

What are challenges and opportunities when using measured consumption (and indoor climate data) for compliance checks in EPBD context?

Peter Wouters

INIVE EEIG and BBRI



Overall context

- Nearly all countries use a calculation method to check compliance with EPBD
 - There are exceptions, e.g. Sweden uses real consumption data
- With progress of time and the move to NZEB buildings, important to evaluate calculation based approaches....
 - ... the methods themselves?
 - ... new developments, e.g. potential impact of BIM?
 - ... use of real energy consumption data?

QUALICHeCK project (2014-2017)



Compliance and quality of works for improved energy performance of buildings *Final publishable report*



February 2017

François Rémi Carrié (ICEE/INIVE)

With contributions and/or reviews from: François Durier (CETIAT, France), Hans Erhorn (Fraunhofer IBP, Germany), Helke Erhorn-Kluttig (Fraunhofer IBP, Germany), Susanne Geissler (OEGNB, Austria), Arnold Janssens (UGent, Belgium), Pär Johansson (Chalmers, Sweden), Theoni Karlessi (NKUA, Greece), Kalle Kuusk (TUT, Estonia), Jarek Kurnitski (TUT, Estonia), Marina Kyprianou-Dracou (CYI, Cyprus), José Molina (USE, Spain), Marianna Papaglastra (Sympraxis Team, Greece), Horia Petran (INCD URBAN-INCERC, Romania), Nikolaos Stathopoulos (ENTPE, France), Paula Wahlgren (Chalmers, Sweden), Eric Winnepenninckx (BBRI, Belgium), Peter Wouters (BBRI, Belgium)

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Source book for improved compliance of Energy Performance Certificates (EPCs) of buildings

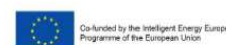


February 2017

**François Durier (CETIAT, France), Susanne Geissler (OEGNB, Austria),
Peter Wouters (BBRI, Belgium)**

With contributions from: Aleksandra Arcipowska (BPIE, Belgium), Samuel Caillou (BBRI, Belgium), François Rémi Carrié (ICEE, France), Maarten De Groot (BPIE, Belgium), Pär Johansson (Chalmers, Sweden), Theoni Karlessi (University of Athens, Greece), Marina Kyprianou-Dracou (CYI, Cyprus), José Molina (University of Seville, Spain), Eric Winnepenninckx (UEAic, Belgium)

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! Societal support !

Procedures to obtain and prove
compliant data

There should be clear procedures
what must be done

Robust legal procedures in case of
non-compliance

There should be clear legal procedures how
to decide on non-compliance and related actions

Handling of non-compliance in
practice

There should be an effective control
and sanctions if non-compliance



[HOME](#)→[Announcements](#)→**1st European conference | BIM and energy performance of buildings, 25 June 2018, Brussels,**

Belgium

Quick Access

- Introduction
- Status on the Ground
- Compliant and Easily Accessible EPC Input Data
- Quality of the Works
- Compliance Frameworks

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1st European conference | BIM and energy performance of buildings, 25 June 2018, Brussels, Belgium

Posted on 2018/04/04 by Alexander Deliyannis



1st European conference "BIM and energy performance of buildings"

25 June 2018, 9:00 – 17:00

Brussels – Auditorium Hadewijch

Brussels – June 25

Context for this presentation

A (governmental) requirement that the measured consumption of the building should be less than XX?



We also want to know your opinion...



Important that we receive it back!

- ✓ Please give it back when leaving the conference!
- ✓ We have registered the number of each unit on the registration list



How does it work?

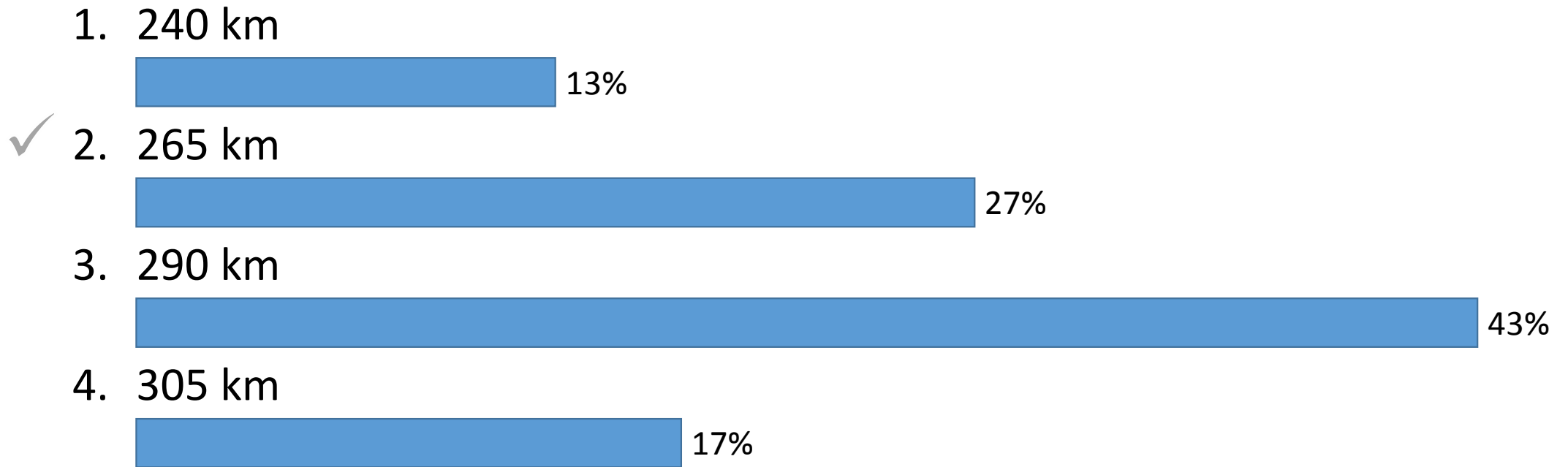
(questions with a single answer)

- ✓ Read question and corresponding answers.
- ✓ Each answer is identified by a number.
- ✓ Choose the most suitable answer.
- ✓ Simply press the corresponding number in your voting unit.



[Vote Now](#)

What is the distance by air from Brussels to Paris?



How does it work? (questions with multiple possible answers)

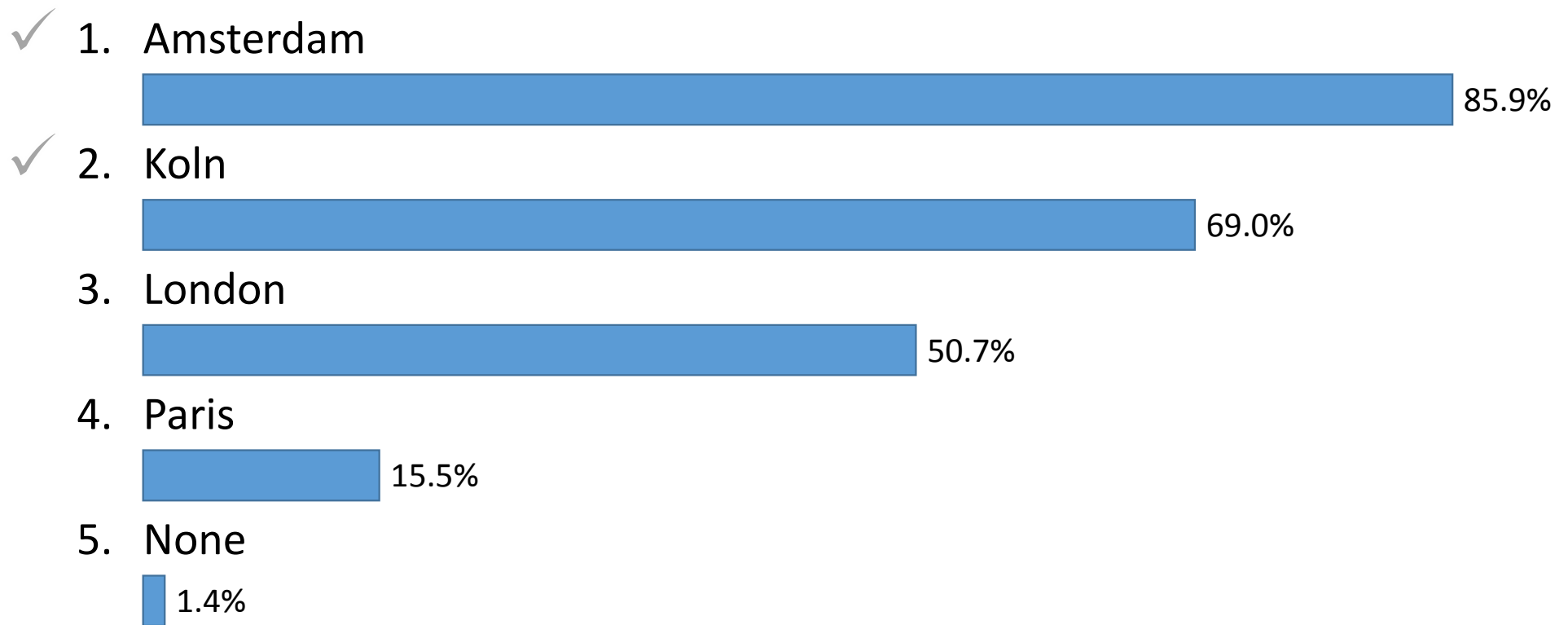
- ✓ Read question and corresponding
- ✓ Each answer is identified by a number
- ✓ Choose the most suitable answer
- ✓ Press the corresponding number unit, followed by 'send'.



Which of the following cities are within 250 km of Brussels (by air)?

Enter
Number(s)
and Press
Send

Vote for up to 4 choices



(% = Percentage of Voters)

Classical approach based on EPB calculation

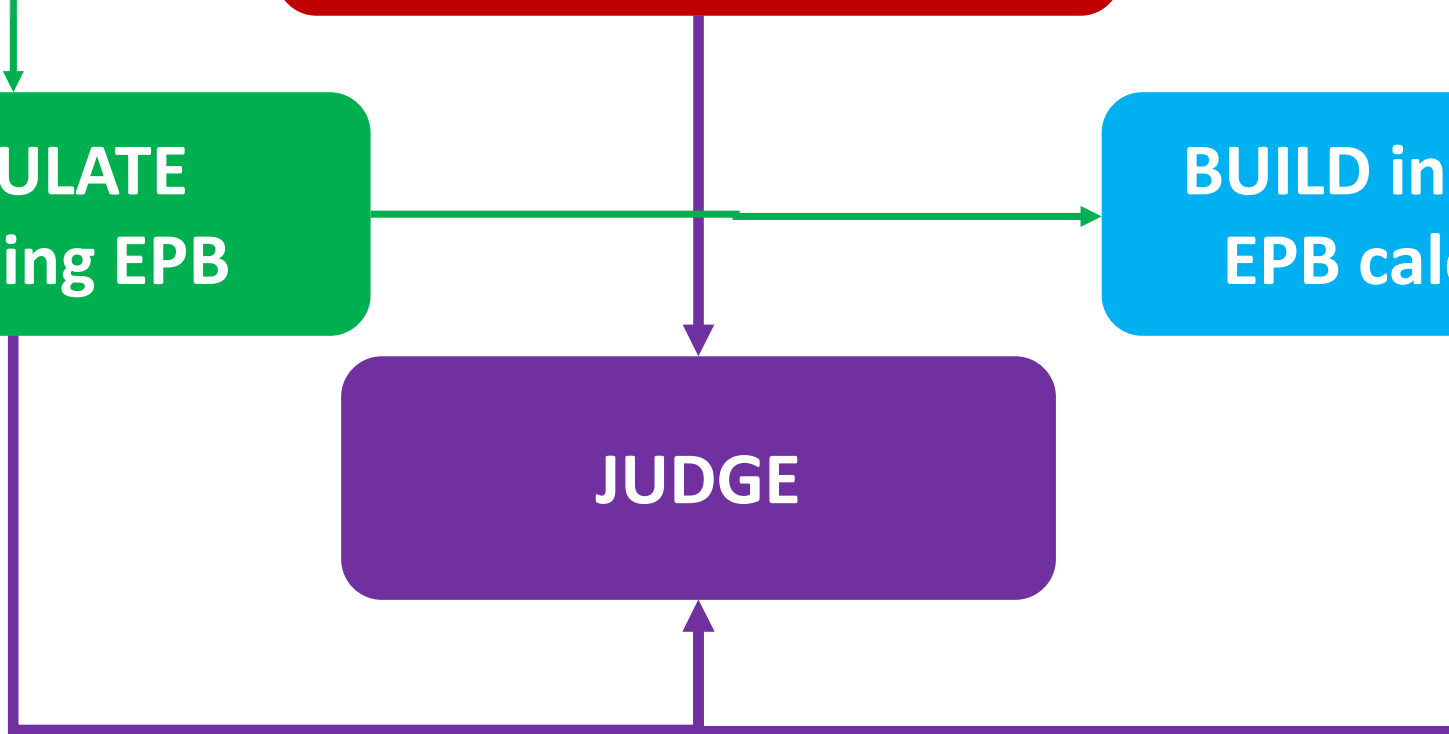


REQUIREMENT based on
calculation method

CALCULATE
according EPB

BUILD in line with
EPB calculation

JUDGE



What can we learn from the car
industry about the assessment of
energy consumption
and
CO₂ emissions?



