Environmental *Change* Institute

Transforming energy demand

23 February 2021

ONE

Brenda Boardman, Emeritus Fellow



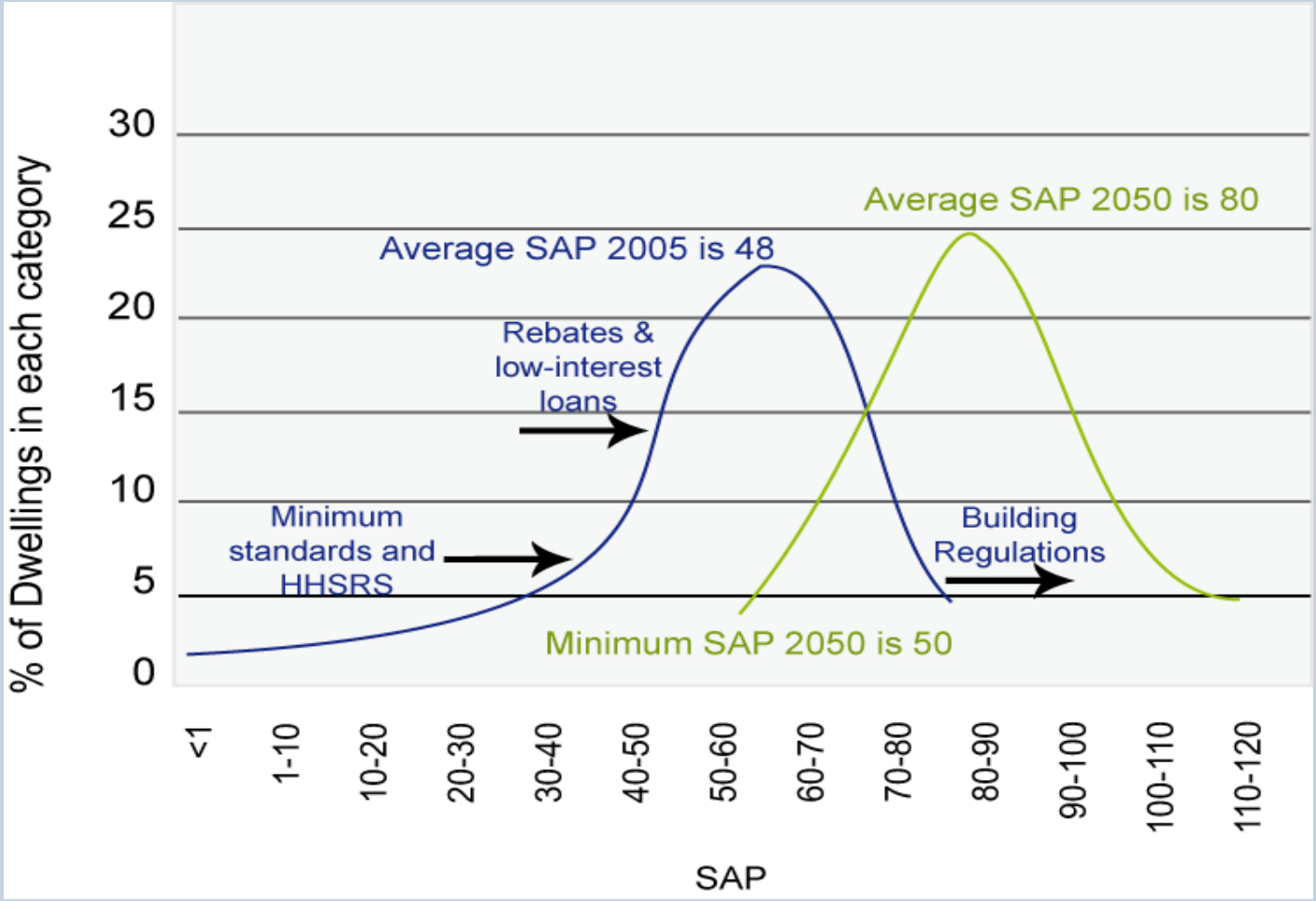


Today's thesis

- Appliance policy has been successful
- Housing policy has been less successful
- Housing policy can learn from appliance policy

