IEPPEC International Energy Policy & Programme Evaluation Conference

Bringing Order to Chaos: Developing a Comprehensive Framework for Understanding Barriers

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ABSTRACT

Energy plans and climate mitigation strategies generally include goals to increase energy efficiency and list interventions and policy tools to do so. These interventions are directed at removing barriers to energy efficiency. However, there is little consensus on the framework for discussing and measuring barriers, and little analysis about whether interventions actually address the relevant barriers needed to foster energy efficiency. It often appears that the barriers are constructed by the researcher for each situation, resulting in a hodge-podge of terms and definitions. Systematic, theory-based, primary research on barriers to energy efficiency is scarce.

Reducing barriers to a limited number that can be applied to a wide variety of applications sets the stage for improving our understanding of barriers and how to handle them under a range of circumstances. The Theory of No Change (TONC), presented in a 2011 research paper, was developed to address these issues. TONC arose from an extensive review of barrier research and provides a framework to cluster and sort barriers to the adoption of energy-efficiency measures and practices.

This paper sets out to improve the practical application of the TONC by presenting primary research carried out independently in Germany and the US. This research allows us to test the Theory of No Change (TONC) and analyze the barriers to energy efficiency. The barriers identified in this primary research were compared to the barrier framework of the TONC. This exercise showed the barriers suggested by the TONC were suitable for ordering the findings into categories and also proved helpful in designing the research questions to identify barriers. The primary research also suggests adapting some aspects of the theory. The exercise proved to be helpful to put order into a jumble of barriers mentioned by stakeholders and makes the task of suggesting remedies and improvements to project intervention strategies more effective.

Introduction

"Barriers" is a broad term that can be interpreted in numerous ways. While a discussion of barriers is a common element in logic models for efficiency interventions, these lists of barriers often seem to be based on a "I know it when I see it" approach involving a long list of specific barriers for particular applications and market actors. There is little consensus on the framework for discussing and measuring barriers, and little analysis about whether interventions actually address the relevant barriers needed to foster energy efficiency. Systematic, particularly theory-based, primary research on barriers to energy efficiency is scarce.

To be useful, barrier analysis requires an operational understanding of which barriers affect different types of market actors. To draw more general conclusions, e.g., comparing the effectiveness of various policy schemes, it is necessary to use the same understanding of barriers across multiple analyses. This calls for a general classification of barriers, i.e., a tool that helps understand and draw comparisons between cases, and limits the degree of subjectivity which is prevalent in barrier analysis.

Reducing barriers to a limited number that can be applied to be wide variety of applications sets the stage for improving our understanding of barriers and how to handle them under a range of circumstances. Evaluators in Europe and the United States have independently developed a similar structure for barrier analysis and conducted validation of this structure through primary research. This recent research supports the framework proposed in the Theory of No Change (TONC), originally presented in a 2011 research paper. TONC provides a framework to cluster and sort barriers to the adoption of energy efficiency measures and practices over a range of market actors.

This paper describes the Theory of No Change (TONC) and recent research that validates the barriers framework conceptualized in the TONC.[1] Defining a limited number of barriers that are applicable to multiple market actors is necessary to develop a structure that is flexible and useful for a variety of interventions. Assessing the barriers for multiple market actors gives researchers the ability to identify the underlying problem and to formulate remedies more easily.

The following sections cover a description of the TONC, the validation methodology, validation results and conclusions.

Theory of No Change

A classical logic model or theory of change requires tracing intervention steps of a project, assuming each step will lead, unhindered, to the next. At the beginning of a project, known problems to an energy-efficiency intervention are addressed and a strategy to solve the problems is presented. For example, a program identifies the lack of cost-efficiency and the lack of skills by craftsmen as a problem and introduces a subsidy program and training courses for installers.

If the program fails, the program logic might be discarded as faulty without further ado. But without going beyond the assumptions and logics that underlie the program design, it is often hard to understand why an intervention might not have delivered the intended results.

While the term “success factor” is all too common, what is often lacking is a systematic analysis of failure. Classical theory of change explains causal linkages and assumptions, but an alternative approach is to investigate why causal linkages are broken, or why causal mechanisms cannot (yet) work. The simple question behind this approach is, “Why doesn’t it work?” The TONC was designed to identify a set of common barriers that can explain failures and to compare their effect across different projects.

