

# Towards a customer-centred clean energy transition

Chris Dunstan, Chief Research Officer

Reliable Affordable Clean Energy for 2030 Cooperative Research Centre

**RACE for  
2030**

RELIABLE  
AFFORDABLE  
CLEAN  
ENERGY

Presentation and Panel Discussion, IRED 2022

25 Oct 2022



Australian Government  
Department of Industry, Science,  
Energy and Resources

**AusIndustry**  
Cooperative Research  
Centres Program

## What is RACE for 2030?

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A 10-year, \$350m Cooperative Research Centre (CRC), involving 70+ industry, research and government partners.



## Our Mission

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Drive innovation for a secure, affordable, clean energy future.



## Our Vision

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A flourishing low carbon Australia, where energy research improves quality of life and boosts energy productivity.



## Network and Retailers



## Government



## Research



## End Users and Associations



2030

# Technology, manufacturing and start ups



# International



# Towards a customer-centred clean energy transition

## 1. Purpose

- Clear, relevant objectives: what do customers/people want?

## 2. Participation

- Meaningful, appropriate consultation and engagement; trust building.

## 3. Pricing

- Cost reflective prices can reduce total costs, but see #1 and #2

## 4. All relevant costs

- What is relevant? See #1 and #2 (networks, firming, climate, etc)

## 5. All feasible options

- Including: energy efficiency, behaviour, pricing, regulation, standards, incentives

# Catalysing market transformation

## Key inputs (by 2030):

- \$68.5m Commonwealth funds
- \$87m Partner funds
- \$194m Partner In-kind, labour etc
- \$349.5m TOTAL**

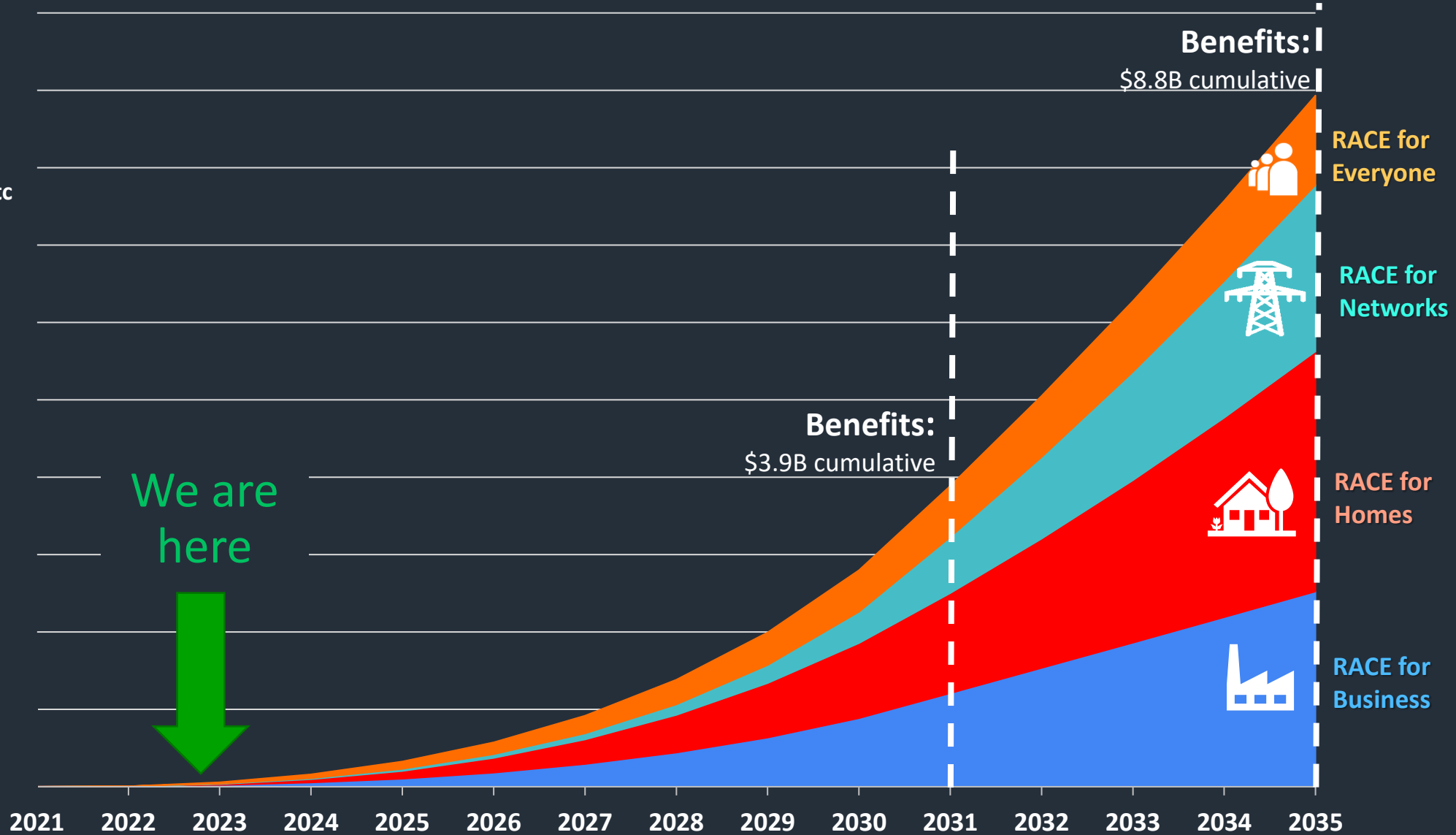
## Research impact targets

(by 2034/35)

