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From awareness to action: energy literacy and household energy use

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Agenda

INTRODUCTION

METHODOLOGY

RESULTS

CONCLUSIONS

Energy systems are changing

- Increasing demand for electricity, supply increasingly unreliable
- Change of paradigm → needs adaptation from technological and human side

Energy Literacy

What is energy literacy?

”Energy literacy is a broad term encompassing content **knowledge** as well as a citizenship understanding of energy that includes **affective and behavioral aspects**” (DeWaters, & Powers, 2013)

“An **understanding of the nature and role of energy** in the world and daily lives accompanied by the **ability to apply** this understanding to answer questions and solve problems” (U.S. Department of Energy, 2017)

”An energy literate person can be someone who knows the **energy consumption of their domestic appliances**, knows with what **actions they can save energy in their home**, knows how to make **economic energy efficient decisions** or knows about the **relation between energy use and climate change**” (van den Broek, 2019)

Why is energy literacy relevant?

It has the potential to **change energy related behaviour** in many ways. It can result in:

- Improved demand side management
- Greater demand side flexibility
- Lower energy bills
- Reduced greenhouse gas emissions

What is the state of the art?

What are the gaps and how do we contribute

Previous literature reviews on energy literacy have focused on:

- What types of energy literacy exist[3]
- What are the determinants of energy literacy[4]

Many papers on **energy literacy and its impact on energy consumption**

Our contribution:

- **Review the literature** on the relation between energy literacy and energy consumption outcomes
- **Group these outcomes**, and associate them to energy literacy levels

Methodology

- Multidisciplinary (economics, psychology, education, engineering)
- **Integrative literature review**[5]: overview of the knowledge base on a topic, critique it, and create new theoretical knowledge
- Data sources: Google Scholar, Scopus, IAEE, IEEE, Semantic Scholar, Publish or Perish, Google
- Search string:

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("energy literacy" AND ("flexibility" OR "demand response" OR "demand
  side management" OR "energy efficiency" OR "energy consumption" OR
        "electricity bill" OR "emissions" OR "households"))
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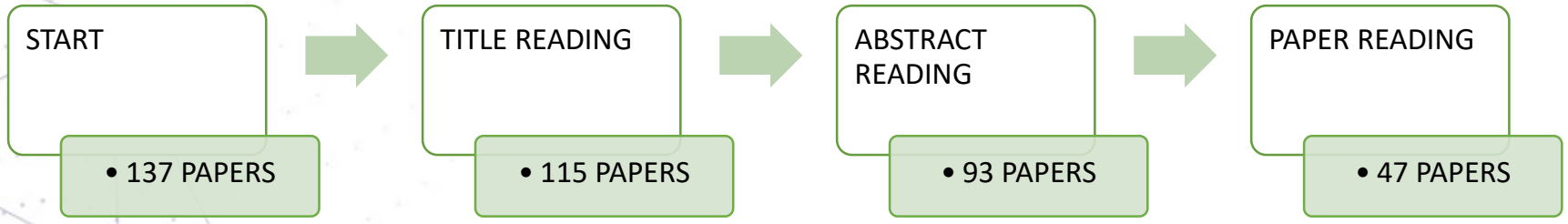
- Staged review



- **Inductive approach** to identify the groups of outcomes of energy literacy[3]

Group 1: Energy saving behaviours

ENERGY LITERACY LEVEL

- **Low**: Knowledge about their own energy usage (appliances and behaviour)

NUMBER OF PAPERS INCLUDED

16

LITERATURE OBSERVATIONS

- It is hard to estimate the different energy consumption that results from a change in lifestyle[6]
- A **higher literacy corresponds to an increase in energy saving behaviours**[7,8,9,10], but not every study confirms it[11]
- Access to **data on consumption** could lead to a reduction of consumption[12]
- **Other factors** are more influential of energy consumption: house characteristics, education levels, income, household size, and electricity prices[13]

CONCLUSIONS

- Energy literacy shows mostly positive correlation with the adoption of energy-saving behaviours
- Increasing the energy efficiency of the household, has a much higher impact[14]

Group 2: Investment in efficiency improvements

ENERGY LITERACY LEVEL

- **Moderate**: low level skills + energy related financial literacy: energy cost-specific knowledge + financial literacy[15]

NUMBER OF PAPERS INCLUDED

21

LITERATURE OBSERVATIONS

Higher levels of energy literacy lead to:

- Perform **cost minimization** when buying appliances[16, 17]
- Buy efficient and durable **appliances**[18, 19, 20]
- Adopt **new** energy technologies[21]
- Isolate and **retrofit** own house[22, 23]

For some studies, energy literacy is **not relevant**, but financial literacy and cognitive abilities yes[24, 25, 26]

CONCLUSIONS

- Energy literacy plays a role in empowering people to make informed decisions and invest in energy efficiency.
- The recent developments in the energy field require new behavioural changes and the adoption of new technologies

Group 3: Flexibility provision

ENERGY LITERACY LEVEL

High: low and moderate levels skills + understanding new energy concepts (including electricity tariffs) and actively managing home energy usage