Barriers to energy efficiency occur at all market levels and are experienced by end users, vendors of efficient products, financiers, and policy makers. While the underlying set of barriers may be similar, market actors have different perceptions, explanations, and use different language to discuss them. Most stakeholders are not researchers, and their perspectives on barriers can be contradictory and sometimes even erroneous. Many times in the course of a project, stakeholders identify a highly specific barrier, e.g., “We didn’t have a good sales person,” even though the underlying barrier is more likely to be the lack of expertise of the customer who needs an effective salesperson to understand the advantages of the energy-efficient technology.

The Theory of No Change provides a framework for defining and understanding barriers for a range of market actors. A meta-evaluation for the Climate-Eval Community of Practice of the Global

[1] Wörlen & Rieseberg (2015), Wörlen (2013), Wörlen (2011 a, b, c)

Environment Facility (GEF) Evaluation Office led to the formulation of a framework of barriers to market changes that prevent the installation of energy-efficiency measures. A case study of ten evaluations on energy-efficiency projects, policies, and programs in Thailand led to the identification of four groups of market actors that are crucial for carrying out energy efficiency projects: users of energy, suppliers of energy-using equipment, financiers, and policy makers. The thesis was these actors experience a limited set of very similar barriers, preventing an intervention. The application of the TONC in two meta-analyses (Wörlen, 2011 and Wörlen, 2013) led to the development of a list of six generic types of barriers: lack of motivation or interest, lack of awareness, lack of access to the "better" technology, lack of technical expertise, lack of affordability and lack of cost effectiveness. As shown in Figure 1, the Theory of No Change postulates that market actors can experience some or all of these barriers which prevents energy-efficiency measures.

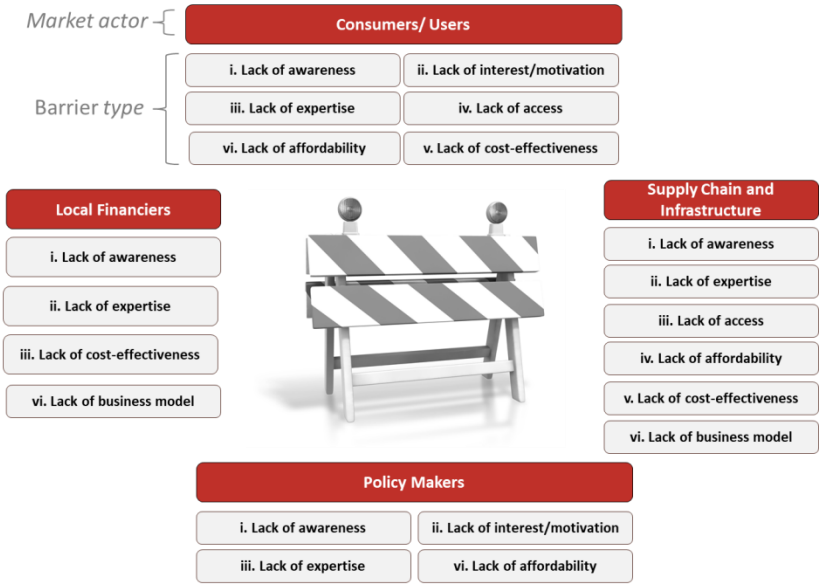

Figure 1: Barriers according to the Theory of No Change. *Source:* Wörlen & Rieseberg (2015)

Validation Methodology

This approach to defining barriers was tested independently in the United States and in Germany. While the TONC covers four groups of market actors (end users, supply chain, financiers, and policy makers), the validation efforts covered in this paper focus on end users and the supply chain for housing measures.

Barrier research was conducted for several research projects in Germany. The research in Germany covered optimization of heating systems, including low cost measures, such as the installation of automatic thermostats, the replacement of inefficient heat pumps, and water-pressure regulation in boilers. Primary research collection included the following:

1. Interviews with a wide range of stakeholders (23),
2. Focus groups with household consumers (25 participants),
3. Interviews with chimney cleaners (10),
4. Interviews with craftsmen (8), and
5. Literature research.[2]

[2] U.a. Wohnen im Eigentum (2017), VZ Rheinland Pfalz (2015), VZ Rheinland Pfalz (2016)

The answers were coded and grouped so the fit with the TONC could be tested.