Context...

- **General impression:**

- Standardised consumption or CO₂-emissions for cars is too optimistic...

- **Why?**

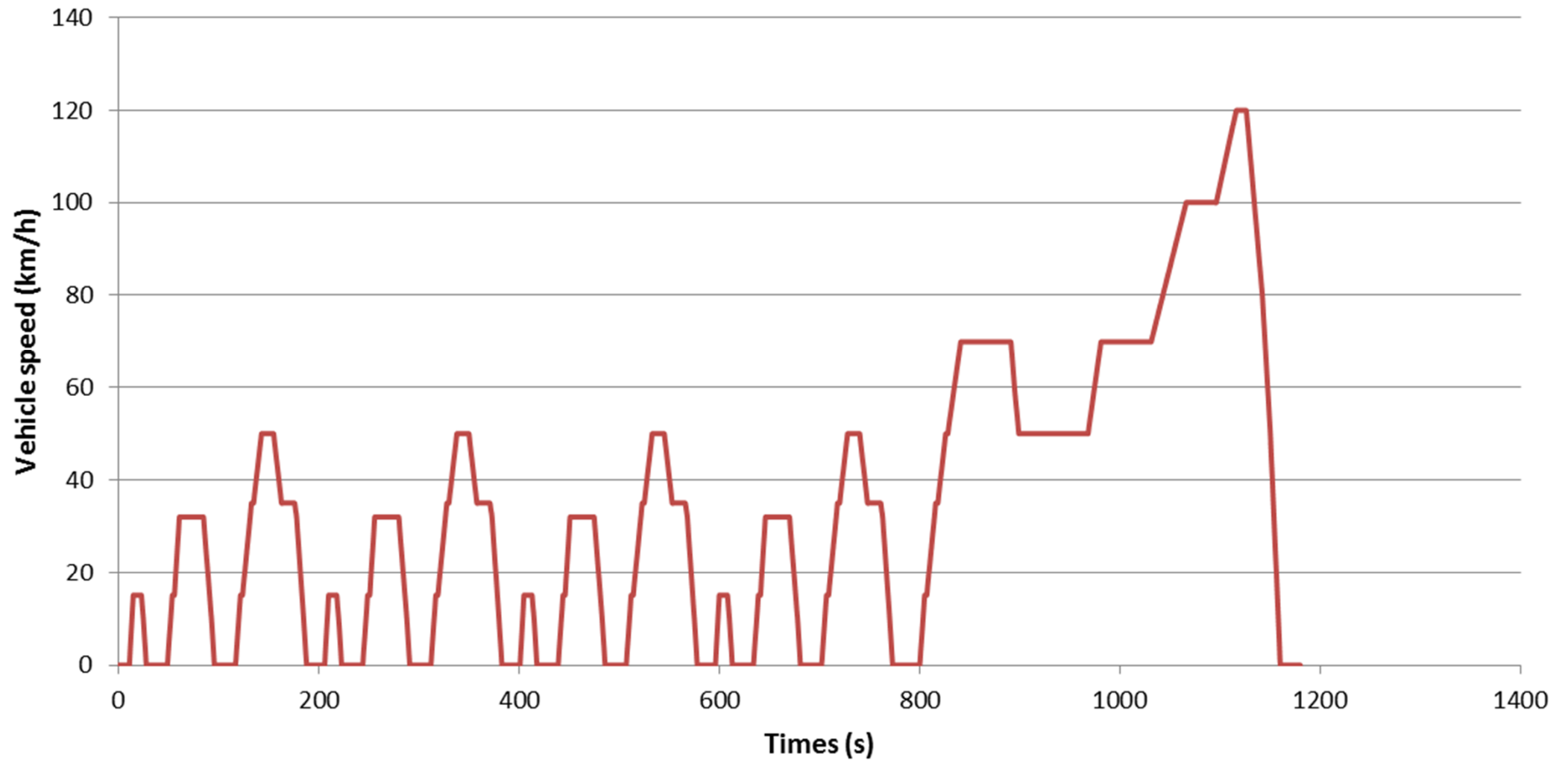
- ... the drivers are not energy efficient enough
- ... wrong testing procedure
- ... fraud
- ... ?



Cars and real consumption /CO₂ emissions

- Since 1997: CO₂ emissions determined according **NEDC protocol**
 - New European Driving Cycle protocol

NEDC



LESS WEIGHT
Removal of standard options =
- 110 kg
-1.6% **-4.4%**

SLOW acceleration/brakes
-1.4% **3.0%**

LOWER AIR RESISTANCE
Testing at 25...30 °C

SUPER OIL
More efficient engine
... but shorter lifetime

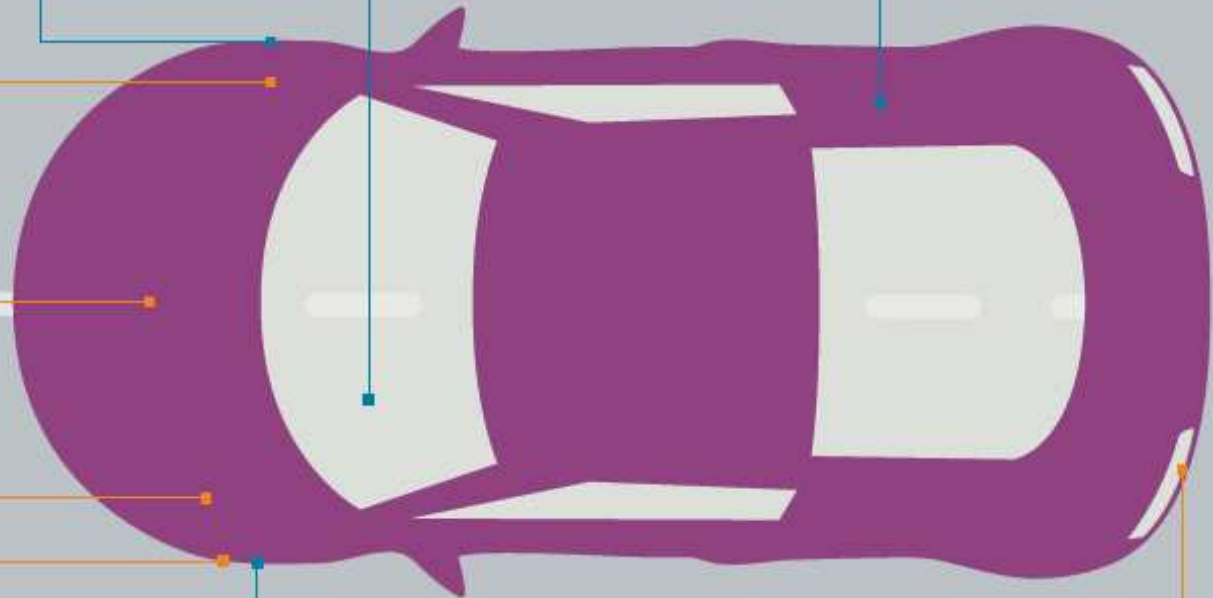
BATTERY NOT CONNECTED
Less energy consumption

TAPING
to reduce turbulence

LOOSER BRAKES
Less friction – less
consumption

HIGH TIRE PRESSURE
+50%
Less consumption
-2.9% **-1.8%**

**CORRECTION FOR
UNCERTAINTY**
-4%



Cars and real consumption /CO₂ emissions

- Since 1997: CO₂ emissions determined according **NEDC protocol**
 - New European Driving Cycle protocol
- Since 2017: **New protocol - WLTP**
 - *Worldwide harmonized Light vehicles Test Procedure*
 - *Should be closer to the reality, typically 20% higher than NEDC results*

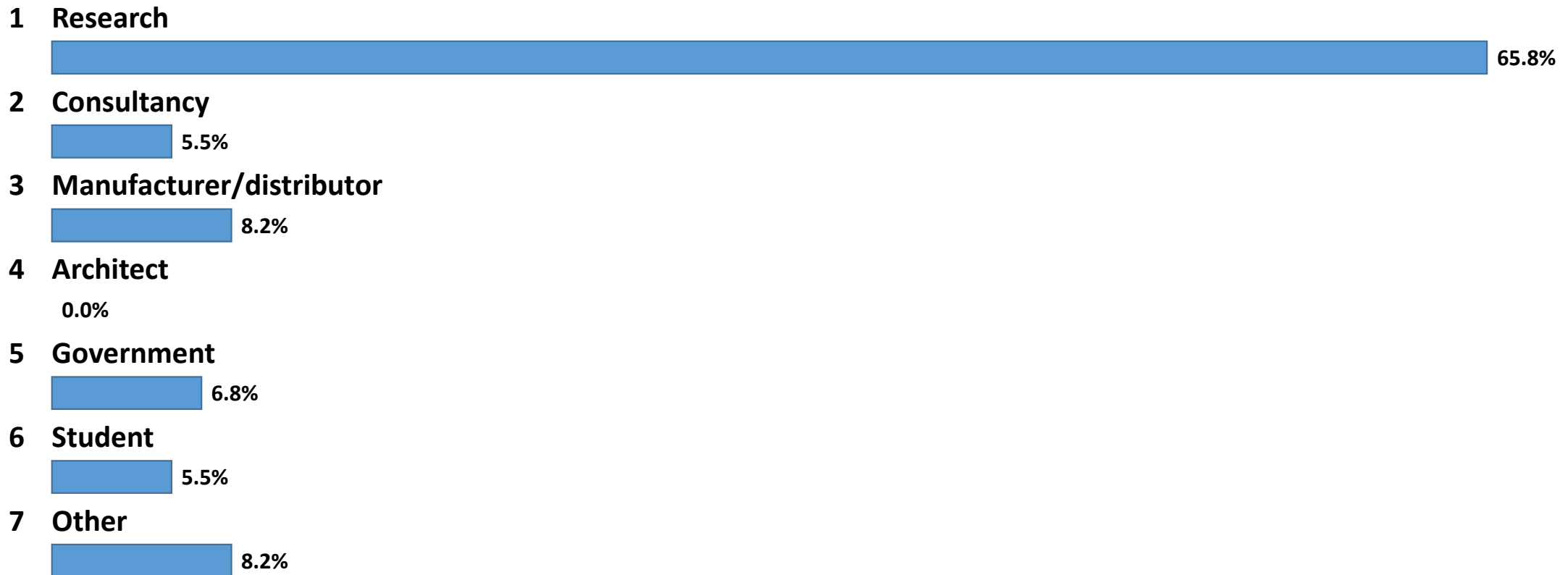
More info: <http://www.car-engineer.com/the-different-driving-cycles/>



**Legal requirement:
“Measured consumption less than XX”**

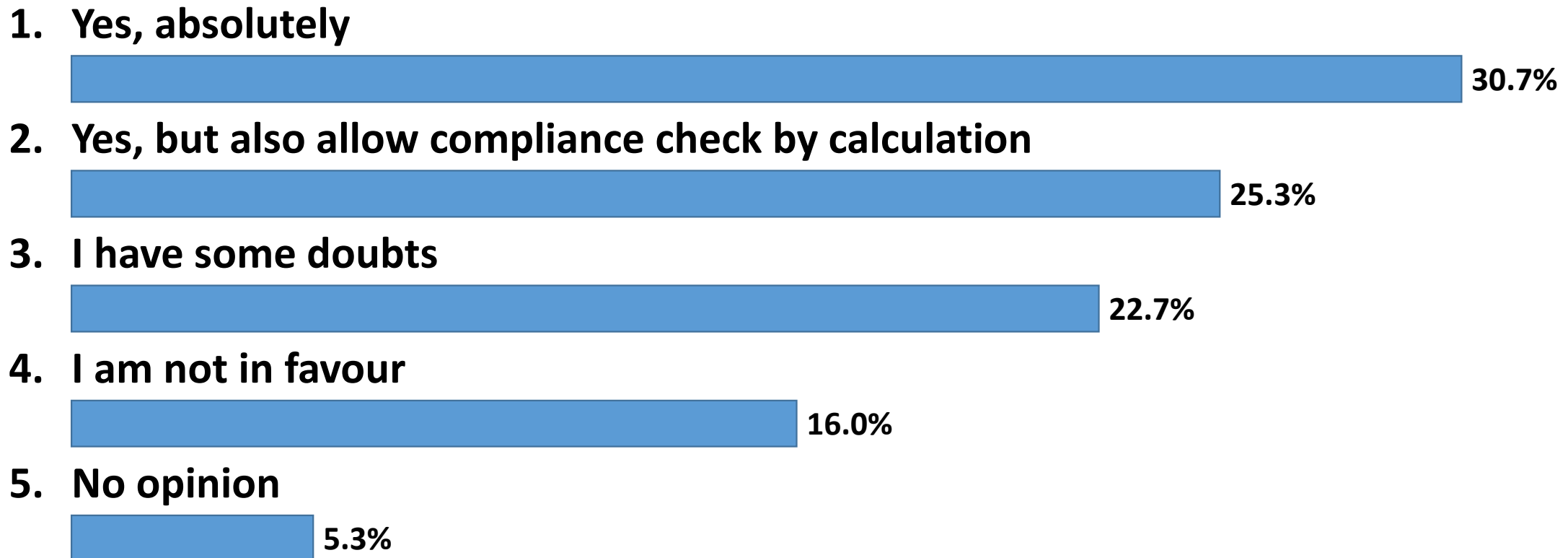
[Vote Now](#)

What is your professional activity?



