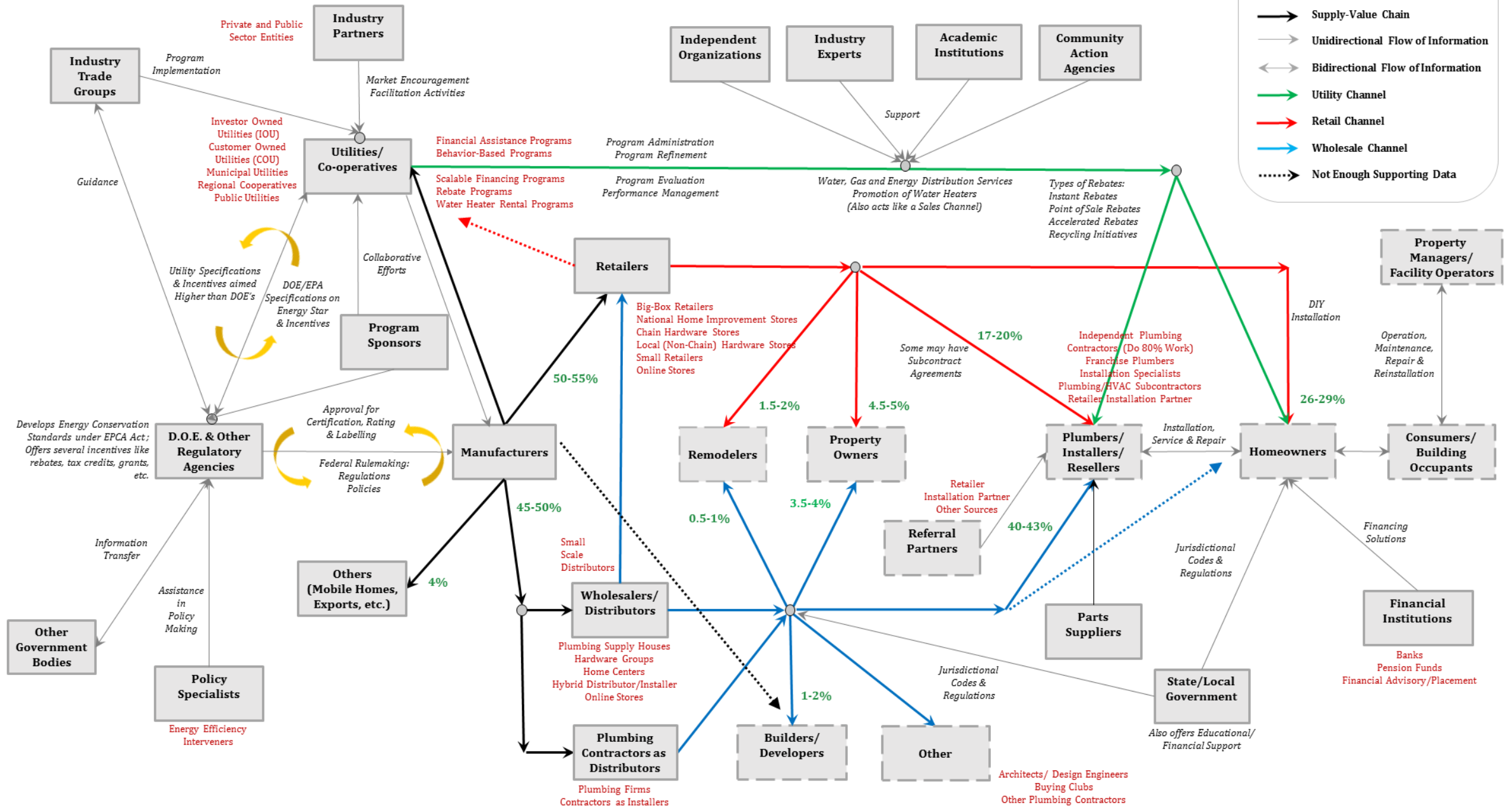
4: Inventory Potential Interventions

5: Prioritize Interventions



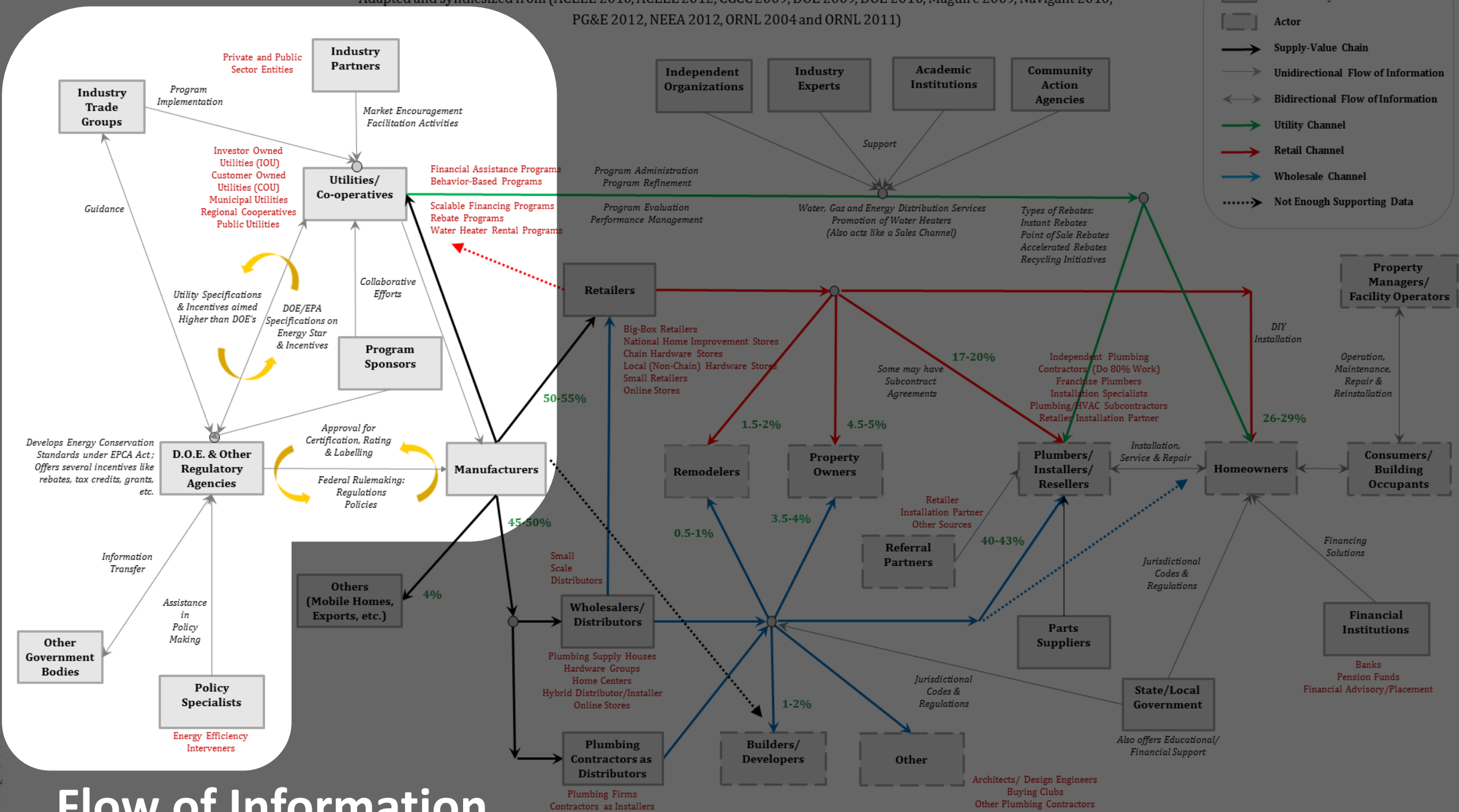
U. S. Residential Water Heater Market Supply-Chain and Stakeholder System

Adapted and synthesized from (ACEEE 2010, ACEEE 2012, CGCC 2009, DOE 2009, DOE 2010, Maguire 2009, Navigant 2010, PG&E 2012, NEEA 2012, ORNL 2004 and ORNL 2011)