Household electricity use (kWh pa) UK, 2008-2019

Transforming housing

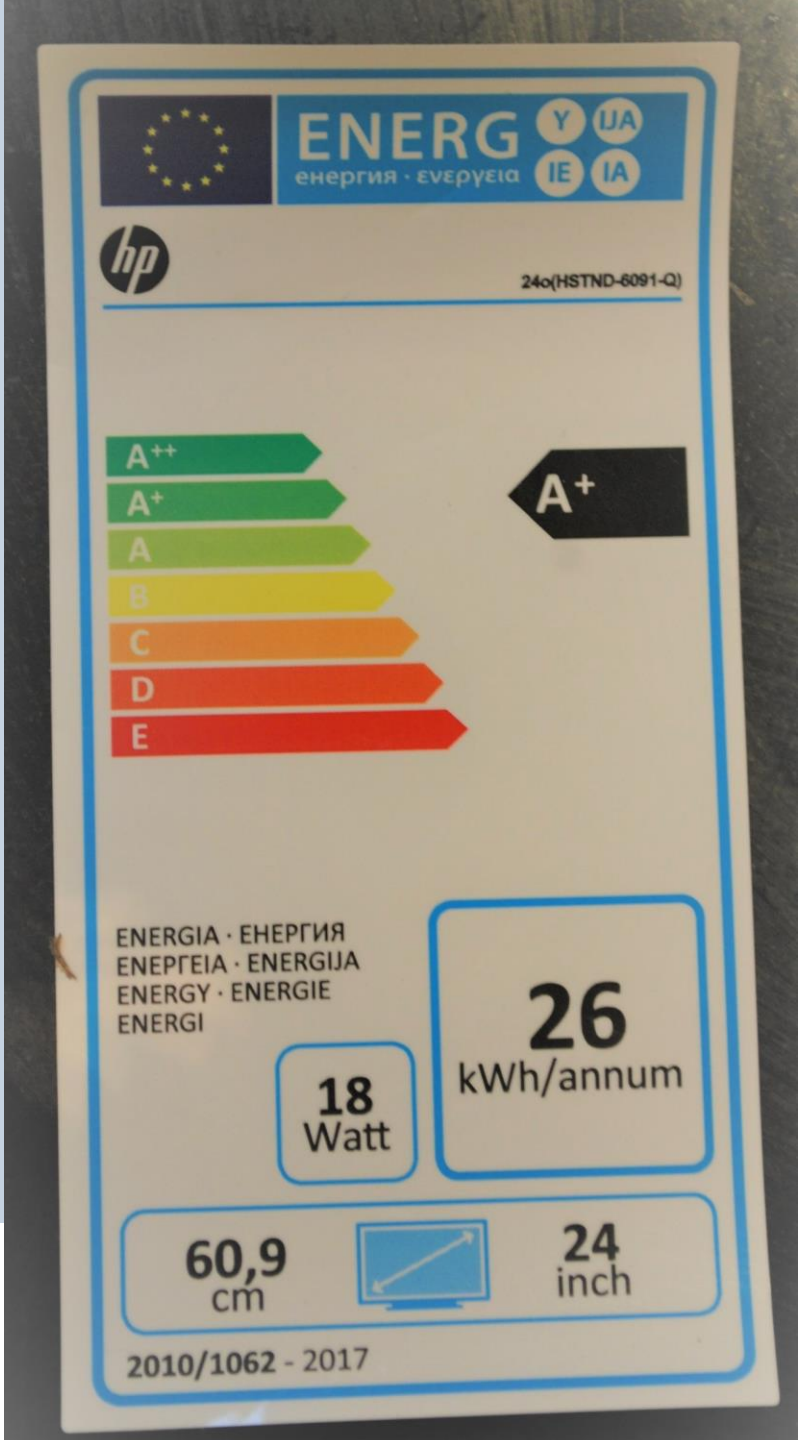


eci

UNIVERSITY OF OXFORD

Energy label - TV

- 7 energy efficiency bands
  - A+ and A++ added
  - so F and G omitted
- Energy use – standard conditions
- Enforce visibility –
  - on the front of every product in the showroom
- Easily understood