[Vote Now](#)

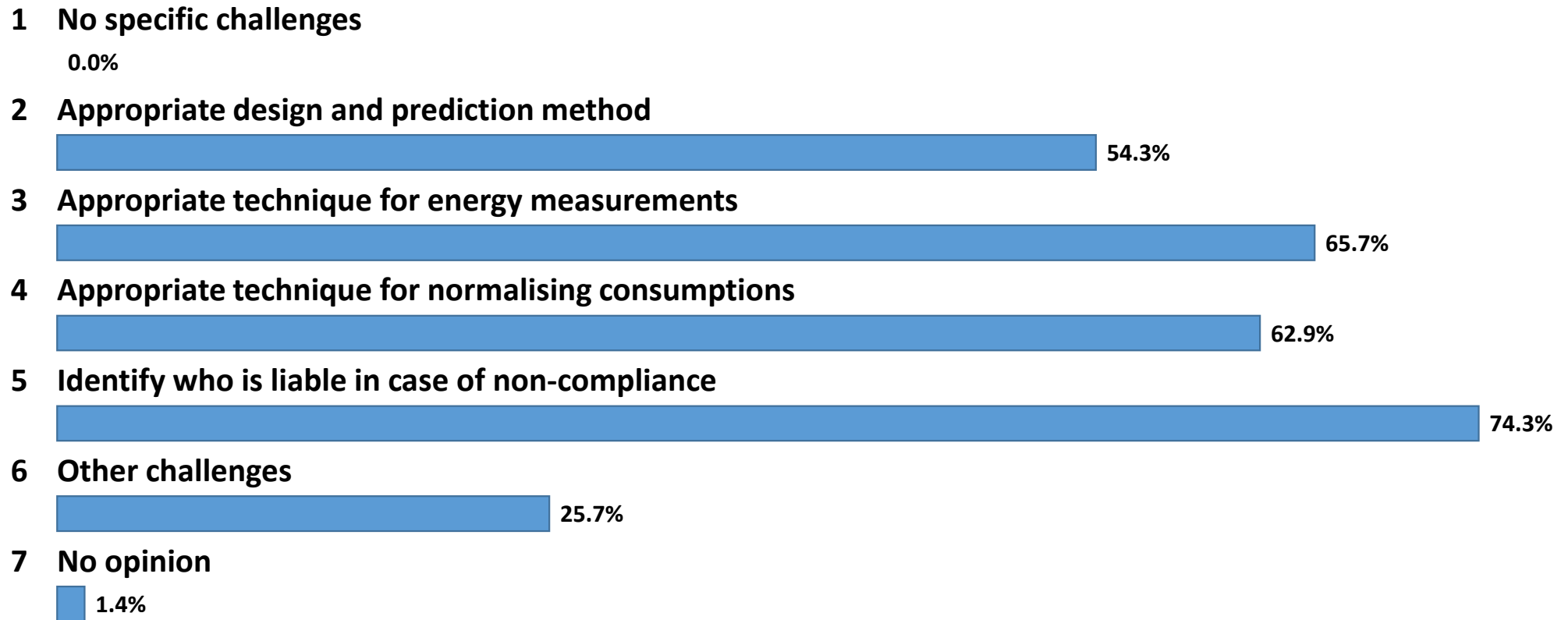
Are you in favour of an EPBD compliance framework based on real consumption?



Which challenges do you see when you have to deal with real consumption requirements?

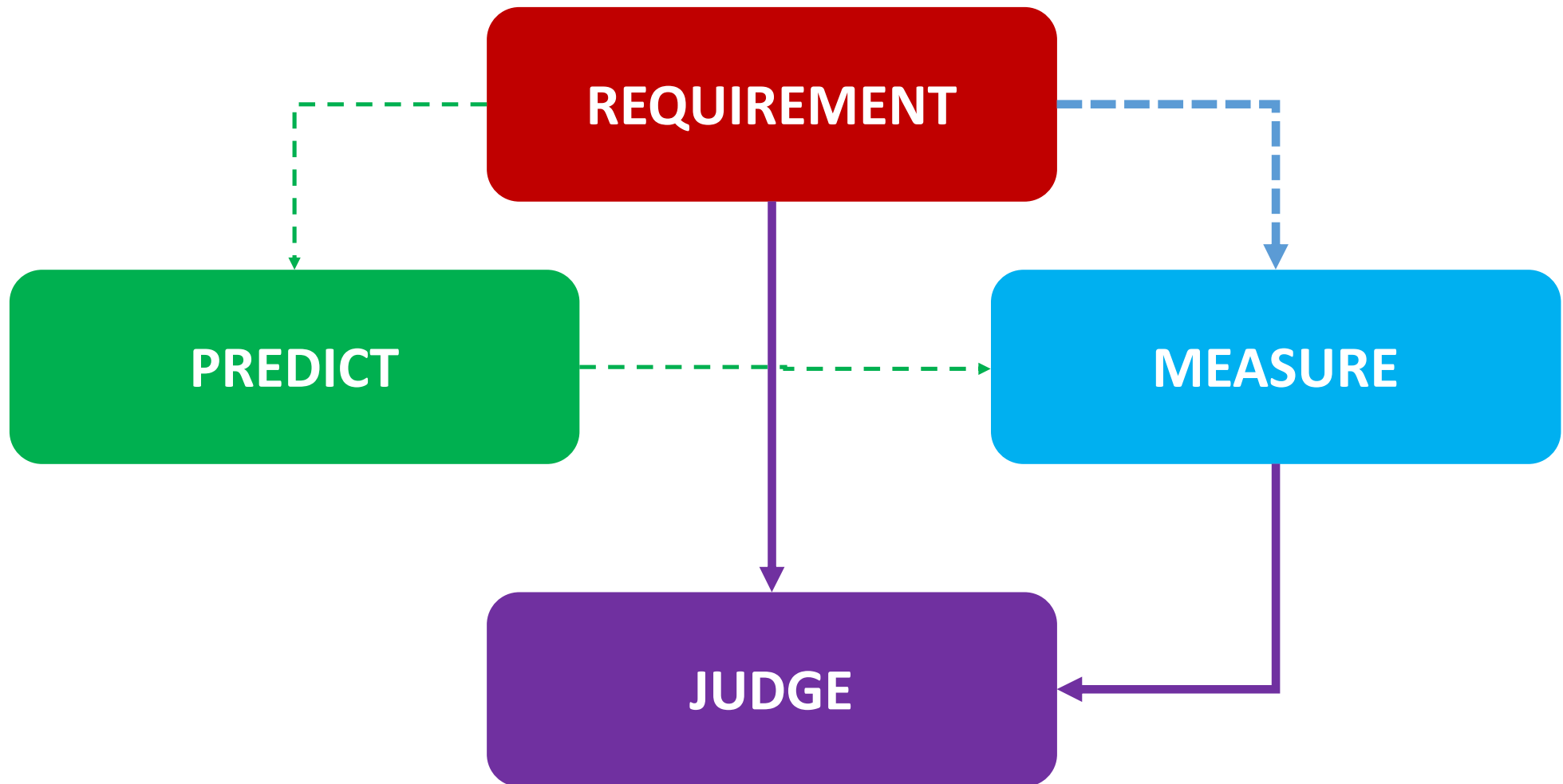
Enter
Number(s)
and Press
Send

Vote for up to 5 choices



(% = Percentage of Voters)

Approach based on measured consumption



Challenges related to compliance and enforcement in EPBD context based on real consumption data

- **Challenge 1:**
 - **Reliable/robust/... prediction method of energy consumption**
- Important issues regarding prediction method:
 - Sufficient detailed estimation of indoor climate and energy consumption
 - Rather realistic estimations about building use
 - ...

Challenges related to compliance and enforcement in EPBD context based on real consumption data

- **Challenge 1:**

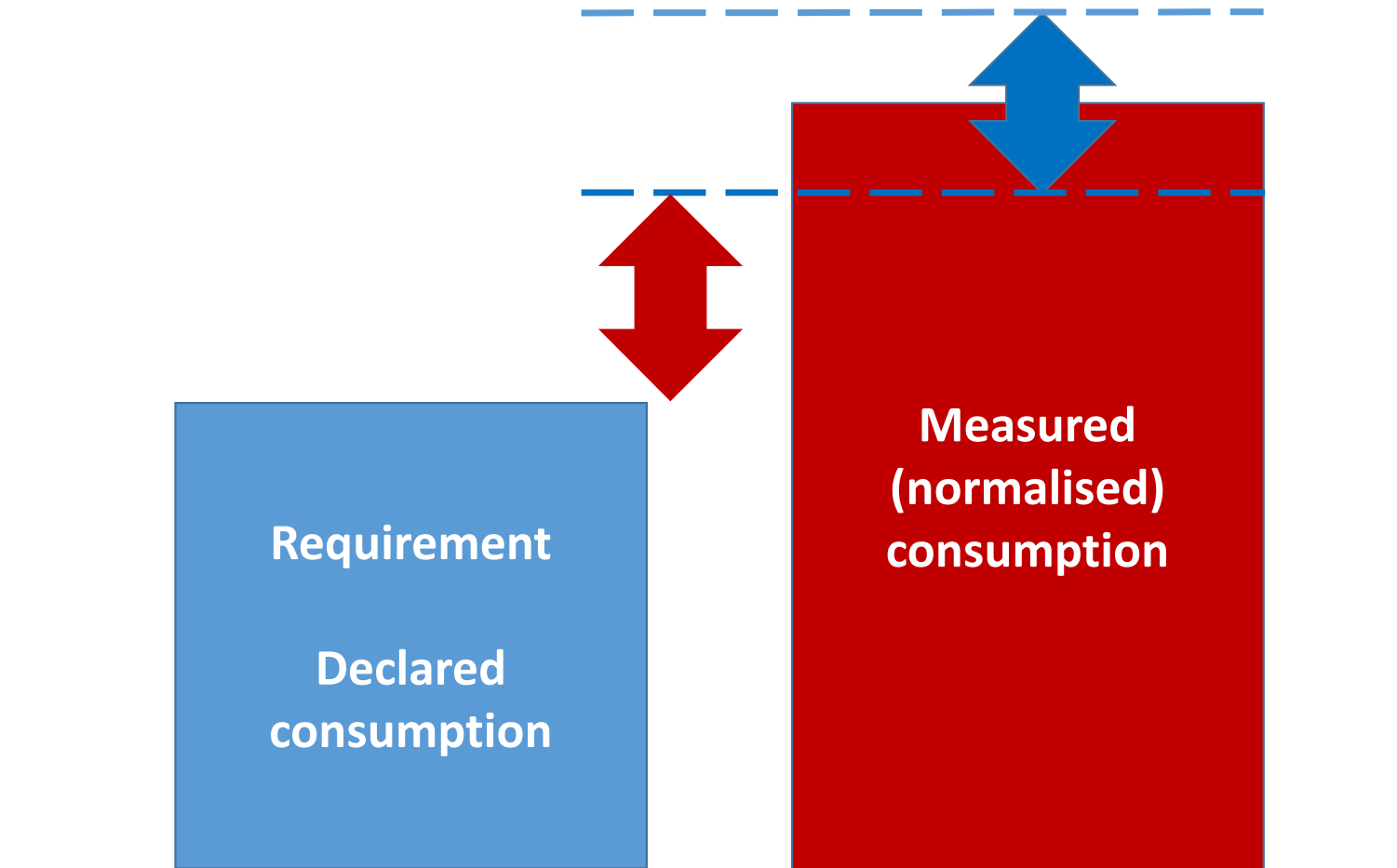
- Reliable/robust/... prediction method of energy consumption

- **Challenge 2:**

- **Determine the real consumption in such a way that it can be compared with the requirement/declaration**

- **Important boundary conditions:**

- Necessary to have a procedure for normalising consumptions (for climate,)
- It might be useful to have submetering data so that deviations from predictions can be better understood



Wide range of possibilities...

(see presentation by Eline Himpe)

- **Measured consumption: various possibilities, e.g.**
 - Sub-indicator for e.g. building shell + consumption for dealing with installations
 - Energy consumption as only requirement
 - Monitoring of subparts of systems
 - ...
- **Data analysis: various levels, e.g.**
 - Just total consumption over long period
 - Detailed monitoring as function of time, including indoor climate
 - Also submonitoring
 - ...