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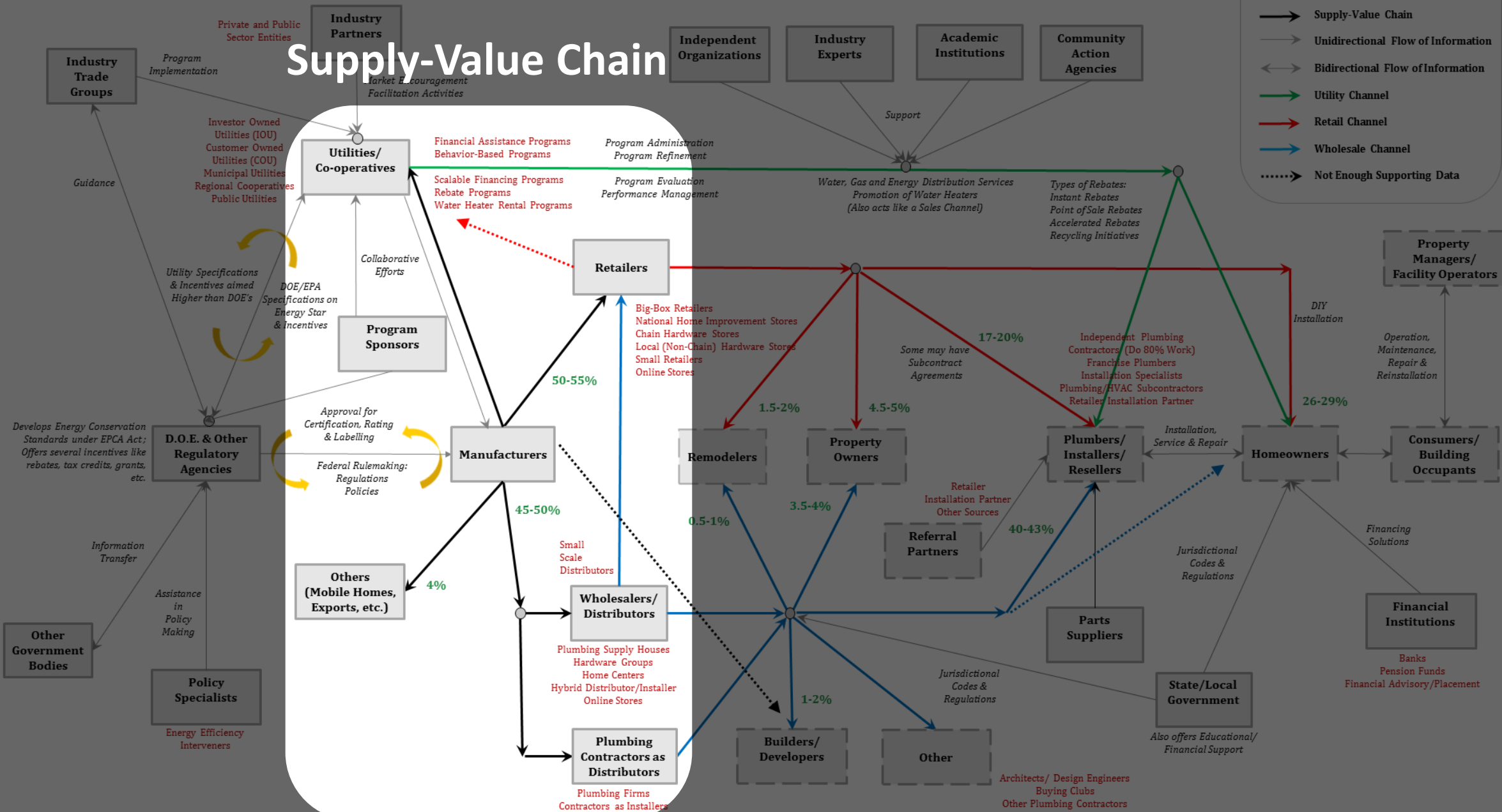