In the United States, research into barriers was conducted for two residential programs: a home-performance program and an upstream heating and water heating program. The home-performance program features a comprehensive energy assessment conducted by a contractor and incentives for installing specific energy-efficiency upgrades, including insulation, blower door-assisted air sealing, heating system replacement, water heater replacement, and efficient lighting. Three separate surveys of participating homeowners were conducted with different approaches to investigating barriers:

1. an open-ended question asking what prevented the respondent from installing energy-efficiency measures earlier (over 1,200 responses)
2. a limited number of cognitive interviews to explore how respondents think about barriers (13 responses)

The surveys were conducted by phone and the cognitive interviews were approximately half an hour; most respondents stayed engaged and were interested in talking about energy-efficiency upgrades. In aggregate, these three survey approaches provide a view of barriers from the homeowners' perspective.

The upstream program involved paying incentives to distributors. Contractors who received the incentive were required to clearly identify the incentive on the invoice provided to the homeowner. Evaluated measures included efficient furnaces, boilers, boiler-circulating pumps, and heat pump water heaters. For the upstream program, cognitive interviews and full surveys were conducted for homeowners (330 completed surveys), contractors (54), and distributors (30). The cognitive interviews were exploratory in nature and the full surveys included structured questions with an option to enter a custom response. Table 1 summarizes the programs evaluated and the validation activities.

Table 1: Summary of Barrier Research in the example programs in Germany and the US

Topic	Barrier Research in Germany	Barrier Research in the US
Programs	Low costs measures to optimize heating systems	1) Residential comprehensive home-performance program 2) Upstream heating system and water heater rebates
Measures	Automatic thermostats, replacement of inefficient heat pumps, regulation of warm water flow through the correct setting of valves and the boilers heating curve	1) Home Performance: insulation, air sealing, heating system replacement 2) Upstream: furnaces, boilers, boiler circulating pumps and heat pump water heaters
Research Tools	1) Stakeholder Interviews 2) User/Consumer Focus Groups	1) End user cognitive interviews, phone and Web surveys 2) Contractor and distributor cognitive interviews and Web surveys
Stakeholders Covered	Associations of craftsmen, real estate industry and municipalities, consumer advice centres, manufacturers of heat pumps, craftsmen, chimney sweeps	1) Home Performance: End users 2) Upstream: End users, contractors and distributors
Market Actor Groups	End users/consumers and supply chain	End users/consumers and supply chain

Validation Results

This section discusses the barriers for each stakeholder group and the findings from the validation efforts. Findings are presented by the stakeholder group, i.e., end users and supply chain. Each section begins with a description of the TONC barriers, followed by a discussion of the research and a summary of the findings.

End Users/Consumers

"End users" or "consumers" are the operators of the equipment using or converting energy, ultimately causing the GHG emissions. Climate mitigation means they change their behaviour and use energy more efficiently, or convert to non-GHG emitting fuels. Consumers and users of energy typically encounter several barriers to behaving in a more climate-friendly way.

1) Lack of awareness: Users do not know they are using a lot of energy, or they know they do not know there are alternatives to their behaviour. The users are not aware of more energy-efficient products/technologies / behaviours.
1) Lack of interest/motivation: Users do not mind they consume a lot of energy, or have high energy costs, or the sustainable alternative is unattractive for another reason, e.g. perceived as too risky, not comfortable in operation, or simply not fashionable.
2) Lack of expertise: Users know alternative products/technologies/behaviour, but do not have the right level of technical expertise to own or operate the equipment.
3) Lack of access: The technological alternative might not be available to users.
4) Lack of cost-effectiveness: The alternative behaviour would be more expensive than the emitting behaviour, so a change of behaviour would not be cost-effective.
5) Lack of affordability: It might be cost-effective to change behaviour or use a different technology, but the users might still not be able to afford the initial investment, including but not limited to, a situation where the cash flow structure or interest rates are unfavourable.

The relative importance a specific barrier varies according to the type of energy-efficiency investment and, according to the market, legal and even social structure of the investment. For example, the research focus in Germany was low-cost heating system optimization. Accordingly, lack of affordability was not a major barrier. In comparison, the evaluated programs in the US consisted of major measures, such as insulation and heating system replacement, and affordability was identified as a major issue. In addition, the cognitive interviews conducted in the US suggest homeowners have different responses to specific measures. Homeowners who installed comprehensive efficiency upgrades tended to be actively engaged and wanted to discuss how they made the decision, whereas homeowners with an upstream rebate did not engage with the interview process to the same extent.