Challenges related to compliance and enforcement in EPBD context based on real consumption data

- Challenge 1:
 - Reliable/robust/... prediction method of energy consumption
- Challenge 2:
 - Determine the real consumption in such a way that it can be compared with the requirement/declaration
- **Challenge 3:**
 - **Determine who is responsible in case the real consumption is above the requirement/declaration**

Challenges related to compliance and enforcement in EPBD context based on real consumption data

- Challenge 1:
 - Reliable/robust/... prediction method of energy consumption
- Challenge 2:
 - Determine the real consumption in such a way that it can be compared with the requirement/declaration

Focus of the presentation by Eline Himpe:

What are the challenges to compare the (normalised) measured consumption with the requirement/declaration

Challenges related to compliance and enforcement in EPBD context based on real consumption data

- Challenge 1:
 - Reliable/robust/... prediction method of energy consumption

Focus in panel discussion:

To what extent is it feasible to clearly identify the responsibilities?

- Challenge 3:
 - Determine who is responsible in case the real consumption is above the requirement/declaration

A close-up photograph of a computer keyboard. The central focus is a bright blue rectangular key with the words "Thank You" printed in white, bold, sans-serif capital letters. The key is slightly raised and has a subtle shadow. Surrounding it are several standard white keys: to the left is a key with double and single quotation marks (" ' "); above it is a key with curly braces ({}); to the right is a key with a vertical line (|); and below it is a key with the letters "sh". The lighting is soft, highlighting the texture of the keys and the vibrant color of the blue key.

Thank You

**Interactive session:
Compliance and enforcement
of measured energy
consumption in practice**

About running this session

The lawyer...



Jelle Laverge

The inspector...



Liesje Van Gelder

The moderator...



Peter Wouters

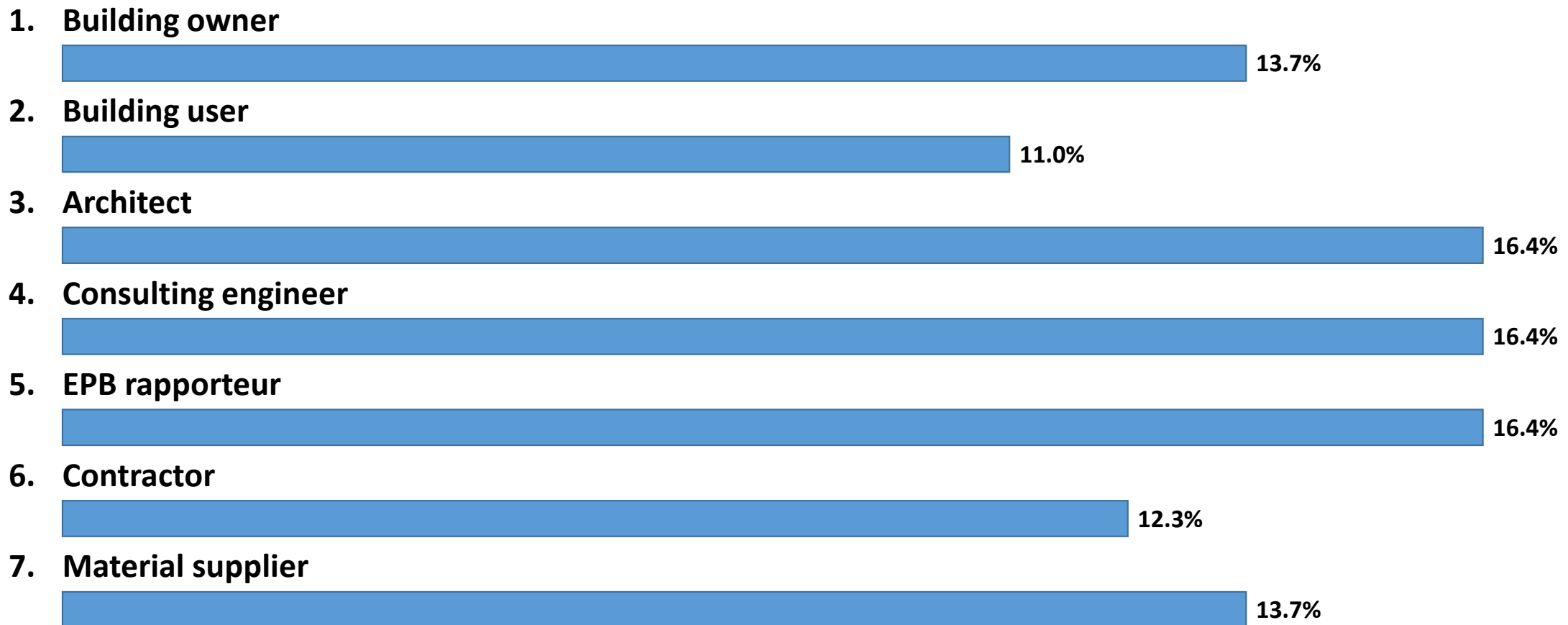
Various persons involved in the process...

- Building owner
- Building user
- Architect
- Consulting engineer
- EPB rapporteur
- Contractor
- Material supplier



Which role do you play?

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Owners



Renters

**Inspector
(Civil servant, ...)**



Architect



EPB calculator



Contractor(s)

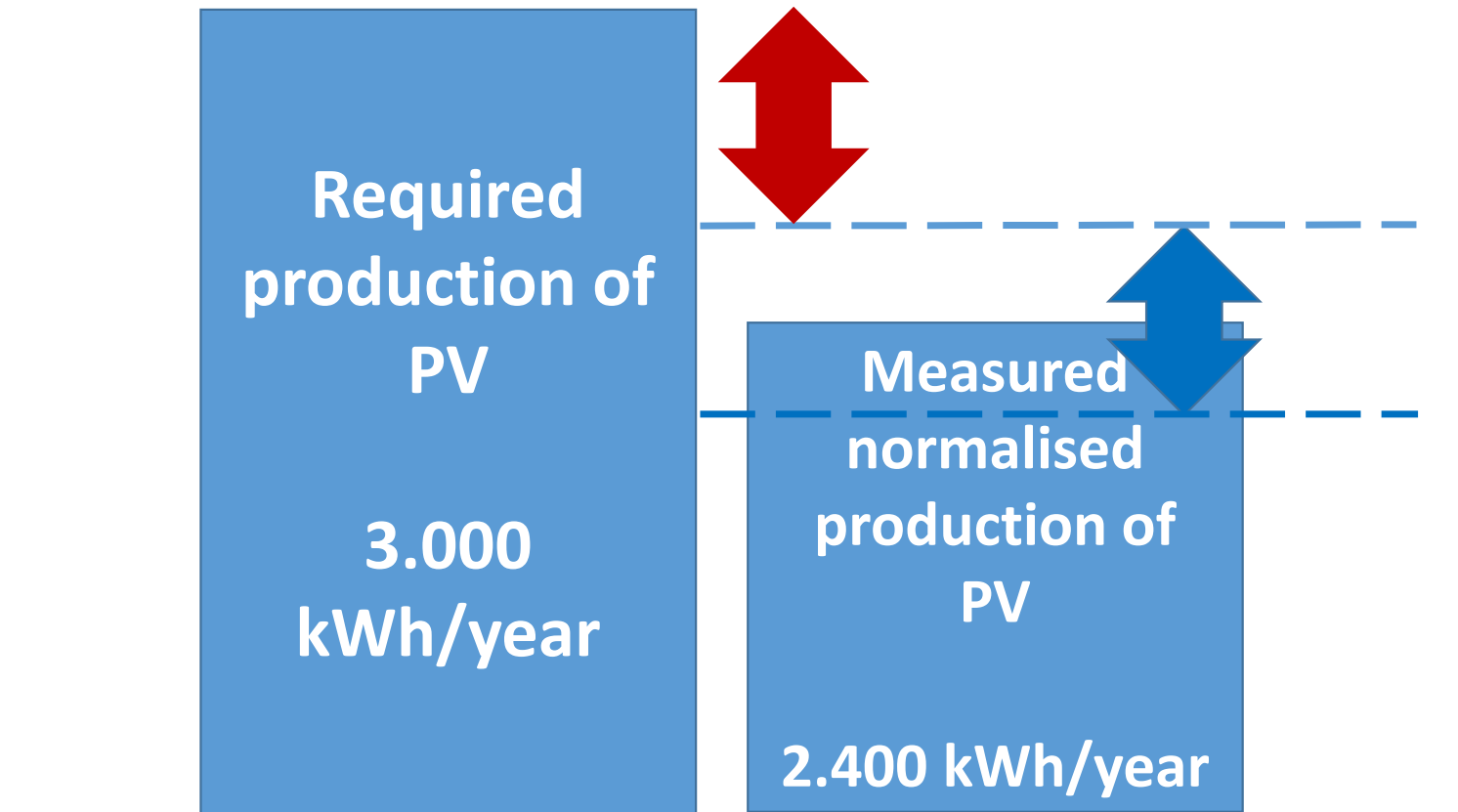


4 cases



Energy production of PV system or solar boiler





○ Energy production of PV system or solar boiler

In case of non-compliance: there should be a sanction...

What type of sanctions can be imposed?



The lawyer...



Jelle Laverge

The inspector: the owner has to build according the applicable legislation...

Inspector
(Civil servant, ...)



Energy production of PV system or solar boiler

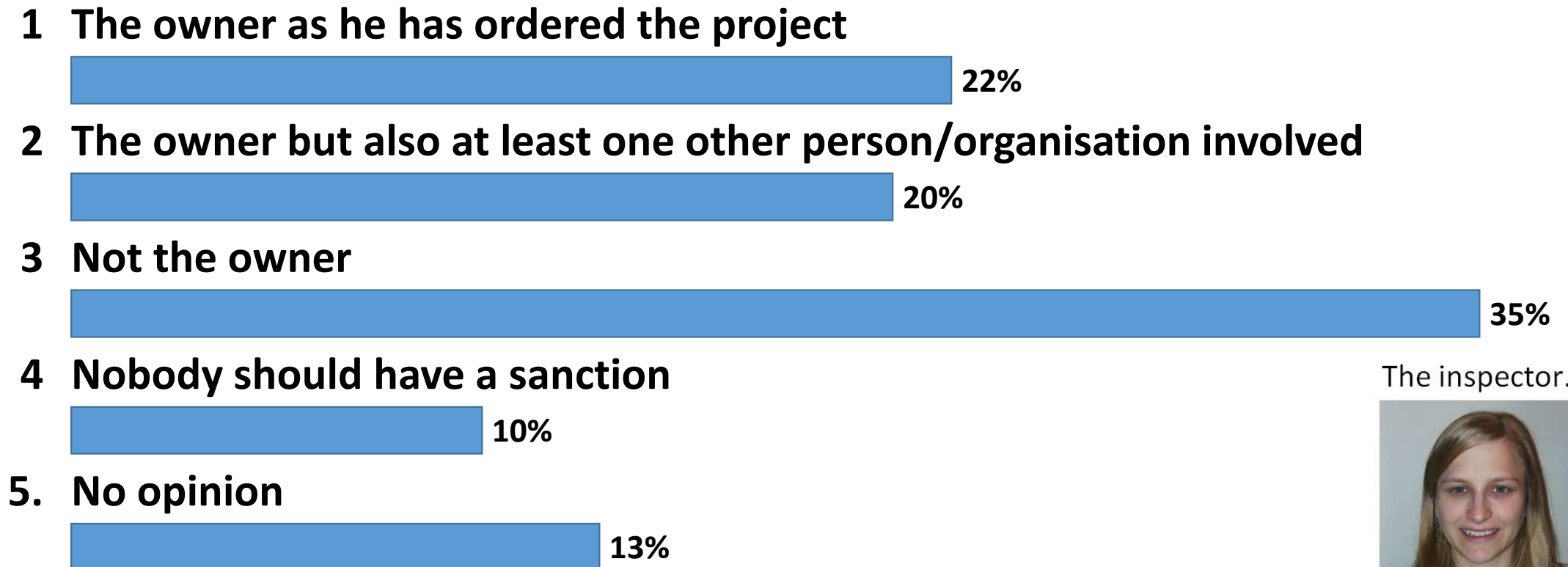
The inspector...



Liesje Van Gelder

Vote Now

Who should receive the sanction?



Energy production of PV system or solar boiler

The inspector...



Liesje Van Gelder

Who should receive the sanction?

	Description	Building owner	Building user	Architect	Consulting engineer	EPB rapporteur	Contractor
1	The owner as he has ordered the project	4	2	1	1	3	2
2	The owner but also at least one other person/organisation involved	2	3	1	3	1	3
3	Not the owner	4	2	6	4	3	2
4	Nobody should have a sanction	0	0	1	2	2	1
5	No opinion	0	0	3	2	1	2



Energy production of PV system or solar boiler

The inspector...