Flow of Information

U. S. Residential Water Heater Market Supply-Chain and Stakeholder System

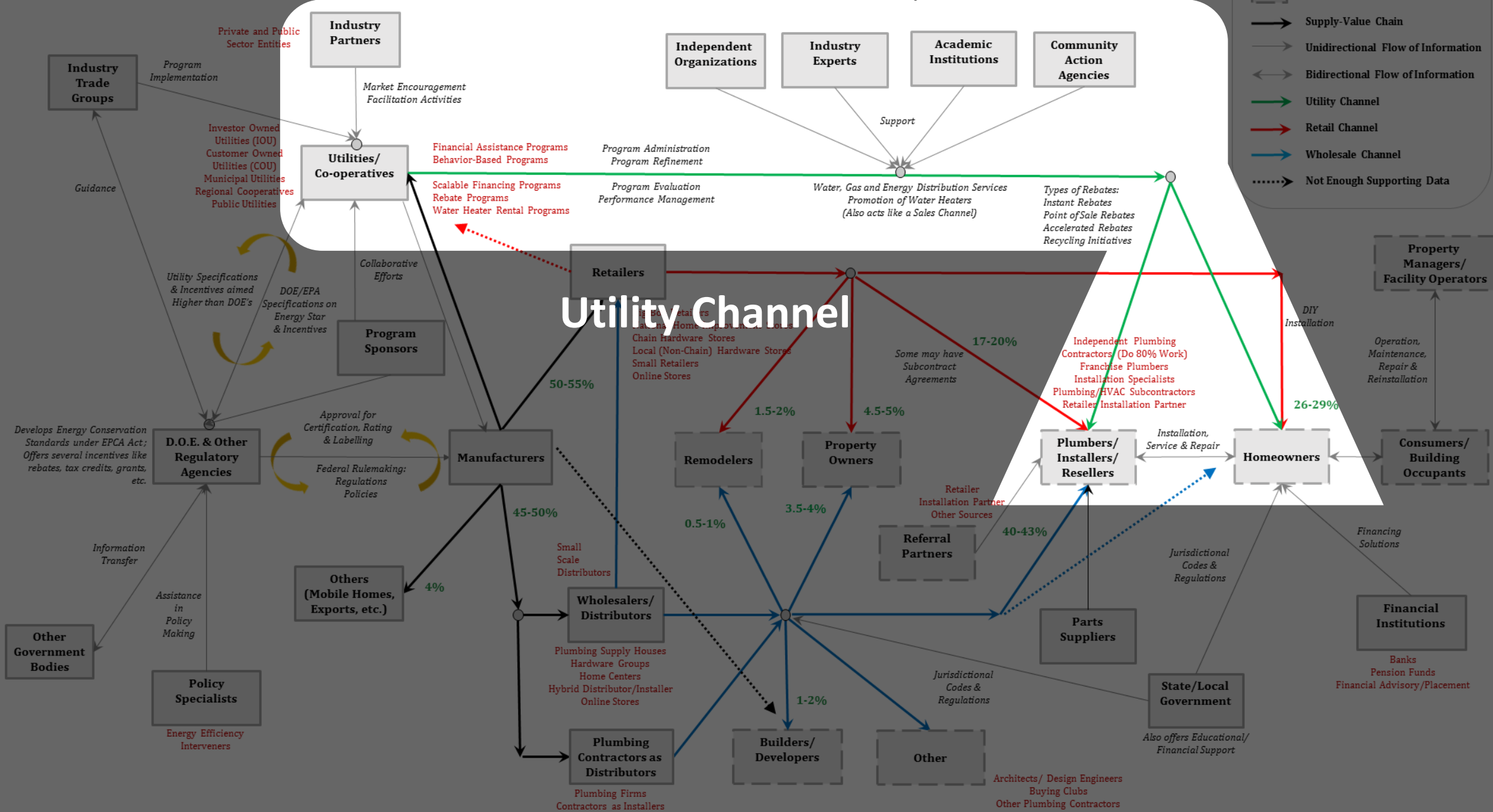
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Supply-Value Chain