New energy label from March 2021

Various products, over time

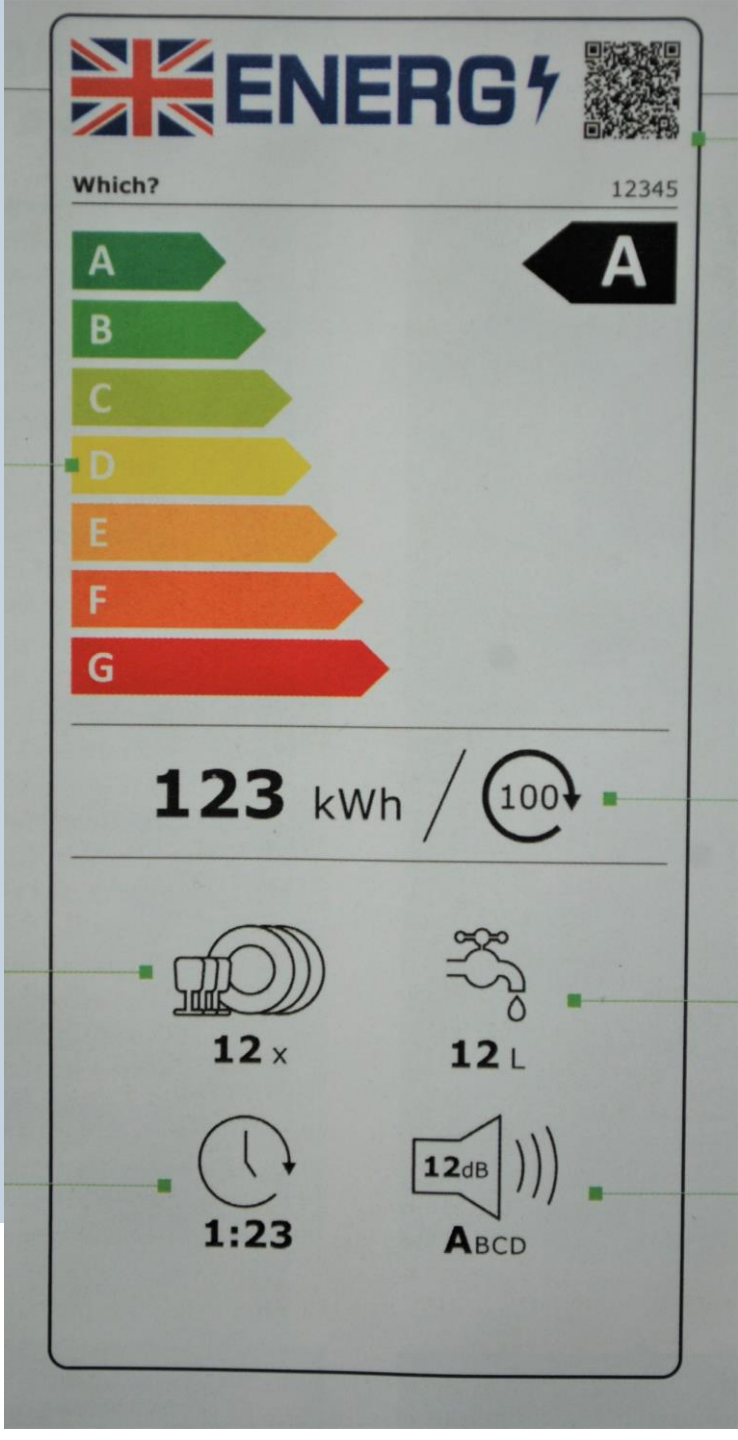
This is for a dish-washer

Rescaled to original A-G

A+, A++, A+++ disappeared

Energy per 100 uses, explicit

Extra energy services, eg eco programme cycle duration



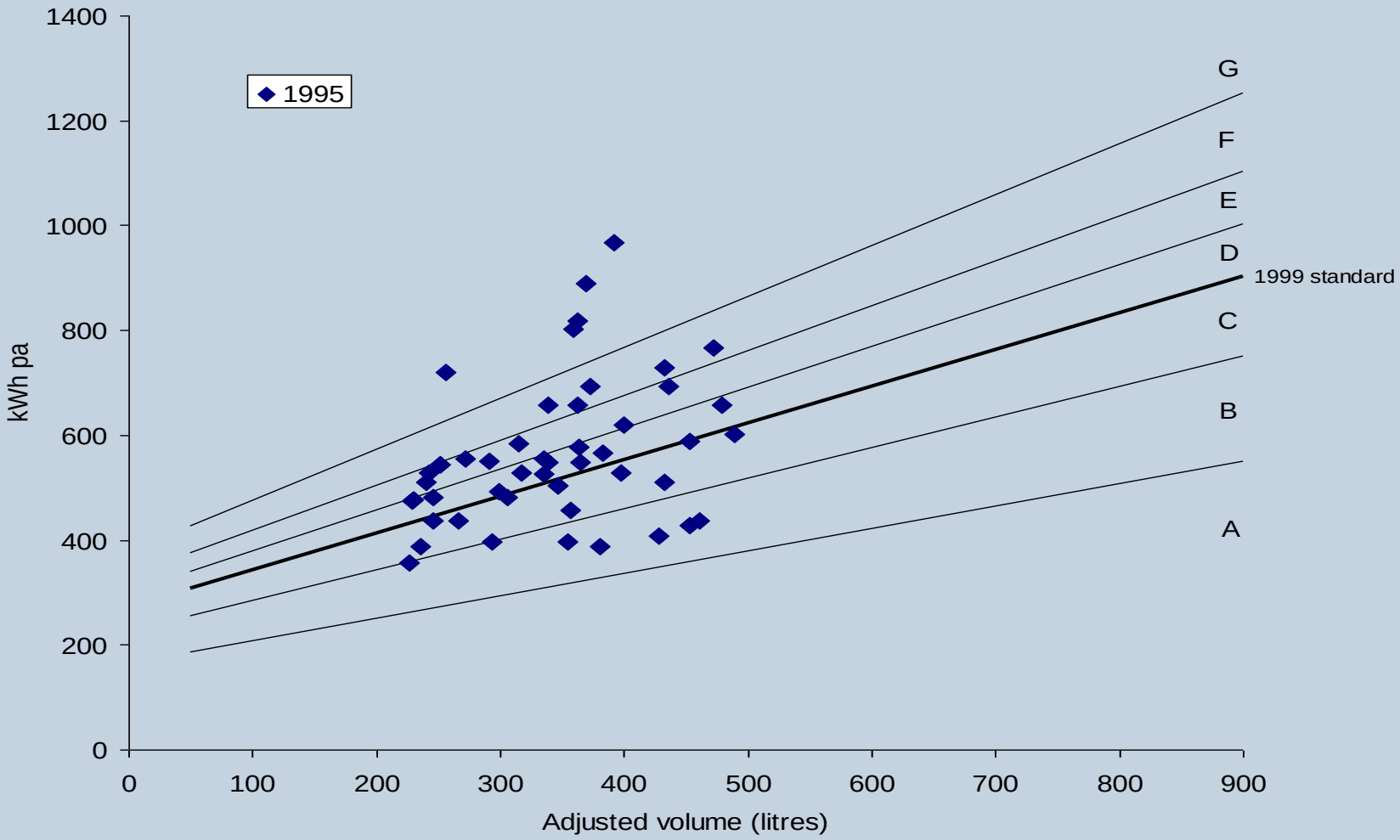
How to achieve accurate, useful labels

- Strong focus on procedure in laboratory tests