- Cut customer energy bills by \$8.8 billion
- Cut emissions by 20 Mt CO<sub>2</sub>

## Impact leverage:

>56x (by cash)



# RACE Research Programs and Themes



## RACE for Business

Value chain optimisation to transform energy productivity **B1**

Industry 4.0 for energy productivity **B2**

Electrification and renewables to displace fossil fuel process heating **B3**

Flexible demand and demand control technology and development **B4**

Onsite anaerobic digestion for power generation and natural gas/diesel displacement **B5**



## RACE for Homes

Residential solar pre-cooling **H1**

Enhancing home thermal inertia **H2**

Using home energy technologies for grid support **H3**

Rewarding flexible demand: Customer-friendly cost reflective tariffs and incentives **H4**

Smart algorithms for optimising home energy supply and use **H5**



## RACE for Networks

Electric vehicles and the grid **N1**

Low cost visibility of network conditions **N2a**  
Assessing and mapping the hosting capacity of energy networks **N2b**  
Integrating solar, energy storage and flexible loads with DER networks **N2c**

Algorithms and analysis for cost effective micro-grids **N3a**  
Storage as a Service: Distributed community batteries **N3b**

Distribution system operator and beyond: Optimising planning and regulation for DM and DER **N4**



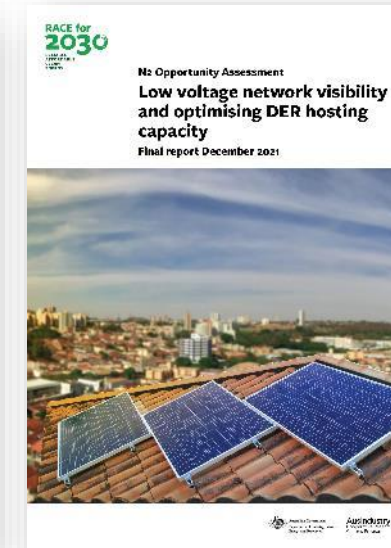
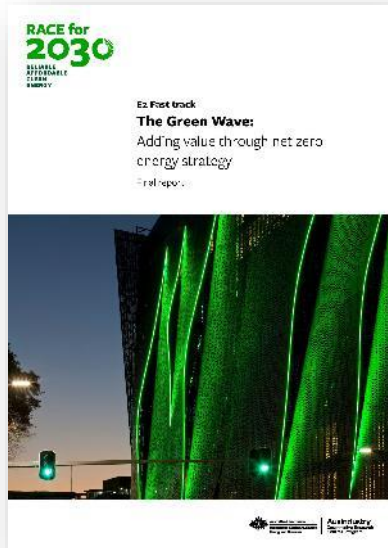
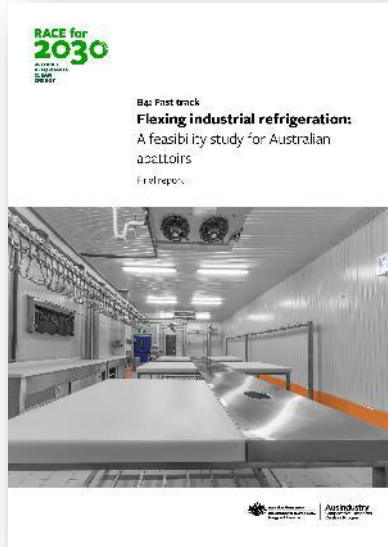
## RACE for Everyone

Trust building for collaborative win-win customer solutions **E1**

Innovative foresighting and planning **E2**

Developing the future energy workforce **E3**

# Research Activity



**16** completed projects  
**52** active projects

**Completed projects:**

**9** Opportunity Assessment reports

**7** Fast Track projects

**Active Projects:**

**7** Opportunity Assessment projects

**22** Fast Track projects

**5** Standard Track projects

**18** Industry PhDs



# RACE for 2030 FY23 Research Plan

**RACE for  
2030**  
RELIABLE  
AFFORDABLE  
CLEAN  
ENERGY



# Priority projects in FY23 Research Plan

Title	Est. Budget (cash only)	Est. start	Status
<b>Power Flex</b> (Business solutions for minimum demand)	\$1.25M	Mar '23	Partner co-design process initiated (input invited)
<b>Low energy and carbon cement</b>	\$2.1M	Oct '22	Approved by RACE for 2030 Board
<b>Energy upgrades for Australian Homes</b>	~\$1.5M	Mar '23	Full Application in draft (input invited)
<b>Solar pre-cooling &amp; pre-heating pilots</b>	\$1M	May '23	In development (input invited)
<b>Strategic EV Integration</b>	\$3.6M	Oct '22	Approved by RACE for 2030 Board
<b>Network visibility &amp; hosting capacity</b>	\$1.5M	Mar '23	Call for proposals closed. Under evaluation
<b>Pathways to Net Zero Precincts</b>	>\$1M	Mar '23	Call for proposals closes 28 Nov 2022
<b>Customer priorities &amp; trust in energy sector</b>	\$150k	Oct '22	Project contract signed.