Discussion of Consumer Barriers

This research suggests that stakeholders and homeowners identify a limited number of barriers preventing residential end users from moving forward with energy-efficiency upgrades. In the open-ended survey question for the US home performance program, the most commonly identified barrier was money-related, which encompassed both the upfront costs and the cost-effectiveness of the measure (lack of affordability and lack of cost-effectiveness). A small number of respondents (less than 5%) identified finding a contractor (lack of access) and time constraints as barriers to installation. While some respondents defined additional barriers to installation, these custom responses tended to fall into the "personal" category, i.e., barriers that cannot necessarily be overcome through program

intervention. For example, a number of respondents mentioned changes in circumstances, including work changes, recently moving into the home, or a receiving a financial windfall.

One of the key findings from the US cognitive interviews was the importance of the phrasing of the question. Previous research for the same program did not identify lack of information or expertise as a barrier. (NMR 2012) The initial barrier question was open-ended in both the larger scale and the cognitive surveys, and the result was the same: many of the respondents simply stated money was a barrier, without giving the question any further reflection. When the cognitive survey was modified to provide more structure and detailed probing, a barrier was defined as having difficulty "figuring out what to install." When this choice was added, lack of information was identified as a primary barrier in the cognitive interviews and also in subsequent, larger scale surveys. In the upstream program, the four most commonly cited barriers were paying the premium for the high-efficiency equipment (lack of affordability), finding a contractor they could trust (lack of access), equipment concerns, and lack of information (lack of expertise).

The study in Germany indicated that distinguishing between lack of awareness and lack of interest was difficult, because "lack of awareness," particularly among private households, was often interpreted by the stakeholders as a "lack of interest." Since information is widely available and accessible in Germany, end users could easily acquire the knowledge they lacked. As the US studies only surveyed participants, it was not possible to measure awareness.

One barrier identified through this research did not fit neatly into the TONC barrier categories. "Lack of time/Low priority" was identified as a barrier in both the European and US research. The US surveys indicate a small segment of the respondents clearly identified lack of time as a barrier. "Lack of time/priority" may serve as an excuse for "Lack of interest". On the other hand, heads of households may actually experience time constraints, having to prioritize claims on their time. Time constraints may also affect other stakeholders, such as real estate managers in the professional industry, as well as municipalities who are confronted with a severe renovation backlog and many new construction projects.

For energy-efficiency work in municipalities, stakeholders pointed out bureaucratic and hierarchical decision-making structures prevented facility managers from carrying out simple energy-efficiency measures needing authorization to carry out.

Summary of End User/Consumer Findings

Some of the key findings are listed below.

1. Open-ended questions suggest users identify a small number of barriers
2. The phrasing of the question is important for obtaining accurate results, e.g., "figuring out what to install" generated many more responses than "lack of information"
3. Perceptions of "lack of awareness" and "lack of interest" are overlapping and may be difficult to separate
4. A few respondents mentioned "lack of time" as a barrier; this response could be synonymous with "lack of interest" or that energy efficiency is not a high priority

The research findings by TONC barrier are compiled in Table 2.

Table 2: Summary of End User Findings by TONC Barrier

TONC Barrier	Research in Germany	Research in the US
(1) Lack of Awareness	Interviewees described end users to be often unaware of the cost-saving potentials and efficient alternatives	Not researched; only participating homeowners were interviewed
(2) Lack of interest	1) Interviewees described users as having no interest in dealing with their heating system beyond securing its functionality 2) Stakeholders speculated that neither cost-savings nor the environmental impact was considered to be of importance to end users	1) In the home performance program, participating homeowners were engaged in the process 2) In the upstream program, homeowners were much less engaged in selecting heating systems
(3) Lack of expertise	Users are not able to fully understand how their heating systems function and which options are available to them, they heavily rely on suggestions from heating installers	"Figuring out what to install" is a barrier for many homeowners and many users tended to rely on the contractor
(4) Lack of access	Skilled workers were not proactively offering measures to the end users; those investors looking for contractors did not identify "finding a contractor" as a major barrier	A small minority of respondents identified "finding a contractor" as a barrier
(5) Lack of cost-effectiveness	Cost-savings were viewed as an important motivation to carry out energy-efficiency upgrades. 1) Cost-effectiveness was described as a problem for hydraulic balancing and large pumps. Other heating optimization measures are usually cost-effective. 2) Cost-effectiveness is more complicated in rental properties, as investors may not directly see the savings.	1) In the full surveys, lack of cost-effectiveness was combined with lack of affordability. In combination, this "money-related" barrier was a commonly cited barrier in all of the end user surveys. 2) The open-ended survey also indicated users see cost-effectiveness and affordability as separate barriers.
(6) Lack of affordability	Affordability or solvency was not perceived as an issue for these low-cost interventions, except for specific vulnerable user groups, such as pensioners.	See above.