  - Even to round robins – same appliance tested in different laboratories
- Emphasis on consistency
- To limit cheating, Manufacturer A can (privately) challenge Manufacturer B – the costs paid by the loser
- Vital to retain customer confidence and trust

eci

UNIVERSITY OF OXFORD

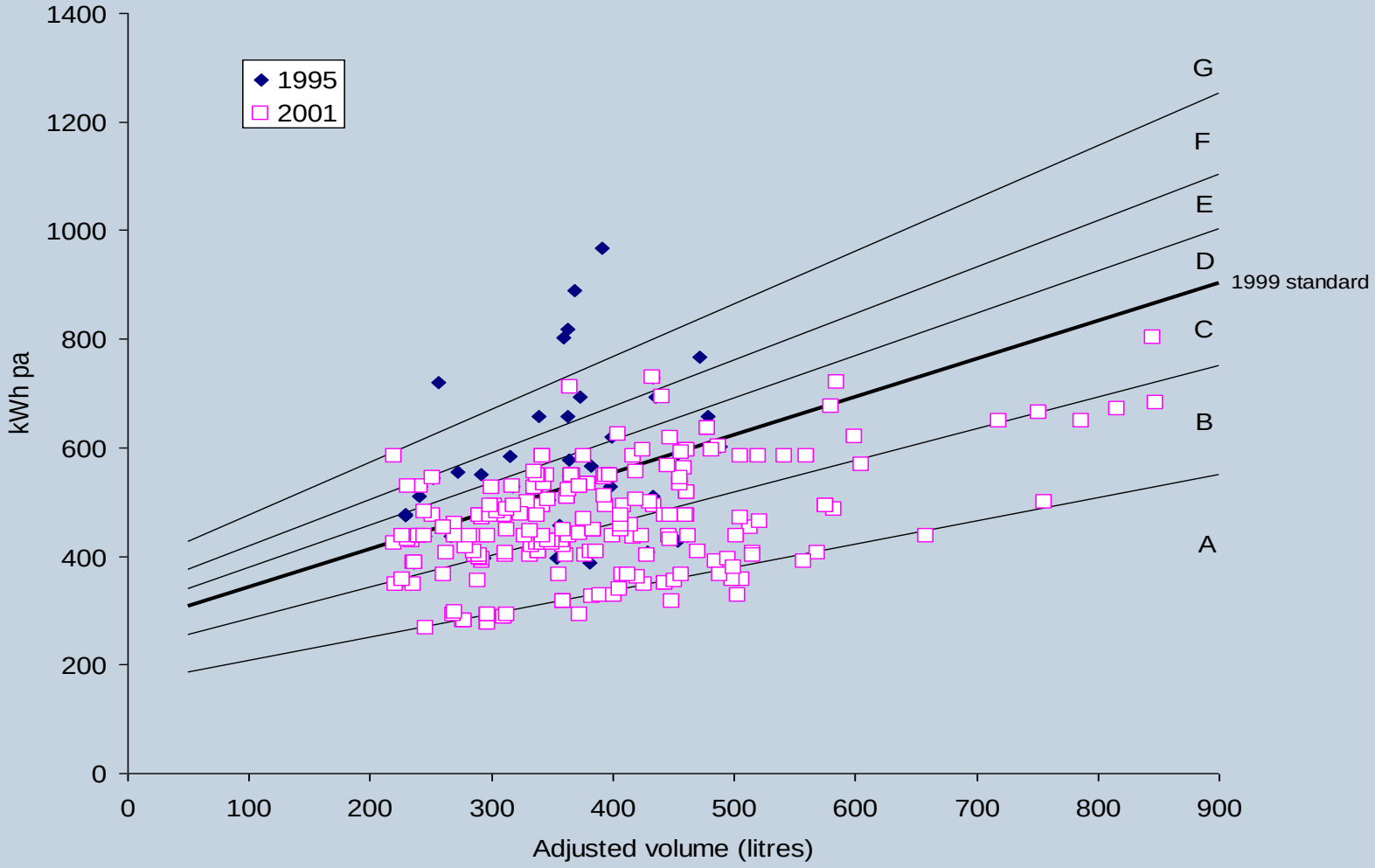
Fridge-freezers: labels introduced, UK 1995