# RACE for Business – current projects

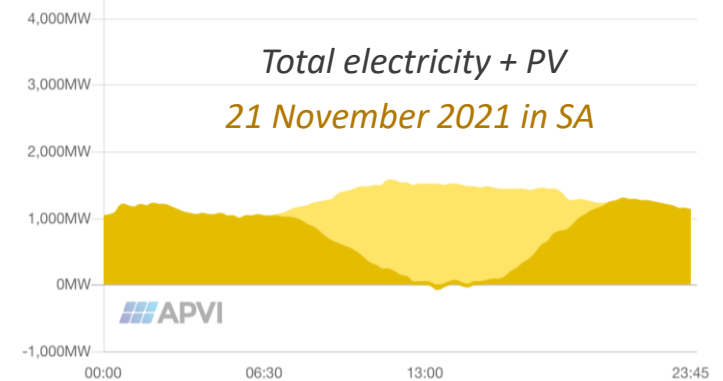
## Efficient CO<sub>2</sub> Refrigeration for Supermarkets



24/7 Renewables: Real-time renewable energy tagging for corporate decarbonisation.



Energy Trends Visualisation: Communicating critical energy sector trends



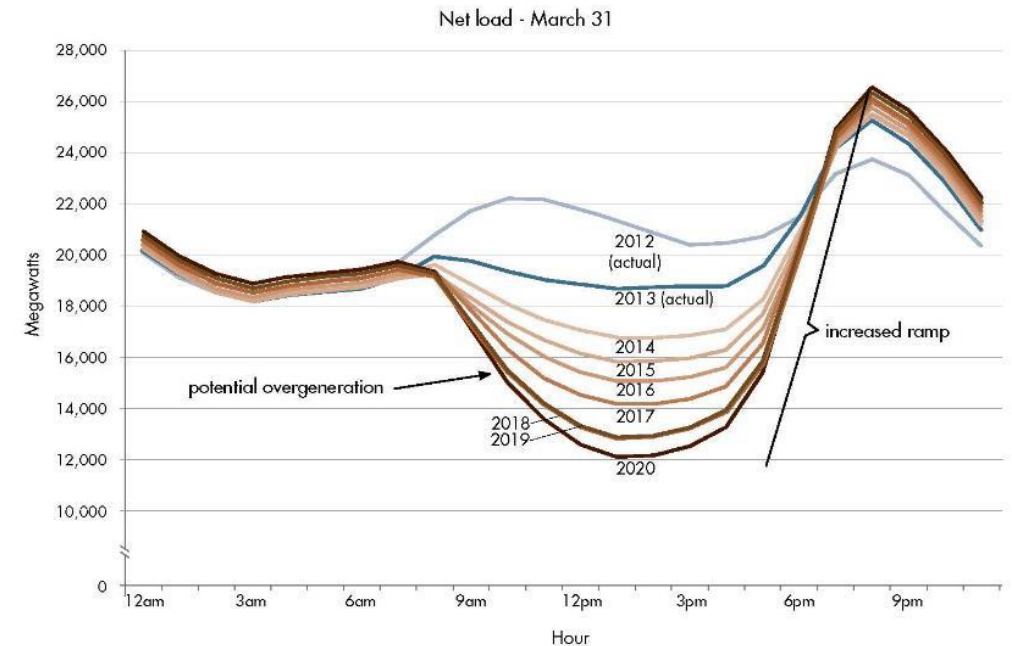
# RACE for Business – new priority projects

**Low energy and carbon cement:**  
Developing local, low-carbon  
cementitious materials



**Business Power Flex:**  
Customer solutions to minimum demand

THE DUCK CURVE  
(Net load chart)