Supply chain

The supply chain consists of all the organizations providing the hardware and the services for operation and maintenance of the sustainable-energy technology. The supply chain is typically a multi-layered structure, from the manufacturer to the installer. In all cases, it includes at least the distributors and installers, or retailers, of a technology and usually also a service or operation/maintenance structure.

If there is sufficiently large demand from consumers/users of a technology or service, the providers are assumed to try to build up a supply chain that delivers this (sustainable) technology or service. Lack of interest is hardly a barrier, as supply chain members are standing in competition with each other and are assumed to look for new business opportunities. However, even if the supply chain would "like" to serve a particular demand, it might encounter its own set of barriers:

1) Lack of awareness: They are not aware there is an alternative solution; they might underestimate the market or the technology (ignorance).
2) Lack of expertise: They know the alternative, but do not know how to provide it.
3) Lack of access: They know the alternative, but it might not be available to them, for example, because it has to be imported or intermediary products are not available.
4) Lack of affordability: They might not have sufficient working capital to add, providing this alternative as another line of business.
5) Lack of cost-effectiveness: They might focus more on other products that are more profitable.
6) Lack of demand: There might not be a market for this product yet (lack of demand).

If market development is not driven by demand, but by another force (e.g. policy), most of these barriers will still apply for the supply chain.

In the case of low-cost energy-efficiency measures to optimize heating systems in Germany, the supply chain mostly consists of skilled labourers, like heating-installation specialists and plumbers. In the US, the supply chain consisted of contractors and distributors.

Discussion of Supply Chain Barriers

The responses regarding "lack of expertise" highlight some of the issues with barrier research and the importance of gathering responses from different stakeholders. German stakeholders felt the craftspeople needed additional training to carry out the complex adjustments necessary to adjust hydraulic water flow and craftsmen themselves agreed *some* of their colleagues might lack training and skills.

In the US cognitive surveys of contractors, the contractors were highly confident of their own knowledge of efficient equipment, and thus, the "lack of expertise" barrier was not included in the full surveys. However, there are indications from other parts of the evaluation that additional training in specific areas could improve installation practices. For example, the impact component of the evaluation found a small minority of condensing boilers were not operating correctly, which could be addressed through additional training.

"Lack of access" was identified as a barrier in the US study, but not in Germany. This difference may be explained by specific technologies covered in the two areas. The supply of hardware, such as pumps or even software programmes for carrying out calculations, was not perceived as a barrier in the German case. In the US case, a significant share of the contractors and distributors mentioned lack of high-efficiency equipment and obtaining replacement parts as a barrier.

"Lack of cost-effectiveness" was identified as a major problem in the Germany case. In an economic situation of a construction boom, with many house owners installing new heating systems and remodeling their houses, craftsmen are frequently booked months in advance and have little interest in acquiring additional business. In the US, lower profit margin for energy-efficient equipment was listed as a barrier by a minority of distributors and contractors.

"Lack of demand" can be seen as the cascading result of barriers at numerous levels and was readily identified by the supply chain respondents on both sides of the Atlantic. The lack of customer awareness and interest was consistently listed as a reason for the lack of demand. In the research in Germany, stakeholders' and customer's understanding of the sector was one of a traditionally passive consumer and a proactive supply chain promoting energy efficiency. The blame for a lack of energy-

efficiency work carried out was put on heating installers not offering and fostering demand, creating a "tit-for-tat" as to who was to blame for a situation.

Another point of view, similar to the end users, was the "lack of time" barrier, which is not explicitly included in the TONC. Chimney cleaners said they would take more time to explain to household users how their heating system worked and how they have to maintain and optimize it regularly, but they lacked the time to sufficiently explain it to the customers at the premise.