eci

UNIVERSITY OF OXFORD

Fridge-freezers: minimum standards, UK



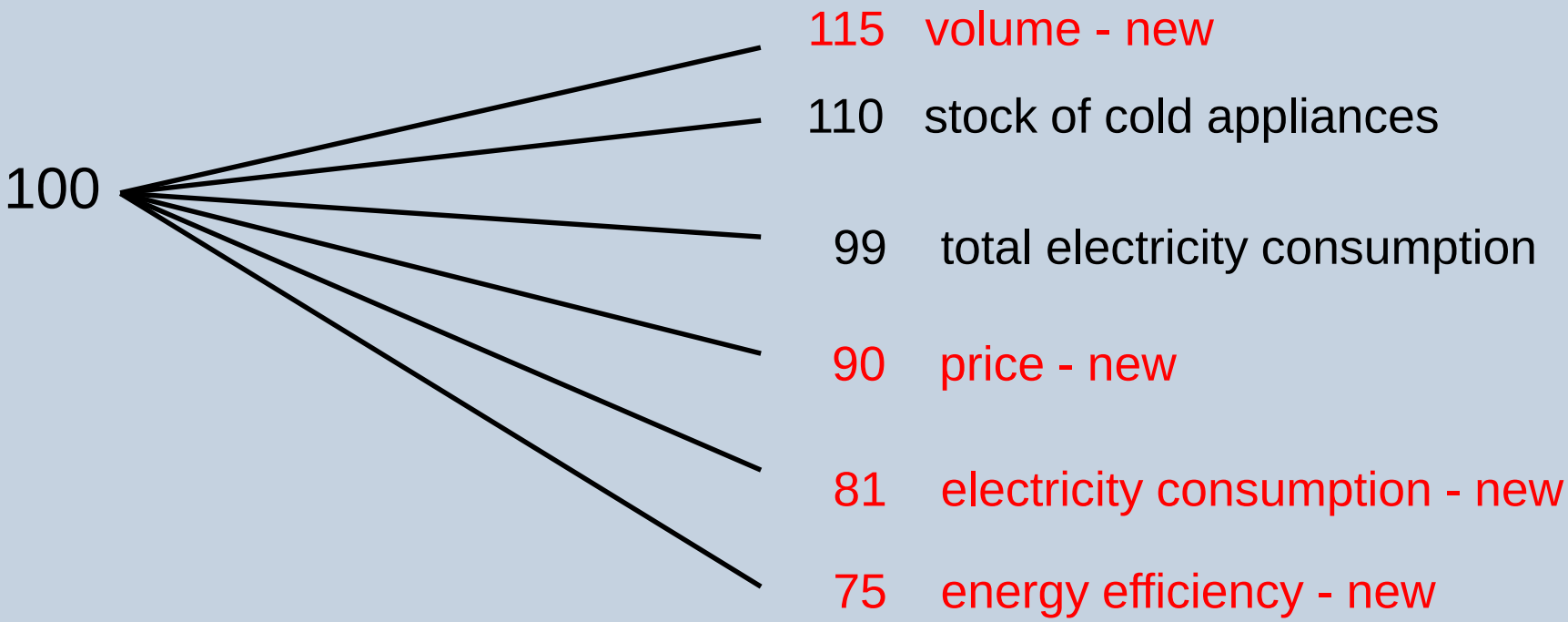
How to make minimum standards effective

- Declare well in advance, linked to the design cycle
- Make mandatory at the point of sale, regardless of stock
- Enforce quickly through trading standards
  - Easy, if combined with accurate, highly-visible label
- This will prevent dumping

eci

UNIVERSITY OF OXFORD

Cold trends, UK 1995-2001



Light output per bulb

Type	Phase-out started	Efficacy (lumens/W)
40W GLS	2010	10
60W GLS	2009	12
100W GLS	2008	15
Halogen	2016	25
CFL		40-60
Linear fluorescent		60-80
LED		120-150

eci

UNIVERSITY OF OXFORD

Lighting: annual household electricity use, 1997-2019, UK

1997	720 kWh	20 bulbs
2009	600 kWh	
2010	555 kWh	
2013	435 kWh	
2016	408 kWh	
2019	396 kWh	34 bulbs

ie 45% reduction in 22 years
Despite 70% more bulbs
Still only 22% are LEDs

eci

UNIVERSITY OF OXFORD

Lighting policies

- Labels announced 1999, on boxes from 01.01.01, influenced manufacturers and retailers, rather than purchasers
- Minimum standards reasonably effective, not perfect
  - Supported by subsidies and give-aways initially
- UK Building Regulations required dedicated fittings in new build = procurement = useful

Lessons from appliances

Product standards are a powerful policy

Labels and minimum standards effective

If Governments (UK and EU) enforce

Energy conservation naturally results, over time –

purchase was going to happen anyway

Speed depends on lifetime of the appliance

Policy delay is costly

eci

UNIVERSITY OF OXFORD

UK energy in housing: SAP and non-SAP

	Energy (kWh)	Carbon	£
SAP: space and water heating, fixed lighting	83%	78%	42%
Non-SAP: other lights, all appliances	17%	22%	50%

eci

UNIVERSITY OF OXFORD

Housing

"It is frustratingly hard to make a really big dent in the leakiness of an already-built house."