# RACE for Homes - current projects

**Carseldine Village Living Laboratory:**  
Demonstrating smart, energy efficient medium density residential development



**SolarShift:** Using existing residential water heaters as a “solar sponge”



**Renovate or Rebuild:** Empowering efficient home renovations via reality TV



# RACE for Homes – new priority projects

Energy upgrades for Australian homes



Residential solar pre-heating & pre-cooling pilots



# RACE for Networks - current projects

## Business Fleets & Battery Electric Vehicles: Tax reform opportunities for EVs



## DER Network Solutions: Opportunity Assessment



# RACE for Networks – new priority projects

**Strategic EV integration:**  
Research support for 3 EV network integration trials (smart charging & V2X)



**Network visibility & hosting capacity:**  
Enhancing dynamic DER hosting capacity





# RACE for Everyone - current projects

**Innovative fore-sighting and planning:**  
Towards least cost planning for the  
Australian electricity sector



**Defining Energy Efficiency in the  
Australian Energy Employment Report**



# RACE for Everyone – new priority projects

**Pathways to Net Zero Precincts:**  
Facilitating practical local decarbonisation



**Customer priorities & trust**  
in the energy sector





**Thank you**

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# RACE for 2030 CRC

## Panel Discussion

Chair: Kate Callaghan, CSIRO

Paul Roberts, Head of Corporate Affairs, SAPN

Chris Dunstan, CRO, RACE for 2030

Melissa Muller, SA Node Mgr, RACE for 2030

John McKibbin, Energy Networks Lead, CSIRO

# Energy Upgrades for Australian Homes project

To research and develop a coordinated, practical and equitable **framework** to reduce energy bills and carbon emissions and improve comfort significantly by upgrading **millions** of existing Australian homes by 2030.

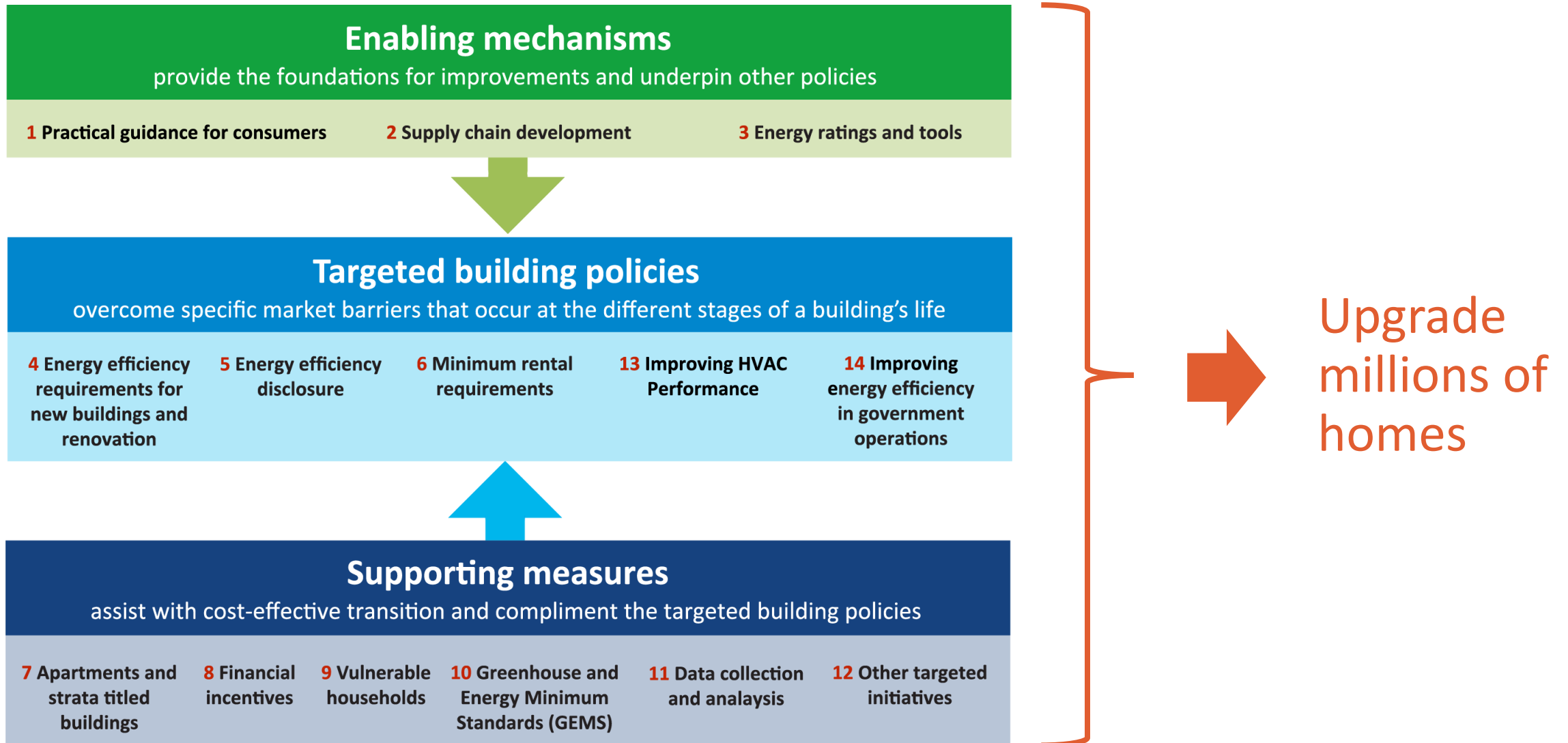
# Upgrading homes is a big deal.