Liesje Van Gelder

We have no idea how
this is possible (but
we are not
competent)



Owners

The EPB report estimated
3.000 kWh of PV per year.
There is only 2.600
kWh/year. There has to be a
sanction...

**Inspector
(Civil servant, ...)**



The inspector...



Liesje Van Gelder

Energy production of PV system or solar boiler

Legal questions...

Who can be held liable in case of non-compliance?



The lawyer...



Jelle Laverge

Legal questions...

Can a building owner be liable for building related faults?



The lawyer...



Jelle Laverge



Owners

Architect



I have prescribed an installation which should produce 3.000 kWh/year

The EPB report estimated 3.000 kWh of PV per year. There is only 2.600 kWh/year. There has to be a sanction...



The inspector...



Liesje Van Gelder



Rapporteur

I have an invoice mentioning a production of 3.000 kWh/year

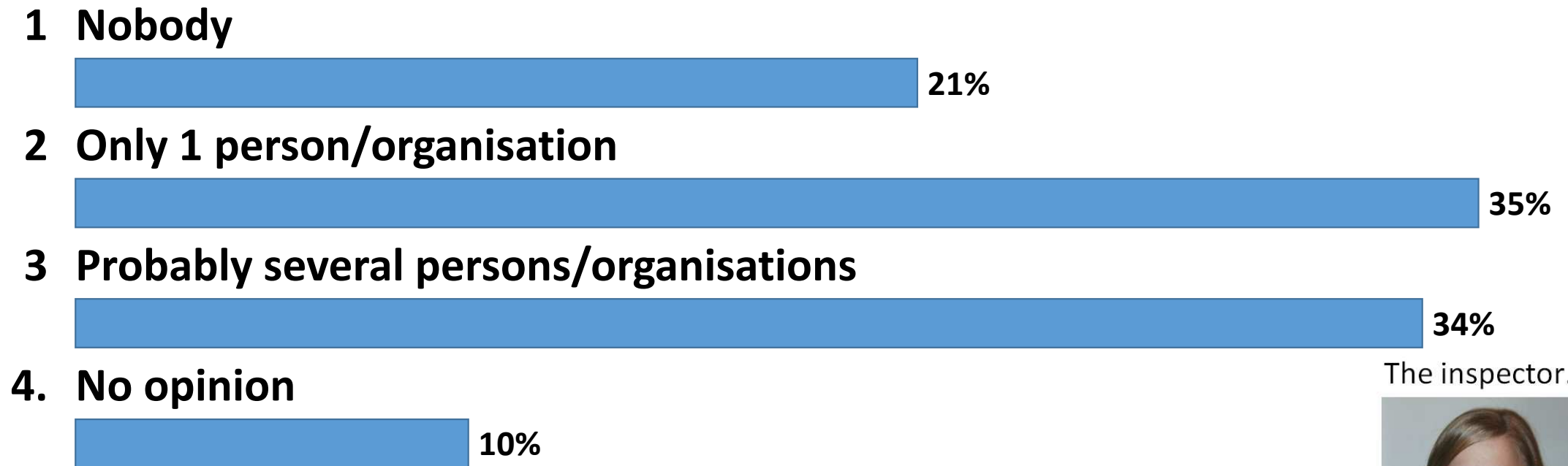
I have used a system of which the manufacturer declared 3.000 kWh/year



Contractor(s)

Vote Now

Who should receive the sanction?



The inspector...



Liesje Van Gelder

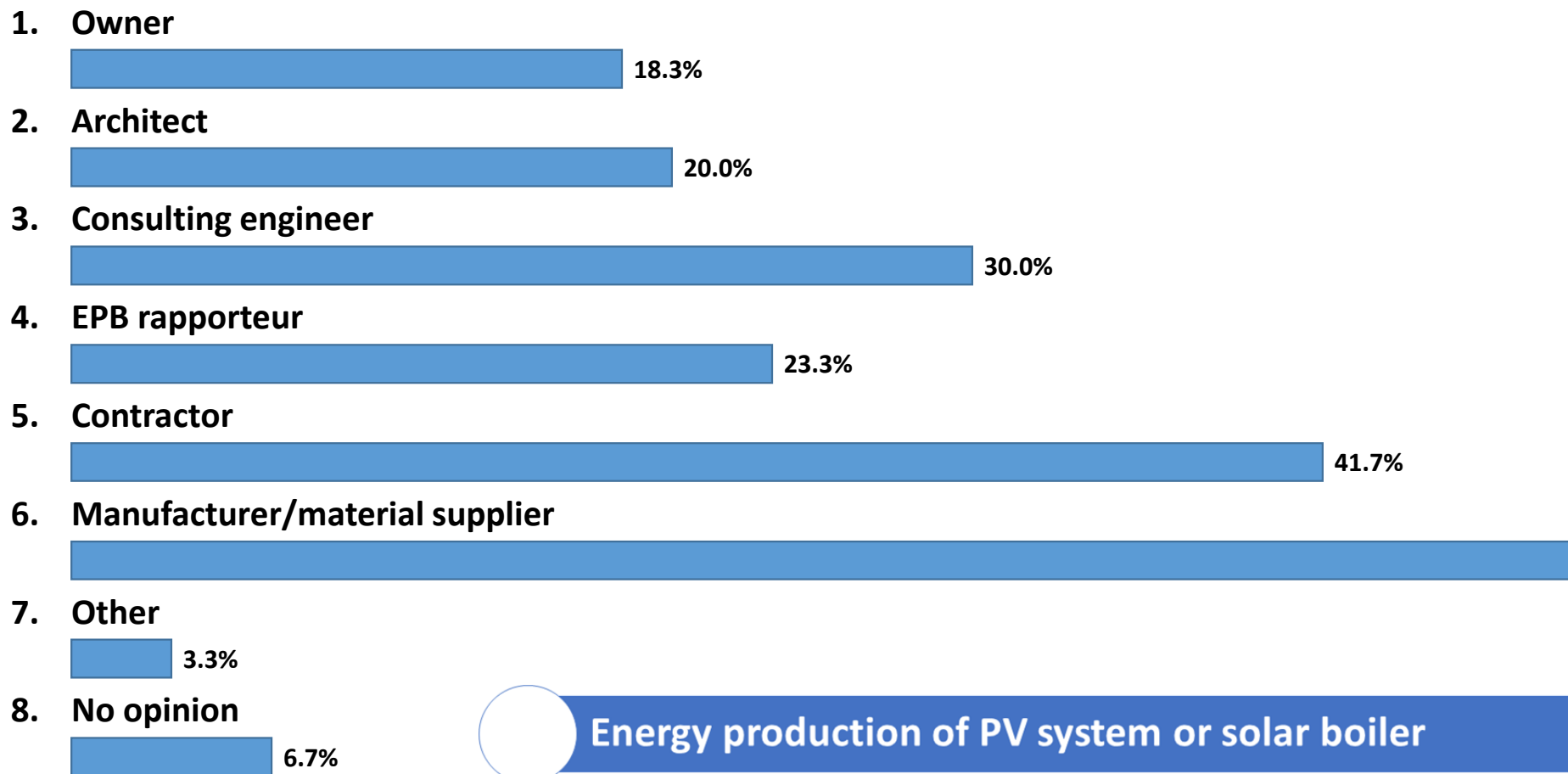


Energy production of PV system or solar boiler

Who should receive the sanction?

Vote for up to 7 choices

Enter
Number(s)
and Press
Send



Energy production of PV system or solar boiler

The inspector...



Liesje Van Gelder

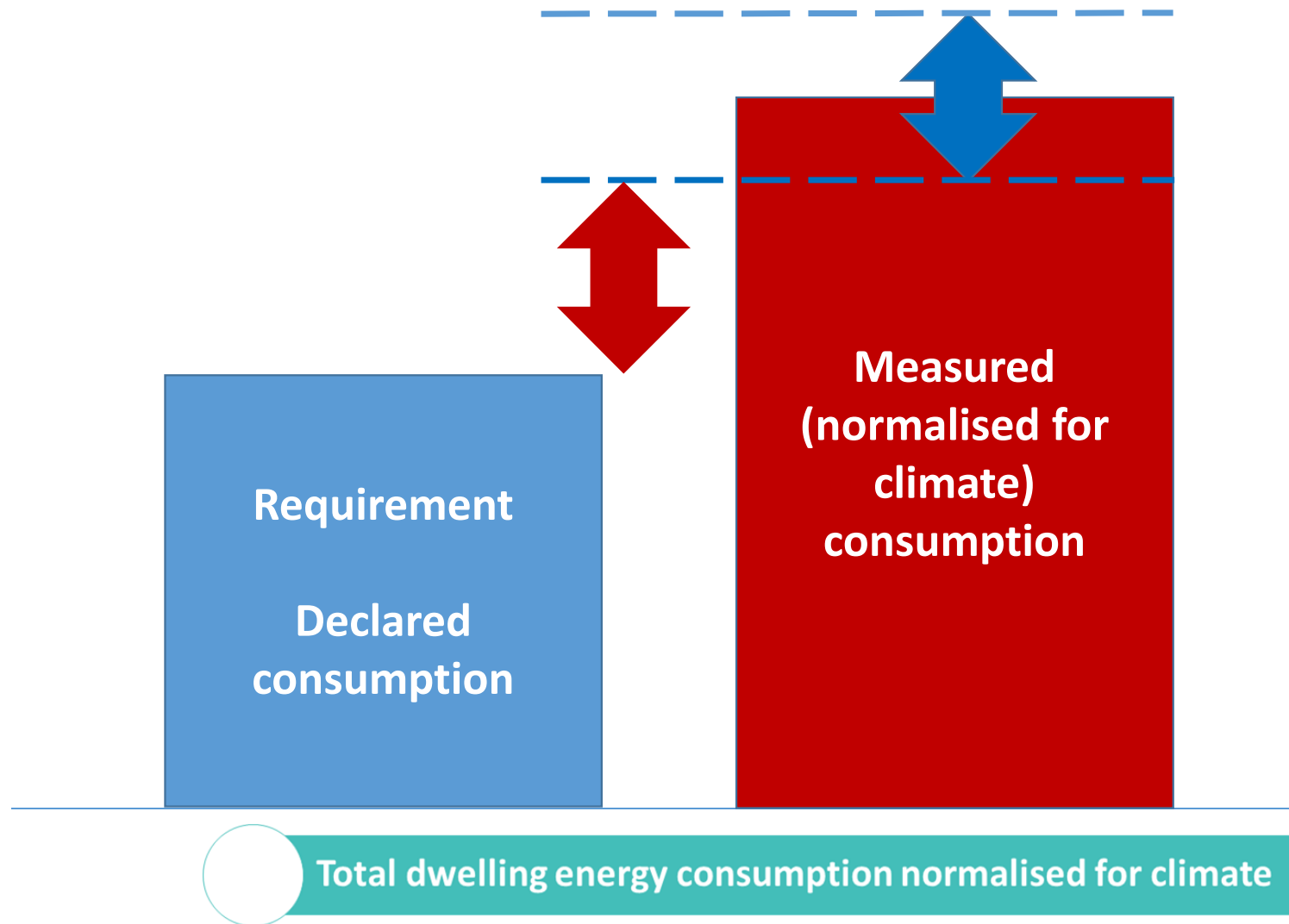
4 cases



Energy production of PV system or solar boiler

Total dwelling energy consumption normalised for climate

Energy consumption normalised for climate



The inspector: The user is responsible!



Inspector
(Civil servant, ...)



Total dwelling energy consumption normalised for climate

The inspector...



Liesje Van Gelder

Do you believe that the user should take measures to lower the energy consumption?

Enter
Number(s)
and Press
Send

Vote for up to 2 choices

1 Yes, as above the limit

37.7%

2 No - as it is not clear which are the causes for too high consumption

52.5%

3 No - even if the only cause is the occupant, as the occupant uses the building as he wants

34.4%

4 No opinion

4.9%

The inspector...



Liesje Van Gelder

Total dwelling energy consumption normalised for climate

Do you believe that the user should take measures to lower the energy consumption?

Choice	Description	Building owner	Building user	Architect	Consulting engineer	EPB rapporteur	Contractor	Material supplier
1	Yes, as above the limit	3	3	2	5	3	4	3
2	No - as it is not clear which are the causes for too high consumption	5	4	8	4	3	4	4
3	No - even if the only cause is the occupant, as the occupant uses the building as he wants	3	3	6	1	1	3	4
4	No opinion	0	0	1	0	2	0	0

The inspector...



Liesje Van Gelder



Total dwelling energy consumption normalised for climate

Legal questions...

Can a user be held liable for not meeting the energy requirement?



Total dwelling energy consumption normalised for climate

The lawyer...



Jelle Laverge

[Vote Now](#)

Do you believe it is possible to sanction such situation?