(David MacKay, when Chief Scientific Advisor, DECC)

Every home + its occupants = unique

Not got a good, trusted, reliable label

Not got effective minimum standards

DJC MacKay, 2009, *Sustainable energy – without the hot air*, p296

eci

UNIVERSITY OF OXFORD

Energy Performance Certificate (EPC) for houses, UK

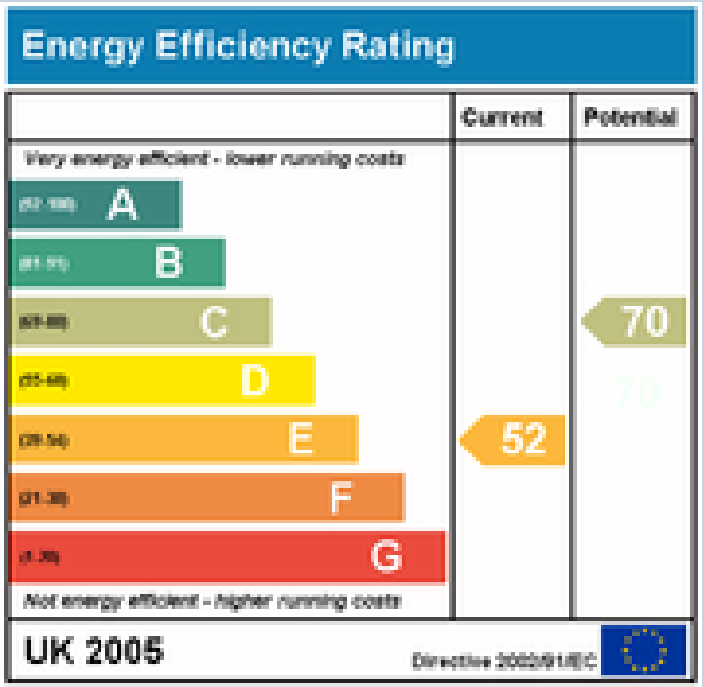
Based on £/m^2

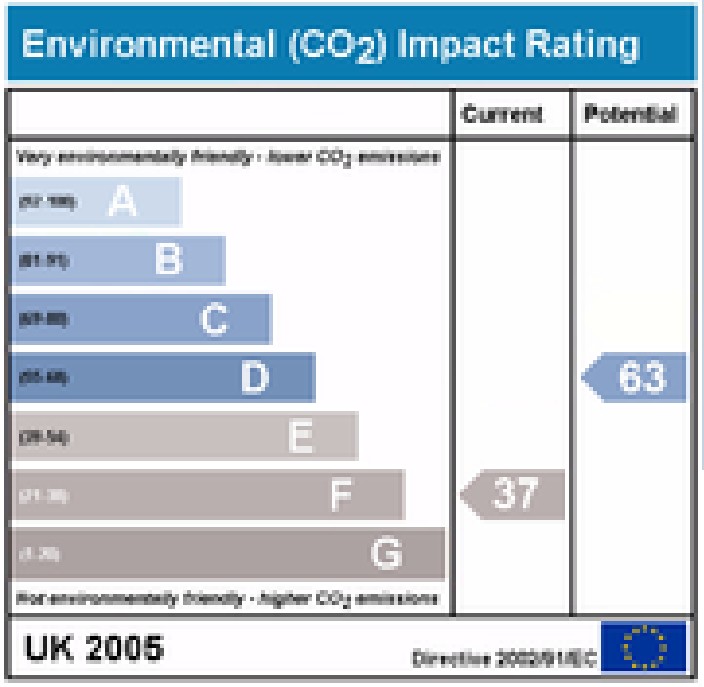
Current average = D

Policy by 2030/35 = C

For climate change, by 2050 = A

+ recommendations for improvements





Blower door for air leakiness @ pressure

EPC functions – compare buildings vs recommendations to occupants

Compare buildings, eg at point of sale / rental

- All assumed to be warm
- Uniform fuel prices
- Occupancy based on m^2
- Standard, theoretical

Recommendations – standard

- Not related to occupants / their wishes
- Generic savings
- Want specific

eci

UNIVERSITY OF OXFORD

EPC failings

In recent consultations – not helping householders:

- Only 5 / 145 respondents thought reliability of EPCs ‘good’
- 6% of householders knew their EPC rating
- 2% of householders acted as a result of the EPC

- EPC has to be shown to prospective purchasers or renters – not enforced for renters

Not helping policy:

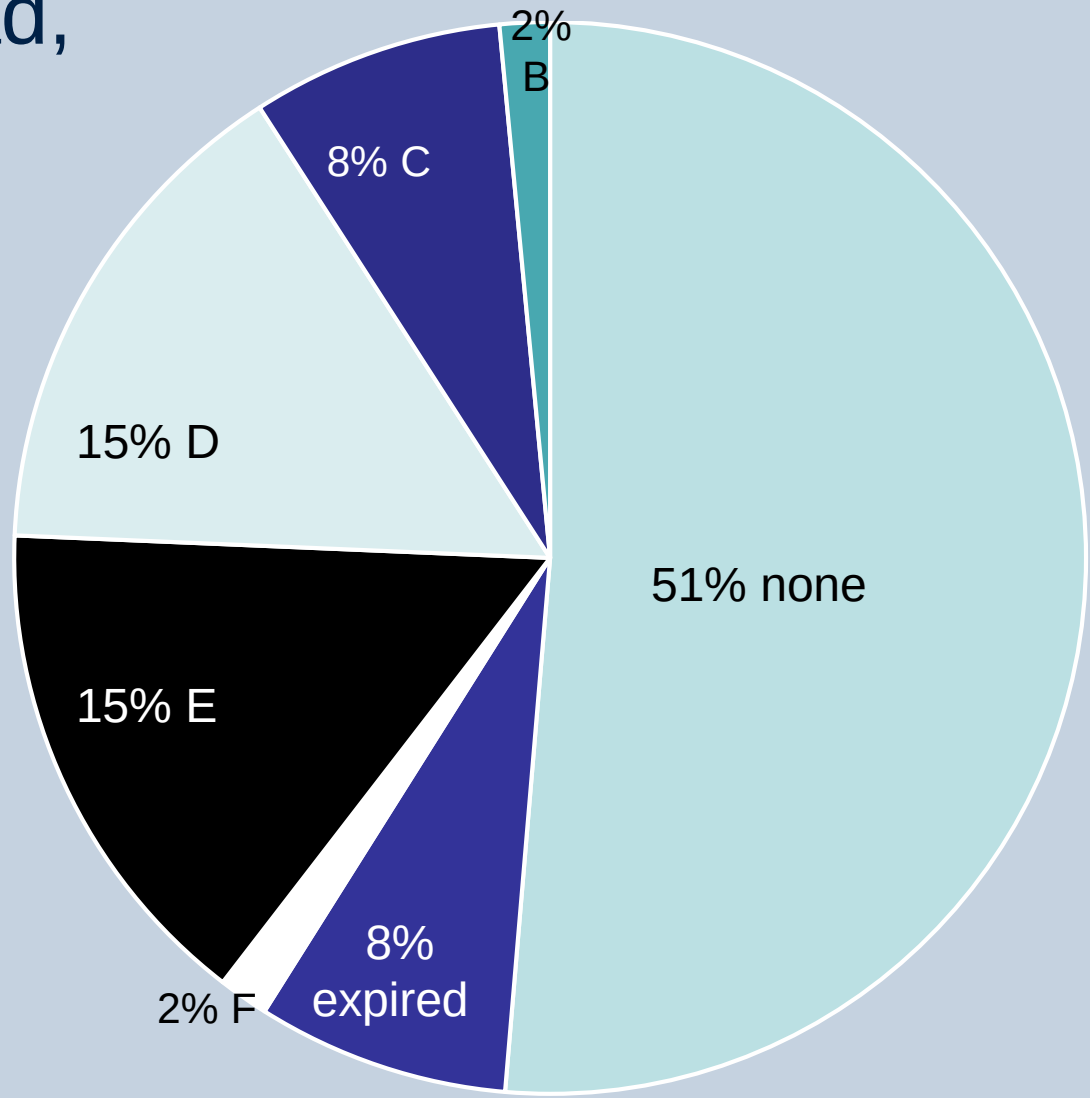
- Perhaps 25% of band D properties listed as band C*
- Misclassification/ inaccuracy disrupts policy
- Policy based on bands is good, but encourages cheating

*Crawley et al 2019

eci

UNIVERSITY OF OXFORD

EPCs – our road, 57 properties



Space heating – delivered energy

- Severely fuel poor — 400 kWh/m^2 pa
- UK housing stock, 2016 — 150 kWh/m^2 pa
- Enerphit (retrofit) — 25 kWh/m^2 pa
- Passivhaus (new build) — 15 kWh/m^2 pa

eci

UNIVERSITY OF OXFORD

Passivhaus living – before Covid

eci

UNIVERSITY OF OXFORD

Housing - Minimum energy efficiency standards

Aspiration – “as many homes as possible to be EPC Band C by 2035 where practical, cost-effective and affordable” (Clean Growth Strategy 2017)

Failed or failing with:

- fuel poverty
- privately rented sector
- point of sale or rent

eci

UNIVERSITY OF OXFORD

Rate of progress – whole housing stock

- 1996 - 2018 = 0.88 SAP points increase pa
- 2018 - 2050 = 1.14 SAP points pa
- 30% faster

- At 100 by 2050

eci

UNIVERSITY OF OXFORD

EPC Action Plan, September 2020

- 35 proposals, 12 of which to be completed in 2020
  - We will consult / investigate / consider / improve …
  - We will ensure … x 1
  - ‘We will ensure that EPCs are accurate and may be relied upon for use in other government policies …’