~10 million Australian homes (x 10MWh pa)  
 Electricity and gas bills: ~\$2k per home pa  
 = **~\$20 billion pa**  
 Emissions: **~60 Mt CO<sub>2</sub> pa**

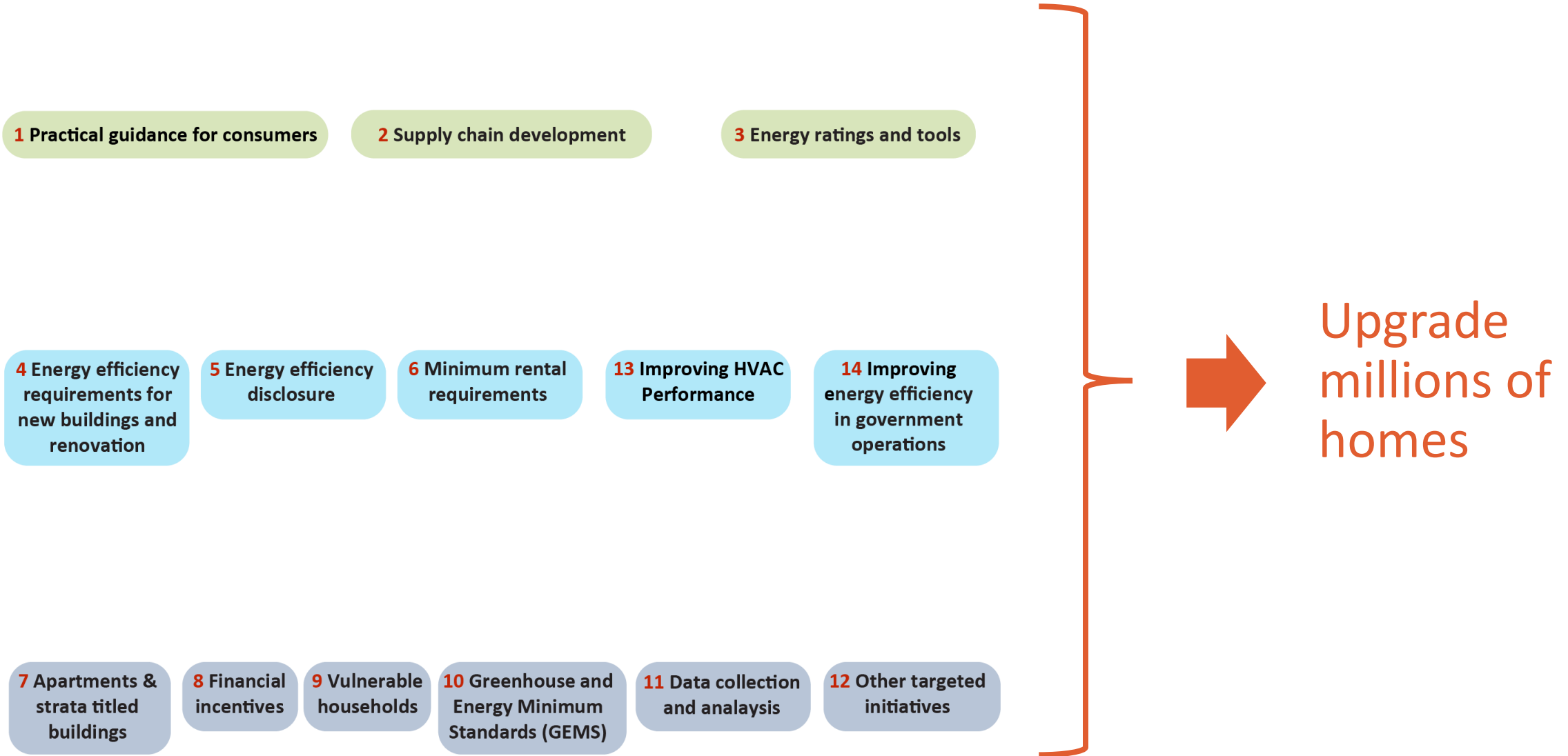
~15 million passenger cars  
 Petrol (cars): 12,000 km/yr x 11l/100km x \$2/litre  
 = **~\$40 billion pa**  
 Emissions: @3tCO<sub>2</sub> per car: **~45 Mt CO<sub>2</sub> pa**

Home upgrade	Investment (Indicative)	Saving \$pa (Indicative)	Emission saving (t pa) (Indicative)
Insulation/draught seal	\$5,000 (up to \$20k)	\$300	1
Rooftop PV (5kW)	\$5,000	\$1,000	5
Upgrade Hot Water	\$3,000	\$300	1
Upgrade HVAC/fans	\$3,000	\$200	1
Home energy mgt system	\$1000	\$200	0
Home battery (excluded)	\$10,000 (excluded)	\$500 (excluded)	0 (-ve?)
EV & two-way smart charger	\$50,000 (x 50%)	\$2,000	2
<b>Total per home</b>	<b>\$42,000</b>	<b>\$4,000</b>	<b>10</b>
<b>x 5 million homes &amp; cars</b>	<b>\$210 billion</b>	<b>\$20 billion</b>	<b>50 million tCO<sub>2</sub> pa</b>