1 Yes, absolutely



2 Yes, but somewhat complicated



3 Probably not

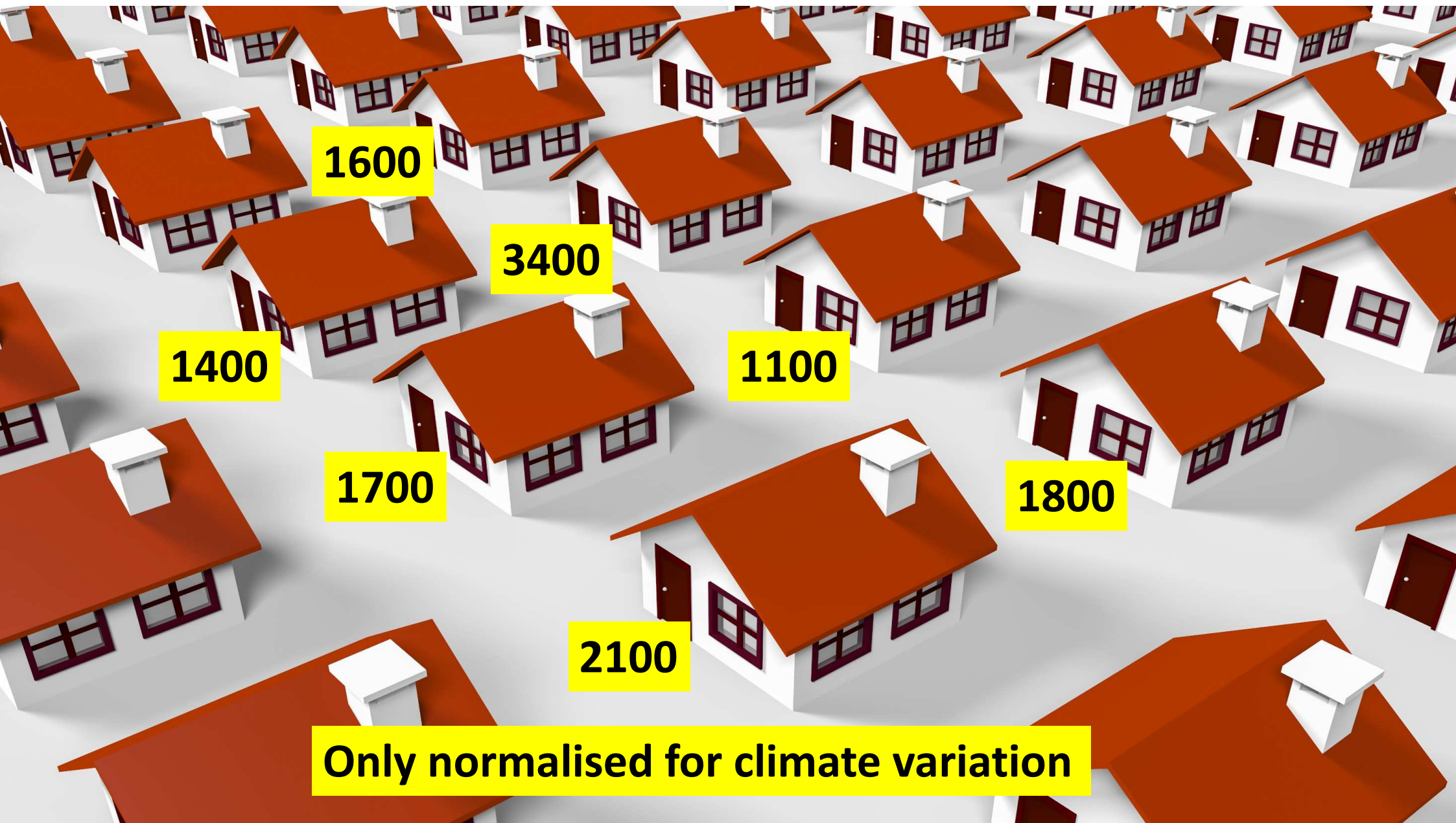


4 Not possible



5 No opinion





1600

3400

1400

1100

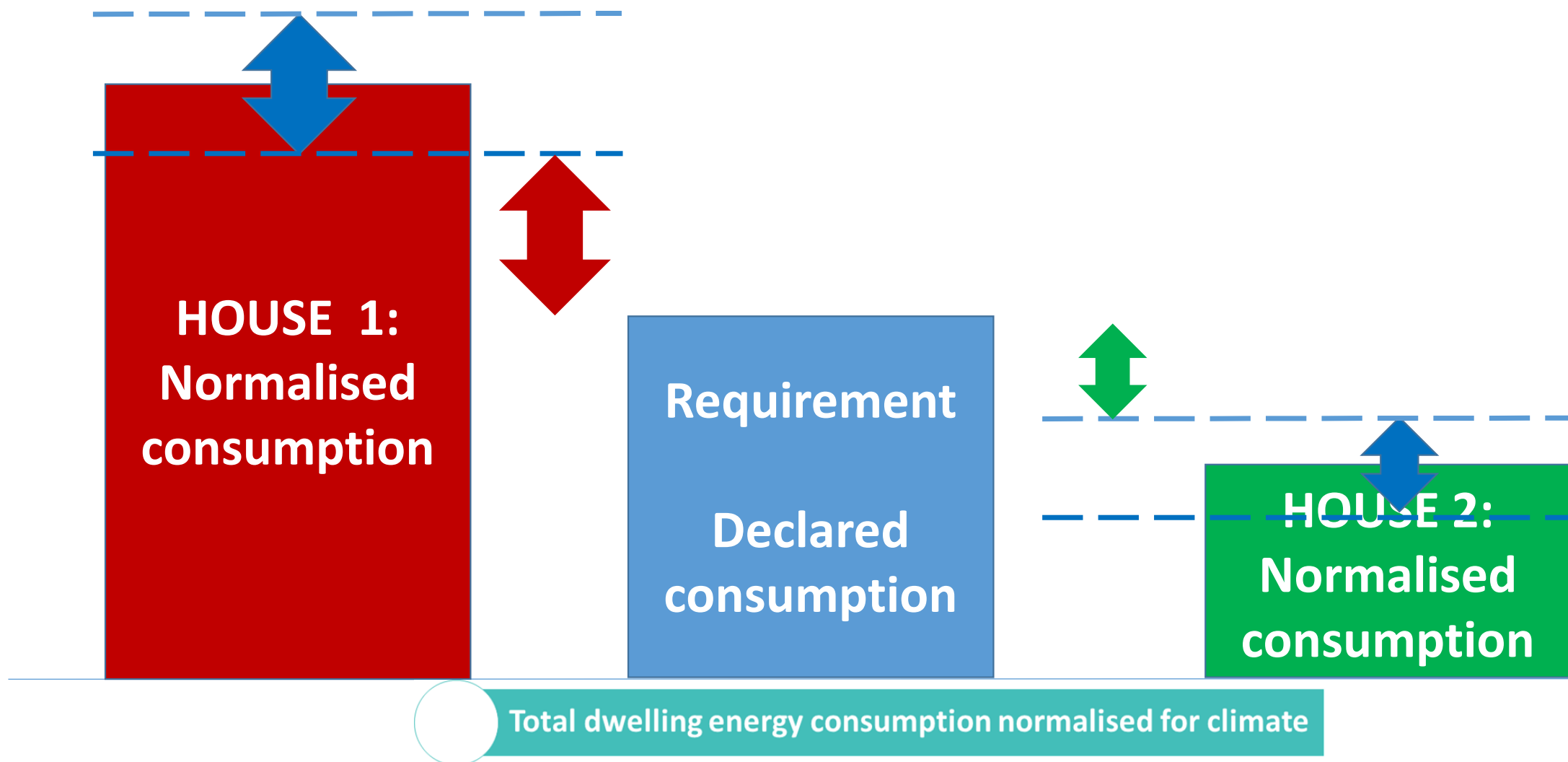
1700

1800

2100

Only normalised for climate variation

Energy consumption normalised for climate



[Vote Now](#)

Do you believe it is possible to sanction such situation?

1 Yes, absolutely



2 Yes, but somewhat complicated



3 Probably not



4 Not possible

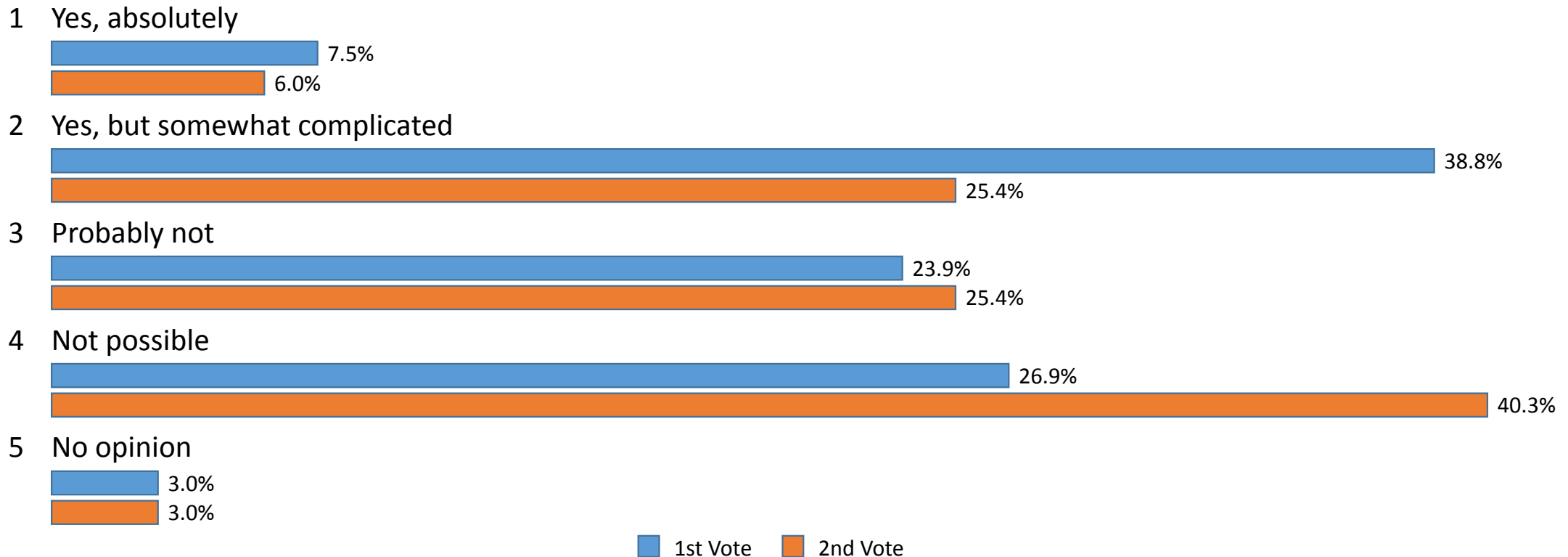


5 No opinion



Total dwelling energy consumption normalised for climate

Do you believe it is possible to sanction such situation?