Summary of Supply Chain Findings

In aggregate, these findings suggest the market actors may not always have a complete and accurate picture of their own barriers and drawing information from other sources can provide a more comprehensive view. The research findings are compiled by TONC barrier in Table 3.

Table 3: Summary of Supply Chain Findings by TONC Barrier

TONC Barrier	Research in Germany	Research in the US
(1) Lack of Awareness	Not mentioned	Not mentioned
(2) Lack of expertise	Interviewees frequently mentioned the lack of skills by craftsmen to carry out hydraulic balancing. It was described as tedious, complex, and generally unpopular among craftsmen.	1) Contractors and distributors seemed to feel they are quite knowledgeable about efficient equipment. 2) Other evaluation findings suggest there is opportunity for additional training.
(3) Lack of access	Not mentioned	Availability of high-efficiency equipment was listed as a barrier by a minority of contractors and distributors. Some contractors mentioned issues with obtaining replacement parts.
(4) Lack of cost-effectiveness	Heating installers and plumbers were described as having no interest in offering work with low-profit margins, particularly during a construction boom.	Lower profit margin for energy-efficient equipment was listed as a barrier by a minority of distributors and contractors.
(5) Lack of affordability	Not mentioned (low-cost measures)	The extra cost of the high-efficiency equipment was the most common barrier to selling more units cited by both contractors and distributors.
(6) Lack of demand	Stakeholders identified a lack of demand from the consumer side due to a lack of awareness.	Lack of demand was identified as a major barrier by both contractors and distributors.

Conclusions

Increasing the adoption of energy efficiency and sustainable technologies requires overcoming the barriers facing customers, supply chain actors, and other market actors. Accordingly, logic models for energy-efficiency interventions frequently include a discussion of the barriers. However, research into barriers and comparing results across interventions is hampered by the lack of a consistent and straightforward system for categorizing barriers.

The TONC provides this categorization and lays out the conceptual framework for understanding barriers across multiple market actors. The TONC structure has the potential to be used for a number of purposes, such as designing interventions to overcome barriers, providing a structure for the discussion of barriers in logic models, testing the links between the intervention and the barriers, and measuring the success of an intervention in overcoming the barriers.

This paper presents primary research used to test whether the underlying construct of the TONC reflects the reality of the decision-making process for customers and supply chain actors. The primary research used a combination of open-ended and coded questions and provided insights into possible omissions or inadequate definitions in the TONC list of barriers.

The research suggests the TONC framework holds up well as a flexible framework to interpret and measure barriers, as summarized in Table 4. This process identified two areas where the TONC structure may need adjustment:

- There is a fine line between "lack of awareness" and "lack of interest" by end users and it may not be possible to distinguish between them
- Hierarchical decision-making structures in municipalities and possibly businesses create barriers that may require an additional barrier category

In addition, the importance of specific barriers often depends on the situation, type of energy-efficiency measure, market and legal structure, as well as social and cultural contexts.

Table 4: Summary of Consumer and Supply Chain TONC Barriers

TONC Barrier	Consumer	Supply Chain
Lack of Awareness	These two barriers could be merged and "time constraints/low priority" could be added to the definition.	Not mentioned; this barrier may be more applicable to emerging technologies
Lack of Interest		N/A; supply chain is already engaged.
Lack of expertise	Major barrier identified in both research activities.	Market actors are likely to assume they are highly knowledgeable; however, additional training may still be needed or useful.
Lack of access	Limited availability of skilled workers can create a barrier; "finding a contractor" was a barrier.	Availability of high-efficiency equipment and replacement parts are potential barriers.
Lack of cost-effectiveness	Many consumers were concerned about whether the efficiency measures were worthwhile and would pay for themselves.	Lower profit margin for energy-efficient equipment was listed as a barrier by distributors and contractors.
Lack of affordability	Consumers identified upfront costs as a major barrier.	The extra cost of the high-efficiency equipment was the most common barrier to selling more units, as cited by both contractors and distributors.
Lack of demand	N/A	Lack of demand was identified as a major barrier by both contractors and distributors.

There are two main conclusions drawn from the barrier research in the two countries:

1) Understanding the decision-making process and language used by the market actors is critical to interpreting their responses and understanding their barriers. Identification of barriers was

affected by the assessment methods and who was asked what. For example, describing the "lack of expertise" barrier as "finding it difficult to figure out what to install" resulted in a substantially higher selection of this barrier, which was missed in previous research.