NUMBER OF PAPERS INCLUDED

9

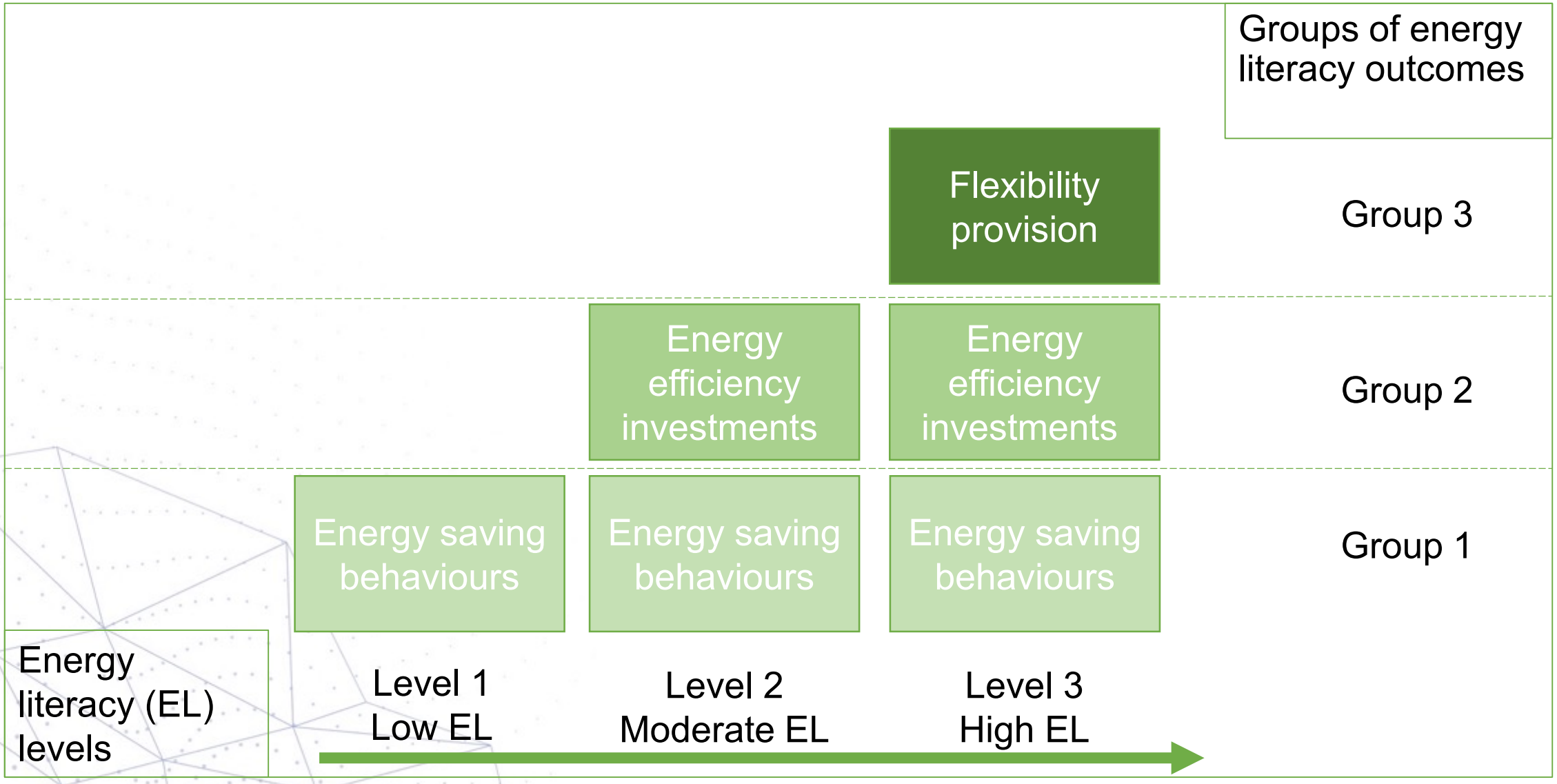
LITERATURE OBSERVATIONS

- Energy literacy has a role in the understanding and adoption of **dynamic tariffs**[27]
- Consumers are more willing to adopt a **dynamic tariff** if they are familiar with it or have already experienced it[28]
- The difficulties in understanding the contracts, combined with risk aversion is one of the reasons why customers do not participate in **real time pricing schemes**[29]
- The lack of energy literacy is a barrier to the **shifting of routine activities**, since consumers underestimate the energy consumption of daily activities[30]
- Higher familiarity with smart grid technology has a positive influence on the willing to **change energy use behaviours**[31]

CONCLUSIONS

- Energy literacy could improve acceptance of dynamic tariffs and provision of flexibility
- Scarce literature on the topic but high potential
- Educating households is a relatively inexpensive tool to achieve a change in energy use

To summarise: Outcomes and levels of energy literacy



Conclusions and research agenda

RESEARCH AGENDA

1. A standardised measurement of energy literacy in households
2. The relation between energy literacy and the provision of flexibility

LIMITATIONS

- Absence of a measurement standard for energy literacy
- Publication bias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Thank you
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