4 cases

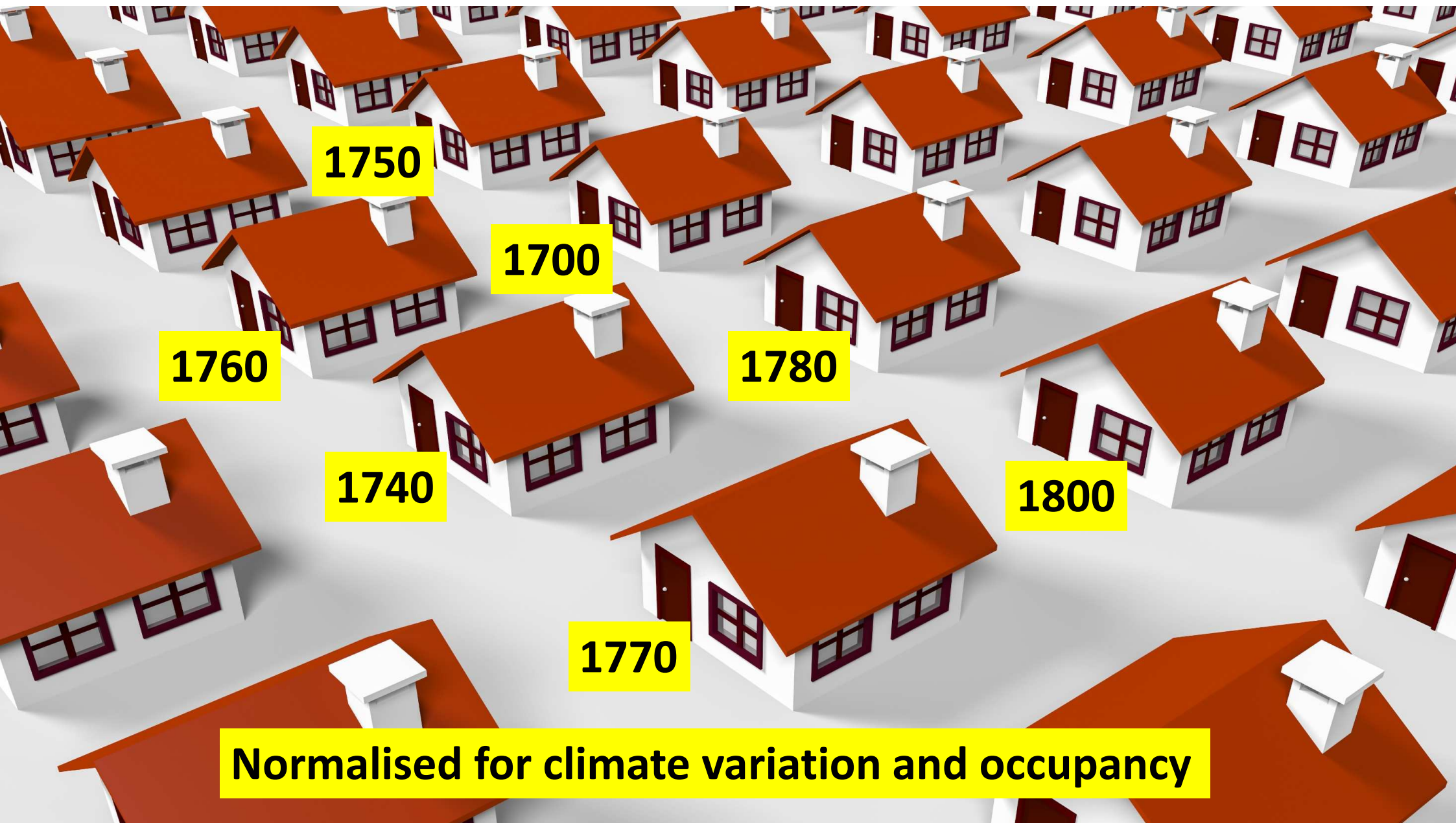


Energy production of PV system or solar boiler

The diagram consists of three horizontal bars of different colors (blue, teal, and green) stacked vertically. To the left of each bar is a white circle with a colored outline (blue, teal, and green respectively). A thin green line connects the top of the first circle to the top of the second, and another thin green line connects the top of the second circle to the top of the third. The text for each case is written in white on its respective bar.

Total dwelling energy consumption normalised for climate

Total dwelling energy consumption normalised for climate AND for occupancy



1750

1700

1760

1780

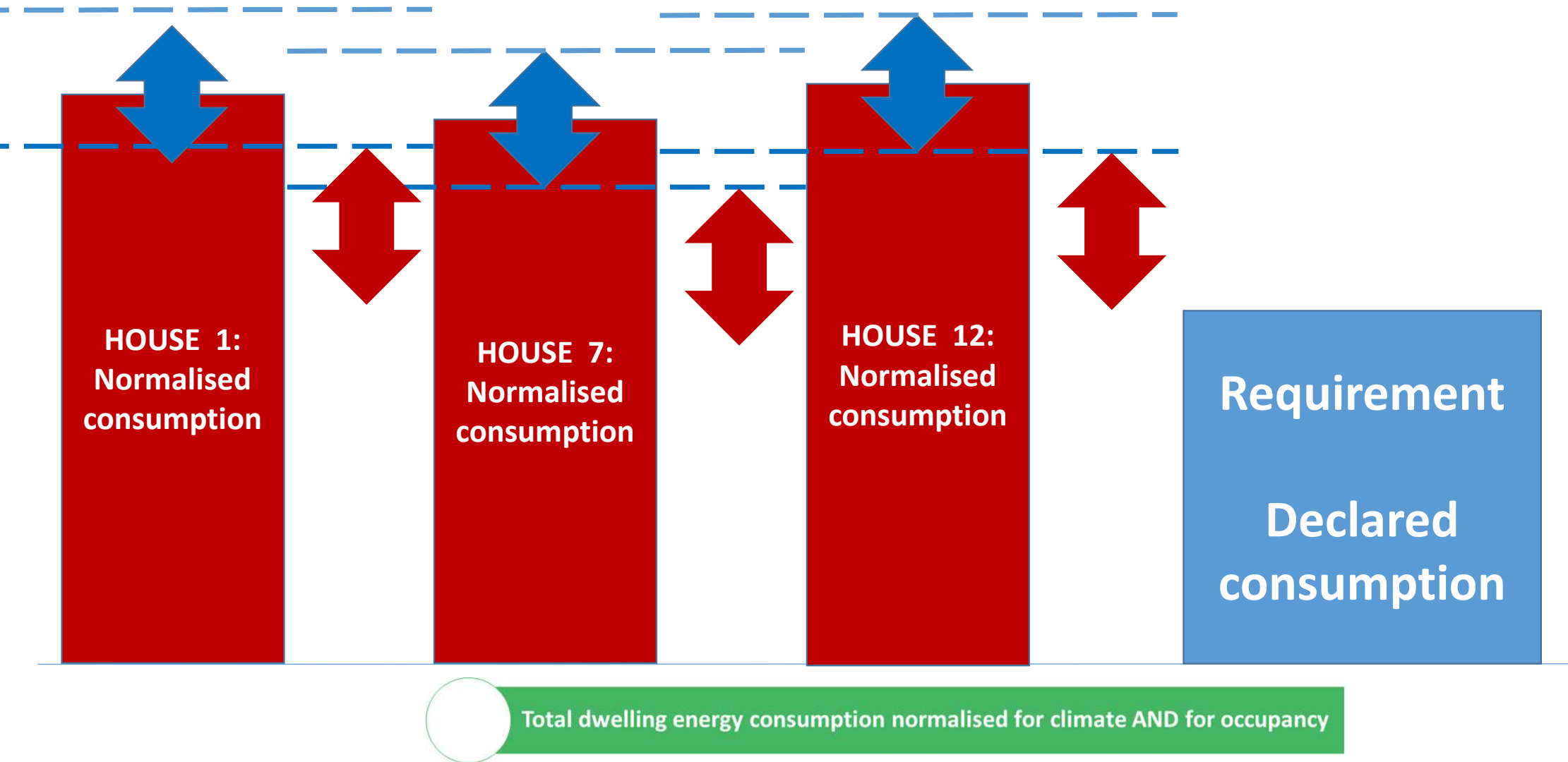
1740

1800

1770

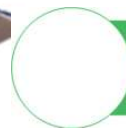
Normalised for climate variation and occupancy

Energy consumption normalised for climate **AND** occupancy



The inspector: The owner is liable!

**Inspector
(Civil servant, ...)**



Total dwelling energy consumption normalised for climate AND for occupancy

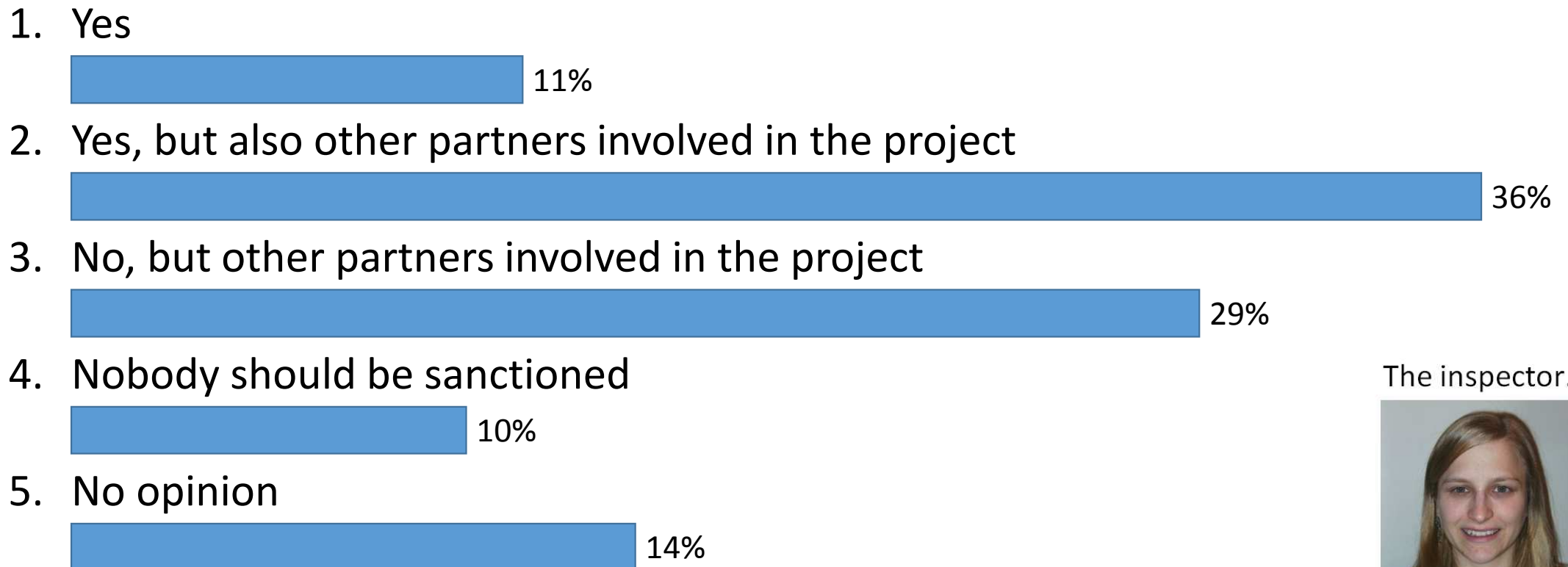
The inspector...



Liesje Van Gelder

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Do you agree that the owner should receive the sanction?



Total dwelling energy consumption normalised for climate AND for occupancy

The inspector...



Liesje Van Gelder

Some considerations...

- A too high consumption after normalisation for climate and occupancy can have various causes:
 - Poor design
 - Not appropriate set of components
 - Poor execution
 - Poor maintenance
 - ...
- Not evident to identify causes based on measured consumption



Total dwelling energy consumption normalised for climate AND for occupancy

The inspector...



Liesje Van Gelder

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Do you believe it is possible to sanction such situation?

1 Yes, absolutely



2 Yes, but somewhat complicated



3 Probably not



4 Not possible



5 No opinion



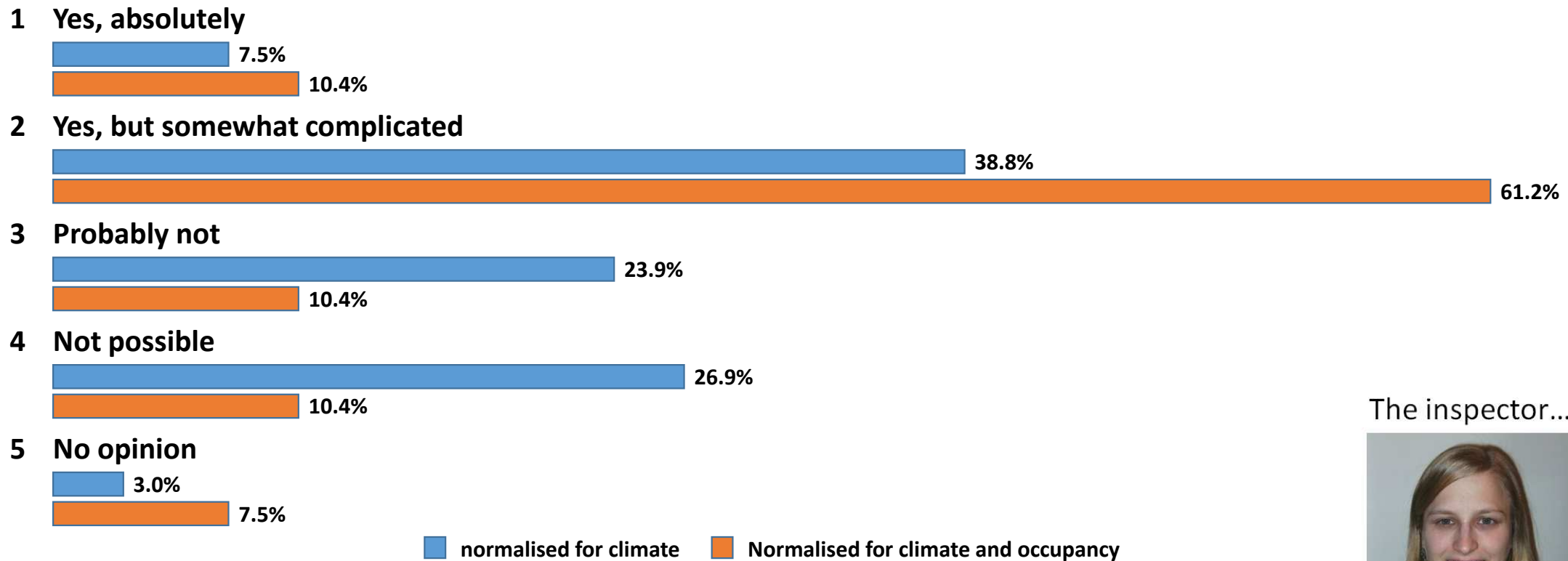
Total dwelling energy consumption normalised for climate AND for occupancy

The inspector...



Liesje Van Gelder

Do you believe it is possible to sanction such situation?



The inspector...



Liesje Van Gelder

Legal questions...