Alternative option

- Add in personal consumption data = DEC (display energy certificate) for homes

Buildings and policy

	Property owner **Theoretical energy use: mainly gas**	**Occupant** **Actual energy use: includes all electricity**
Residential	Minimum standards based on EPC 83% of all energy in 2018	Personal carbon allowances 100% of all energy
Business	Minimum standards based on EPC ~69% of all energy	Display energy certificates 100% of all energy

eci

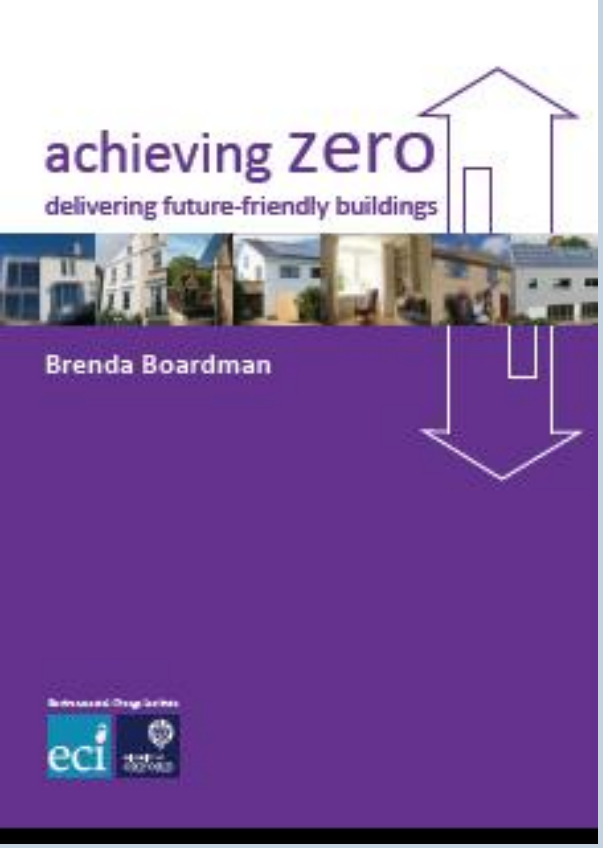
UNIVERSITY OF OXFORD

Nudging behaviour

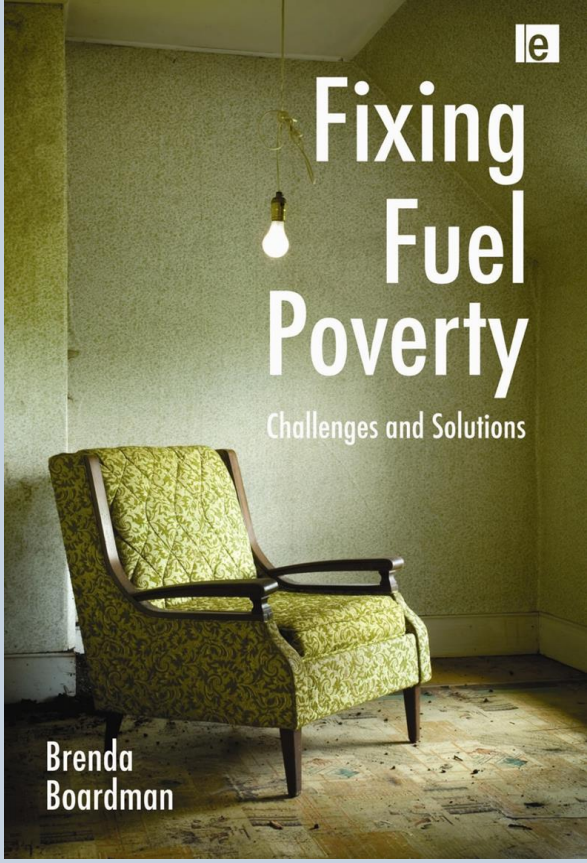
- Personal carbon allowances – David Fleming; ECI/LCF
- Fee and dividend – American students; James Hansen
- Both:
  - Every household / person included
  - 100% of money kept in scheme, no government rake-off
  - Progressive, not regressive
  - Poorest 50-70% better off
  - Becomes tighter over time
  - Affects behaviour, partly through price / trading & psychologically
  - Instead of carbon taxation
  - All commodities (F&D) vs direct energy purchases (PCA)

Lessons

- Labels on
  - appliances are accurate, visible, understood, often acted upon
  - houses are of variable quality, rarely visible, unnoticed
- Minimum standards for
  - appliances effective – manufacturers given good notice
  - houses – minimal awareness, difficult to interpret/achieve
- Post-Brexit – what will happen to appliance standards?
  - If equivalence not maintained, a risk of dumping
  - UK could / should unilaterally introduce tougher standards – be proactive, especially lighting



Thank you



Brenda.Boardman@ouce.ox.ac.uk

eci

UNIVERSITY OF OXFORD

Appliance trends UK 1990-2019

	1990	2019
households	22.7m	27.8m
owning more appliances	212m	715m
appliances / hh (exc lighting)	9	25
light bulbs / hh	20 (1994)	34