2) The market actors do not necessarily have a full understanding of their own actions in the context of the market. For example, the research in Germany revealed a "circle of blame": the providers say "there is no demand because customers are not interested/ are unaware" while the customers claim ignorance ("I cannot ask for it; nobody told me about it"). In both countries, we found craftsmen and contractors were likely to overstate their own level of expertise and other sources of information were needed to assess the importance of this barrier.

These findings highlight the importance of investigating barriers among multiple market actors and supplementing direct surveys with other evaluation techniques.

Future research may be designed to investigate the barriers for financiers and policy makers, as well as to investigate the interactions among market actors. Other areas of exploration include applying the TONC to the design of interventions and logic models, using the TONC as a structure for testing, and measuring the success of interventions in overcoming barriers.

The alignment of the barriers with the theory, as well as the parallels in the barrier structure between the US and Germany was quite significant and supports the usefulness of the TONC. While the TONC structure is similar across the market actors, the definitions of the TONC barriers vary slightly to reflect the perspective of the market actor. The TONC is a framework flexible enough to be adjusted to the respective analytical, evaluative, and project design purposes, at the same time providing a common language across energy-efficiency measures and barrier situations.

References

ERS. 2016. (ERS 2016A) ERS. 2016. Home Performance with ENERGY STAR® (PY2010-2013) Impact Evaluation: Volume 4 Green Jobs – Green New York Audit-Only Savings." Prepared for The New York State Energy Research and Development Authority. Principal Investigator: West Hill Energy and Computing, Inc.

ERS. 2016. (ERS 2016B) "Home Performance with Energy Star: Unregulated Fuels Impact Evaluation (2011-2013)." Prepared for The New York State Energy Research and Development Authority. Principal Investigator: West Hill Energy and Computing, Inc. November. Appendix E: Survey Results Memo.

NMR Group. 2012. "Process Evaluation and Market Characterization and Assessment, Green Jobs – Green New York Residential Program Final Report." Prepared for NYSERDA. Project Number #9835 [Process Evaluation] Project Number #9875 [MCA]. September.

Parlin, K, Fagan, J., Vushe, R. "Breaking Down Barriers: An Alternative Method to Measure Program Influence," 2016 Amsterdam Conference, Amsterdam, Netherlands: International Energy Policy and Programme Evaluation Conference, June, 2016.

Wörlen & Rieseberg (2015) The theory of no change. EAI Speciale I-2015 Transition and global challenges towards low carbon societies.

Wörlen (2013) The Theory of No Change. Evaluation Connections. European Evaluation Society. The EES Newsletter Articles - News - Events. September 2013

Wörlen (2011a): Wörlen, Christine. 2011. Meta-Evaluation of Climate Mitigation Evaluations. Climate Change Evaluation Community of Practice c/o GEF Evaluation Office, Washington D.C.

Wörlen (2011b): Wörlen, Christine. 2011. Meta-Evaluation of Climate Mitigation

Evaluations - Case Study: Transforming Markets for Energy Efficient Products in Thailand. Climate Change Evaluation Community of Practice c/o GEF Evaluation Office, Washington D.C.

Wörlen (2011c): Wörlen, Christine. 2011. Meta-Evaluation of Climate Mitigation

Evaluations - Case Study: Poland´s Heating Sector. Climate Change Evaluation Community of Practice c/o GEF Evaluation Office, Washington D.C.

Wohnen im Eigentum (2017) Auswertung der ersten bundesweiten Befragung der WOHNUNGSEIGENTÜMER Zum Thema Gebäudesanierung. Instandsetzen, modernisieren, sanieren: Wie hält Ihre Weg das Gebäude in Schuss?, VZ Rheinland Pfalz (2016) Verständlichkeit der Energielabel für Heizkessel und Warmwasserbereiter und des Effizienzlabels für Heizungsaltanlagen

VZ Rheinland Pfalz (2015) Elke Dünnhoff, Herrmann Obermeyer, Alexandra Palm (2015) Heizungspumpen in privat genutzten Wohngebäuden – Ergebnisse einer repräsentativen Verbraucherbefragung zu Heizungspumpen bundesweit und in Rheinland-Pfalz.