# (National) Trajectory for Low Energy Buildings

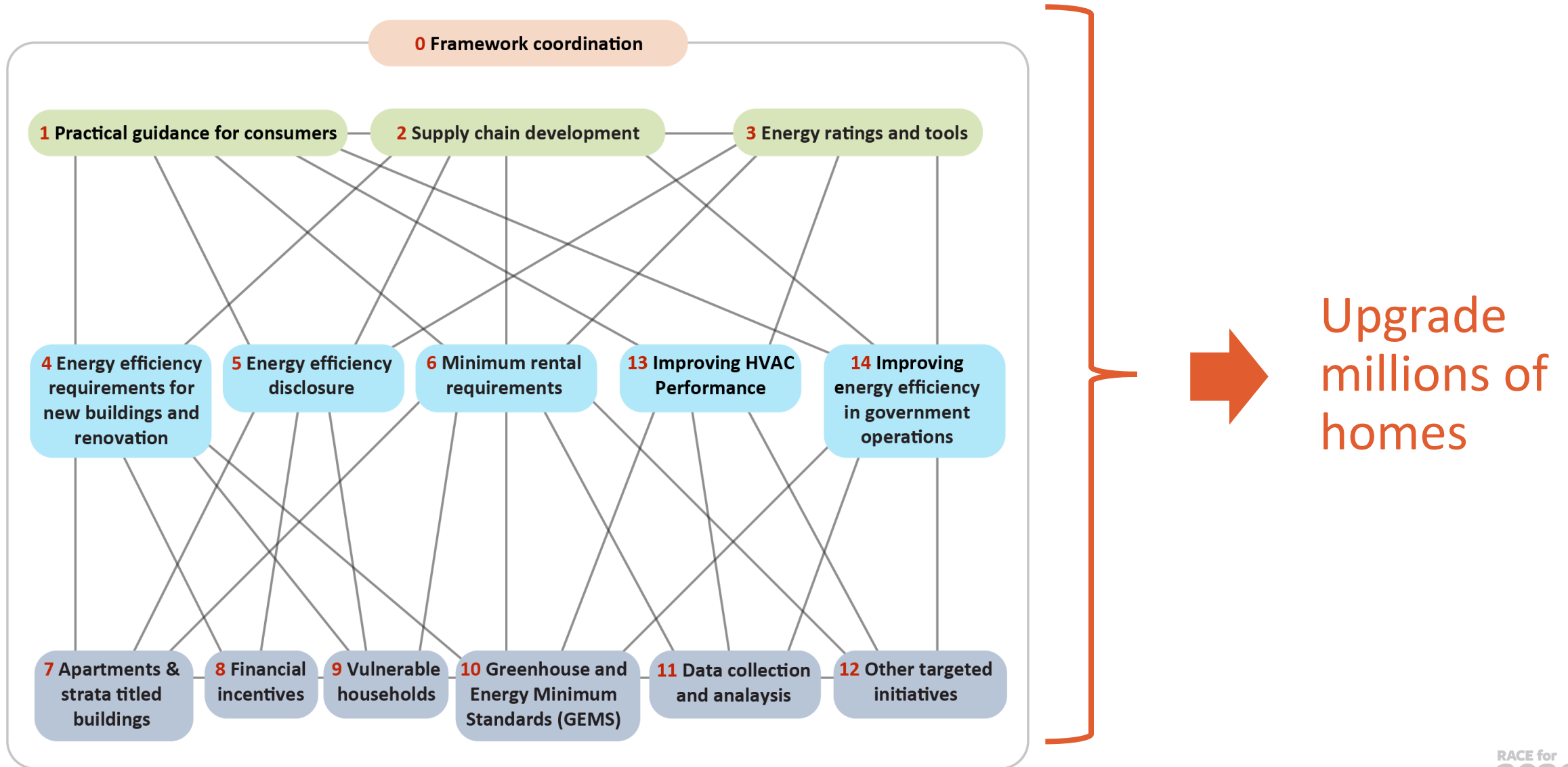


# (National) Trajectory for Low Energy Buildings

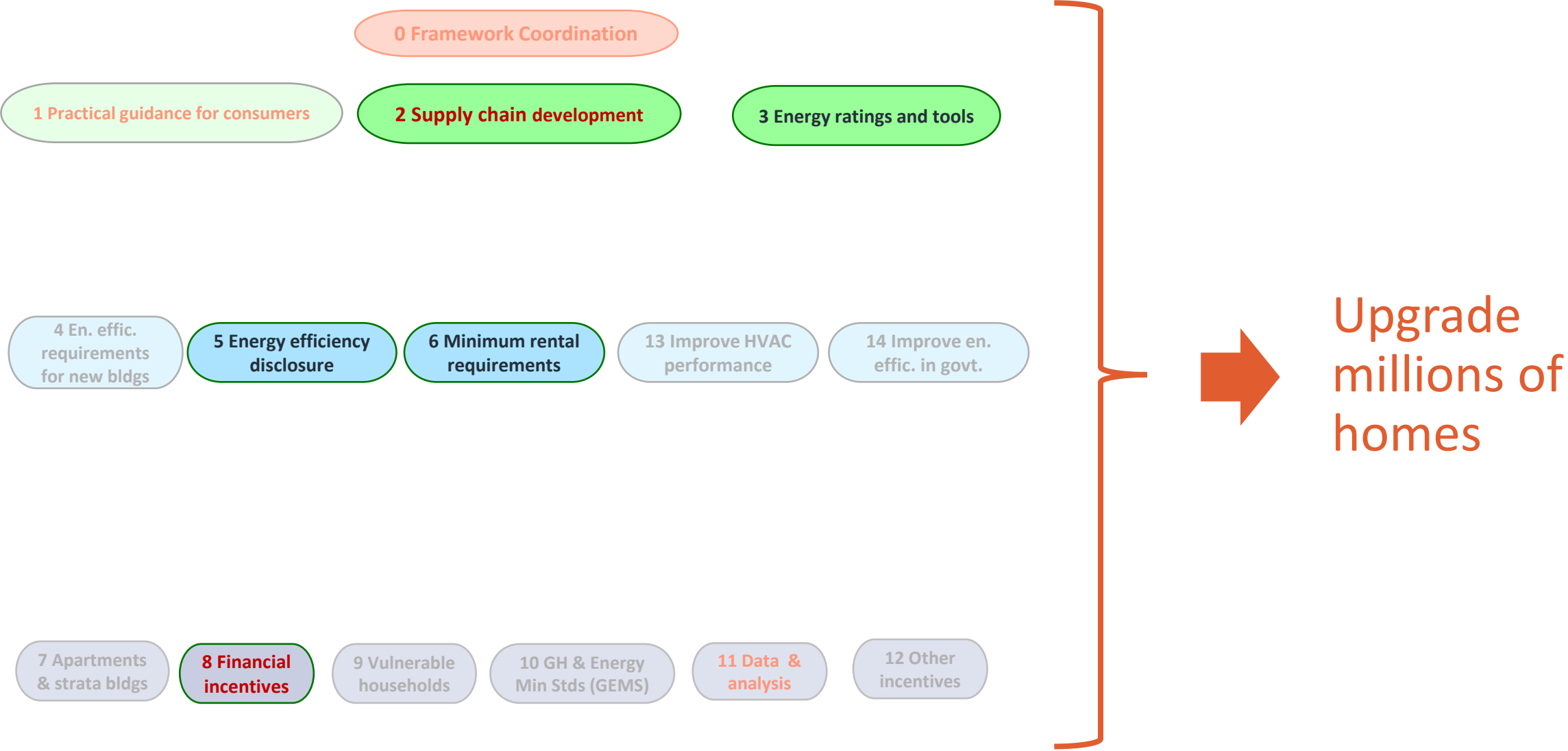




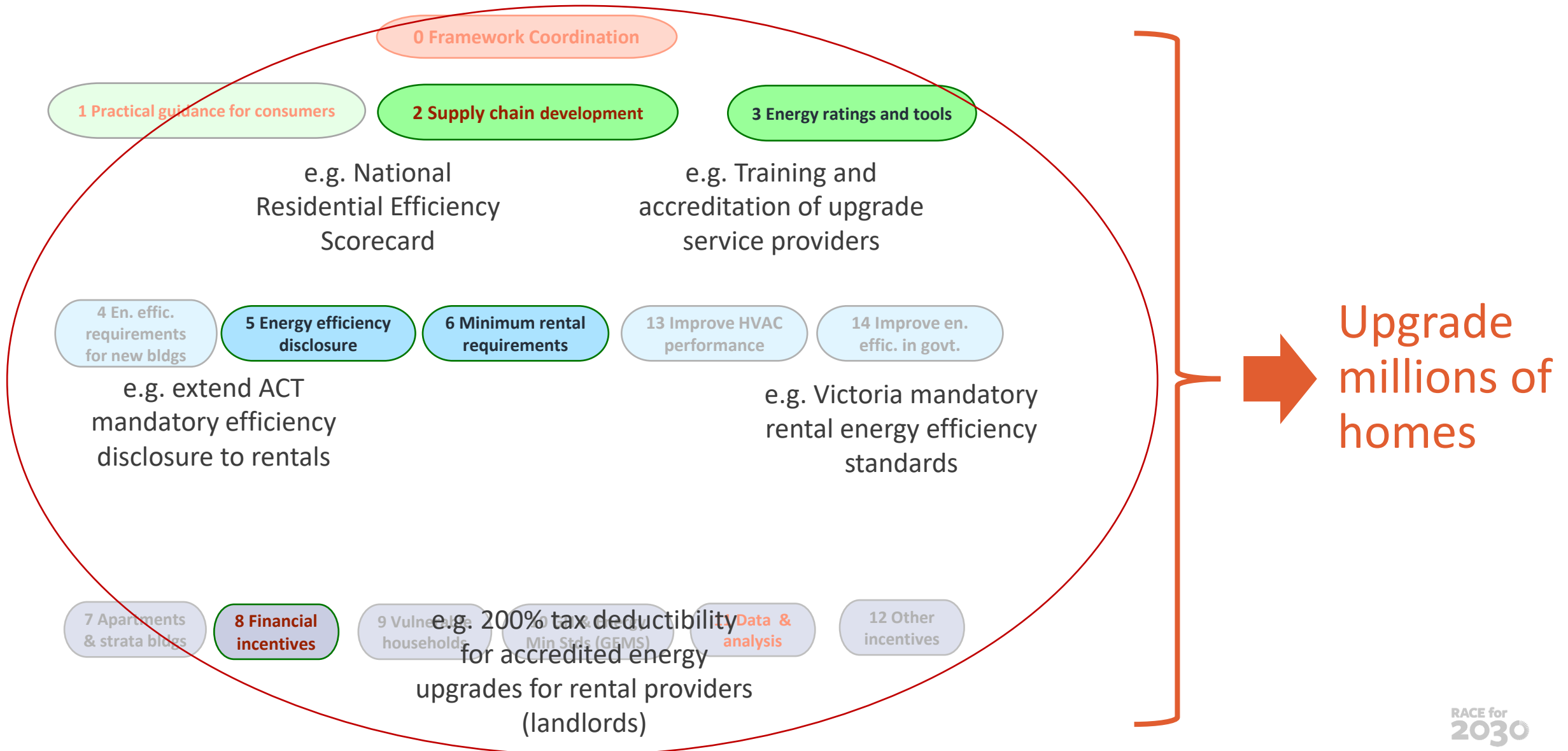
# ... provides a framework for upgrading existing homes



# e.g. a 'minimum viable framework' (for rental homes)



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**Thank you**

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# Industry PhD Projects in Progress (Rounds #1, #2 & #3)

Project ID	Project Title	Industry Partner	Round	Start	Status
22.B1.P.0391	B1: Optimising the total cost of ownership of a central chilled water plant	Exergenics	#3	Jan-23	Student recruitment
21.B4.P.0164	B4: Fast-track to net zero carbon buildings	Buildings Alive	#1	Sep-22	Student enrolment
21.B4.P.0219	B4: Data innovation for zero carbon buildings	Buildings Alive	#2	Jan-22	In progress