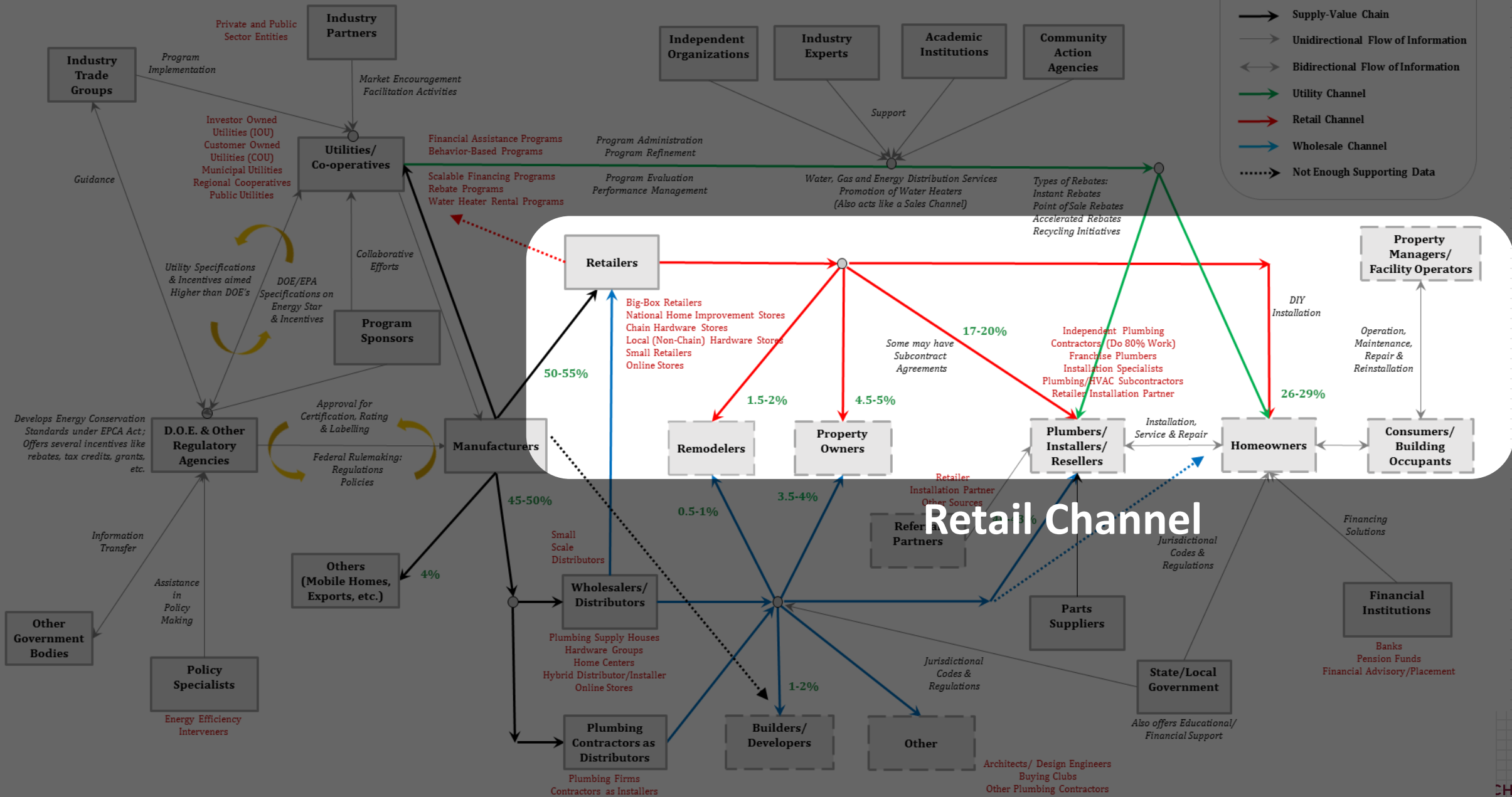
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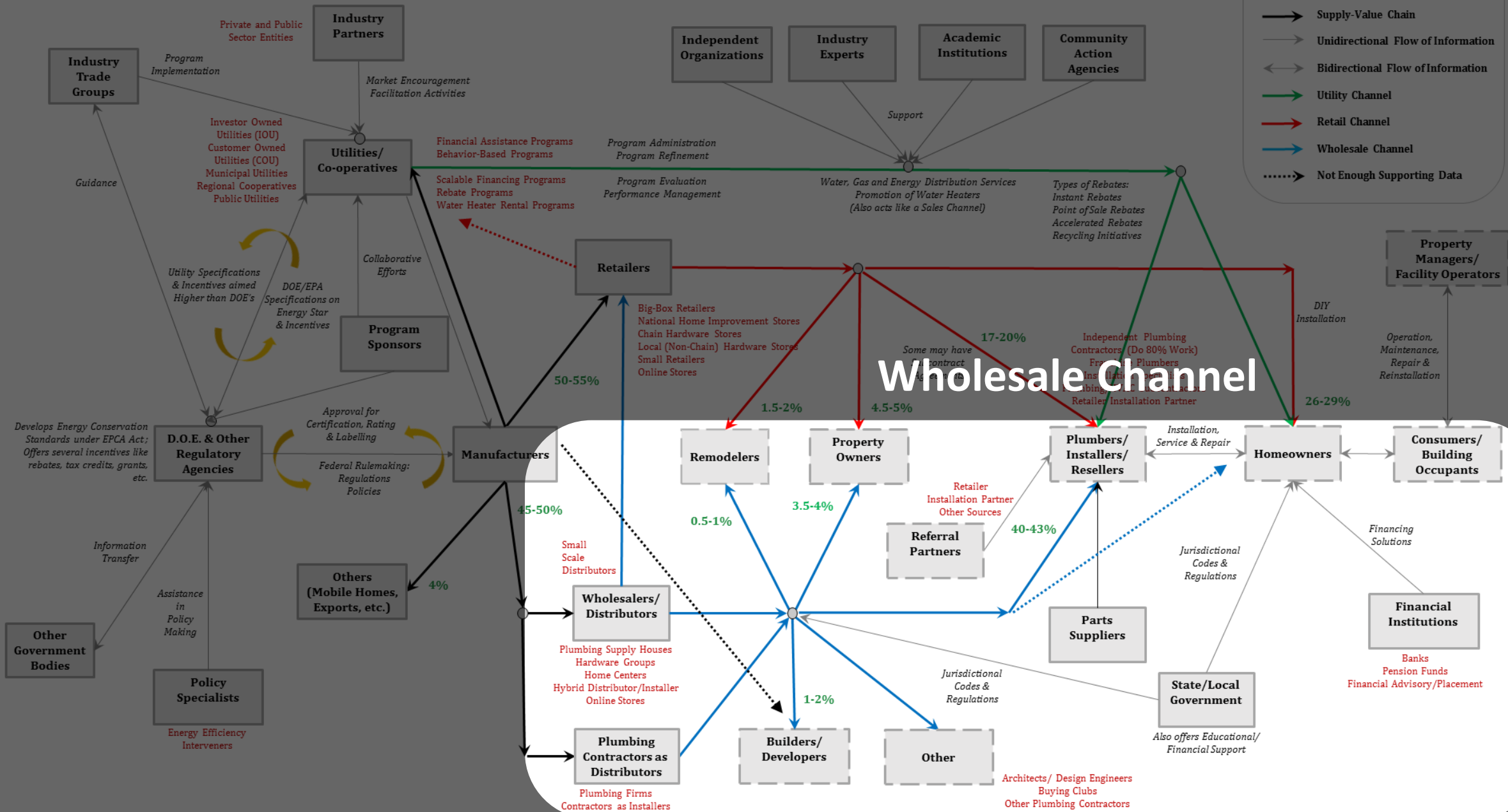
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Decisionmaking

- Water heater sales: 18% for new construction and 82% for replacement
- New construction selection done by contractors, with preference to products which are familiar and are easy to install
- Retrofits may be done due to:
 - Unit failure – emergency (39%)
 - Poor performance (26%)
 - Homeowner planned replacement (35%)

Tangible Benefits?

- Skepticism surrounding energy efficiency, although efficiency ratings are significant selling points (NEEA)
- Consumers not willing to pay the modest premium for efficiency
- Advanced water heating technologies such as tankless may be purchased more due to the tangible amenities – short wait times, lower space requirements etc.

Market Barriers

- Cost: capital, O&M, regulation driven
- Public awareness
- Insufficient installation and maintenance infrastructure
- Limited availability of newer products
- Limited interest in advanced water heating technology
- High proportion of emergency replacements
- Complicated code requirements
- Plumber/installer adoption reluctance
- High fuel prices
- Confusion about technology
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Leverage Points

- Plumbers/Installers
- Retailers
- Manufacturers
- Regulators
- Homeowners

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Thank You!



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