What are the legal means for contesting a sanction?



The lawyer...



Jelle Laverge

4 cases



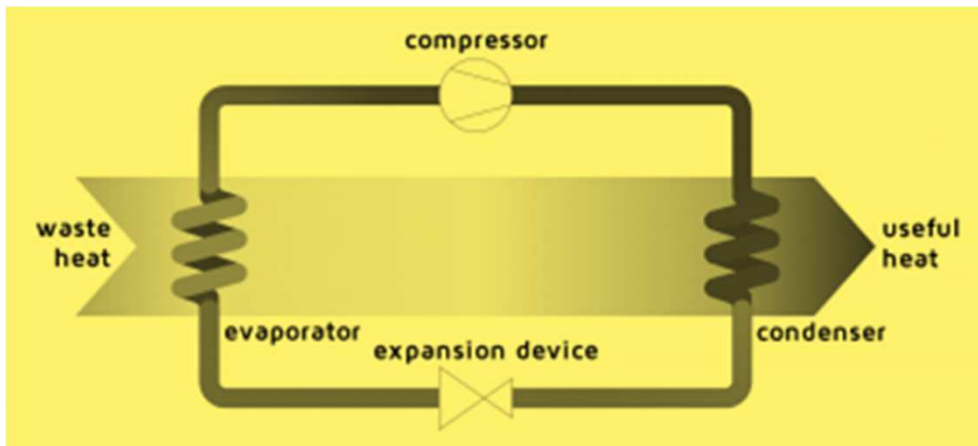
Energy production of PV system or solar boiler

Total dwelling energy consumption normalised for climate

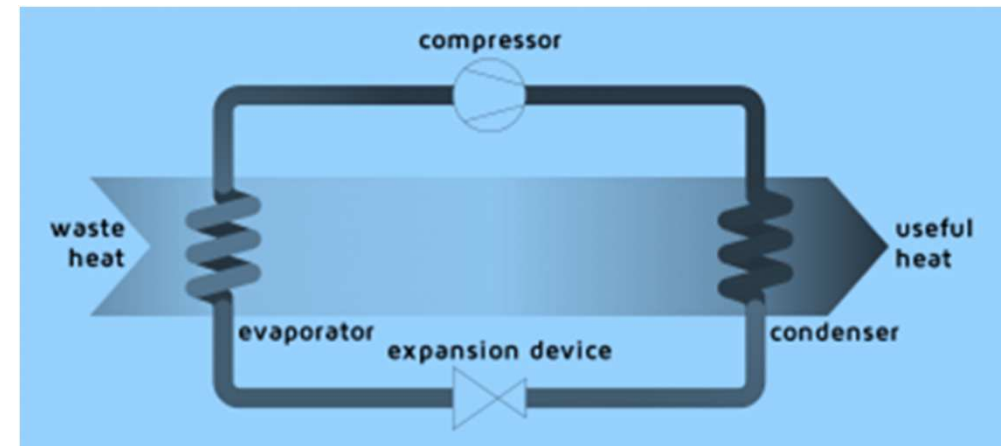
Total dwelling energy consumption normalised for climate AND for occupancy

Seller with 2 different products with difference in energy efficiency

Choice between 2 heat pumps...



Original choice



Alternative choice
3% less performing
10% cheaper

No need for calculation – real consumption of whole building is only that matters...




Seller with 2 different products with difference in energy efficiency

In a competitive market, what system will be chosen by a building investor?

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1 Almost all will choose for better performing system
0%

2 Majority will choose for better performing system
 11%

3 Majority will choose for cheaper system
 47%

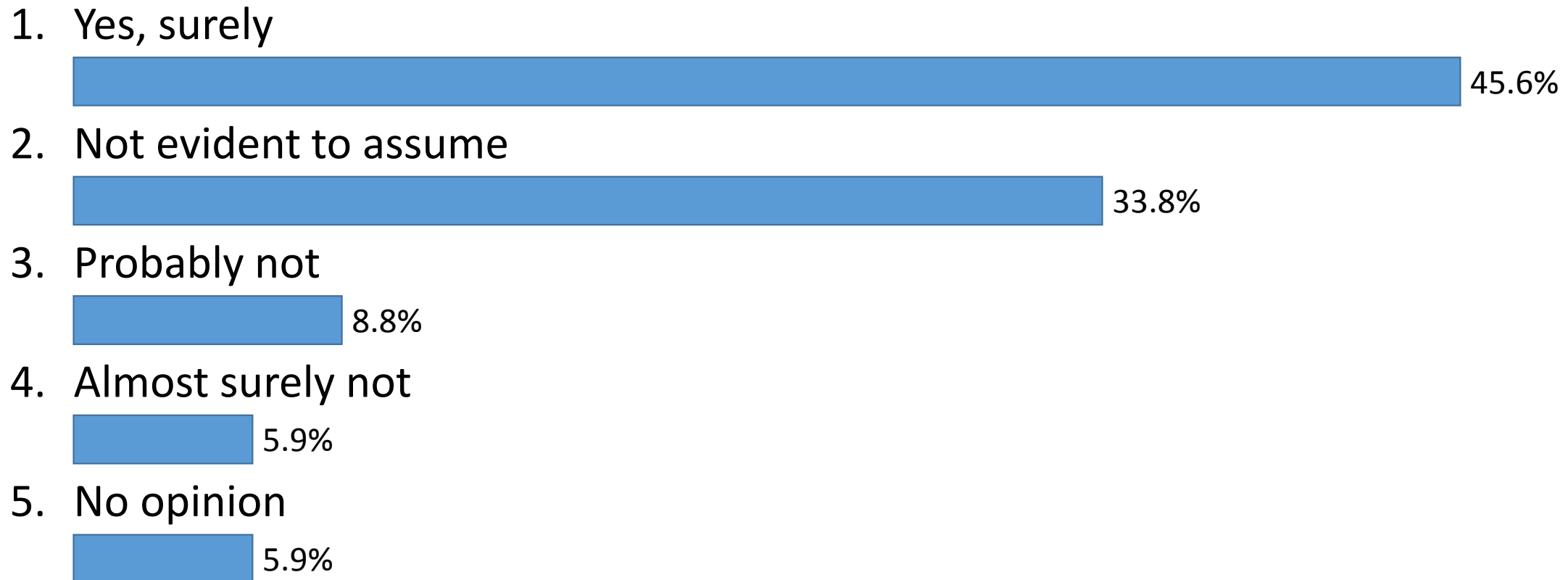
4 Almost all will choose for cheaper system
 33%

5 No clear opinion



Vote Now

In a competitive market, will compliance based on real consumption stimulate innovation?



Seller with 2 different products with difference in energy efficiency

Legal questions...

Is there a difference between sanctions by judges or by civil servants?



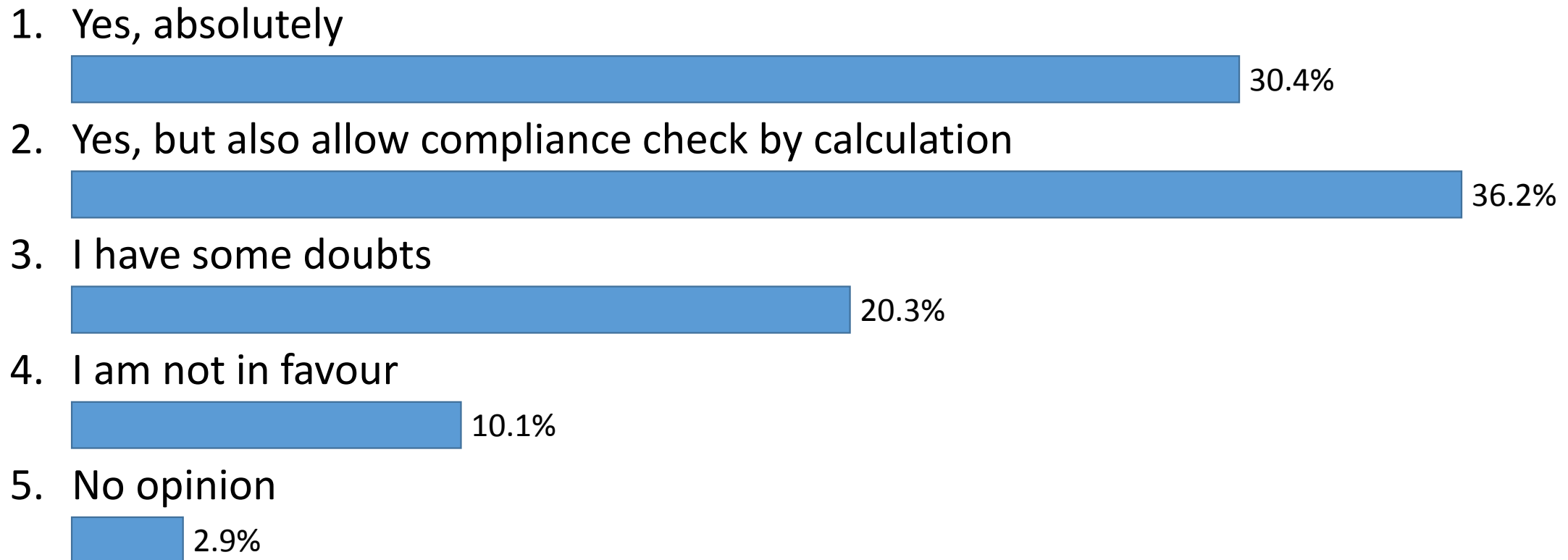
The lawyer...



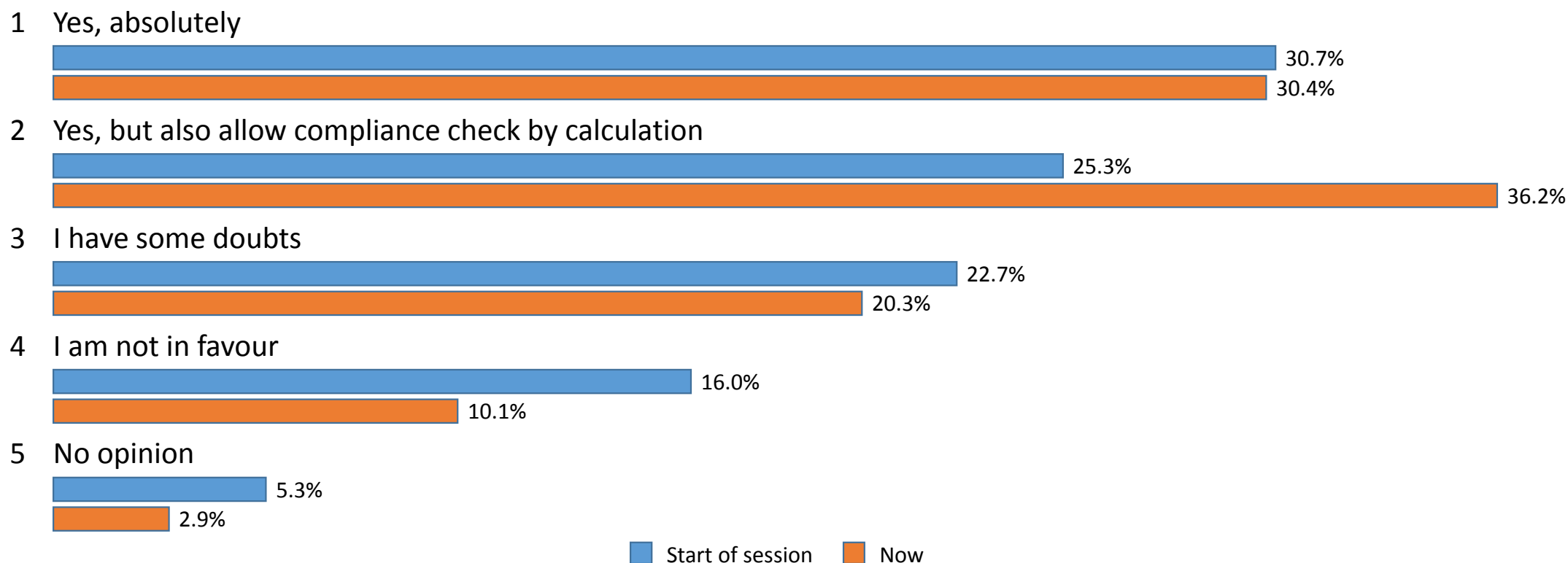
Jelle Laverge

[Vote Now](#)

Are you in favour of an EPBD compliance framework based on real consumption?



Are you in favour of an EPBD compliance framework based on real consumption?



A close-up, high-angle shot of a computer keyboard. The central focus is a bright blue rectangular key with the words "Thank You" printed in a bold, white, sans-serif font. The key is slightly raised and has a subtle shadow beneath it. Surrounding this key are several standard white keyboard keys. To the left is a key with double and single quotation marks. Above the blue key is a key with curly braces and square brackets. To the right is a key with a vertical line. The lighting is soft, creating gentle highlights and shadows on the keys' surfaces.

Thank You