22.B4.P.0392	B4: Maximising renewable energy for water corporations	Sydney Water	#3	Jan-23	Student recruitment
21.B5.P.0217	B5: Optimal design of biogas power generation system	Sydney Water	#2	Dec-21	In progress
22.B5.P.0403	B5: Anaerobic digestion of sugar mill wastes	Singh Farming	#3	Jan-23	Student recruitment
21.H2.P.0161	H2: Retrofitting of residential buildings	ClimateKIC	#1	Mar-22	In progress
21.H3.P.0162	H3: Small scale green hydrogen solutions	Starling Energy	#1	Jul-22	Student enrolment
21.H4.P.0163	H4: Innovative tariffs and demand response	Ausgrid	#1	Jul-22	Student enrolment

# Industry PhD Projects in Progress (Rounds #1, #2 & #3)

Project ID	Project Title	Industry Partner	Round	Start	Status
21.N1.P.0165	<b>N1: Smart Charging Strategies for EVs</b>	Enzen	#1	Jul-22	Student enrolment
21.N1.P.0215	<b>N1: AI for EV and V2G resources optimization</b>	Planet Ark Power	#2	Jul-22	Student enrolment
22.N1.P.0379	<b>N1: Demand management of V2H and V2G</b>	Planet Ark Power	#3	Jan-23	Student recruitment
22.N2.P.0380	<b>N2: Hosting capacity using artificial intelligence-based techniques</b>	Zeppelin Bend	#3	Jan-23	Student recruitment
22.N2.P.0400	<b>N2: Business models - DER hosting capacity</b>	Planet Ark Power	#3	Jan-23	Student recruitment
21.N3.P.0166	<b>N3: Designing Renewable Micro-Grids</b>	Planet Ark Power	#1	Jul-22	Student enrolment
21.E1.P.0167	<b>E1: Development of an Australian Energy Sector Trust Index</b>	Essential Energy	#1	May-22	In progress
21.E1.P.0168	<b>E1: Renewable microgrid energy solutions</b>	Western Power	#1	Feb-22	In progress
21.E1.P.0169	<b>E1: Approaches of successful start-ups in the energy transition</b>	Solar Analytics	#1	Aug-21	In progress