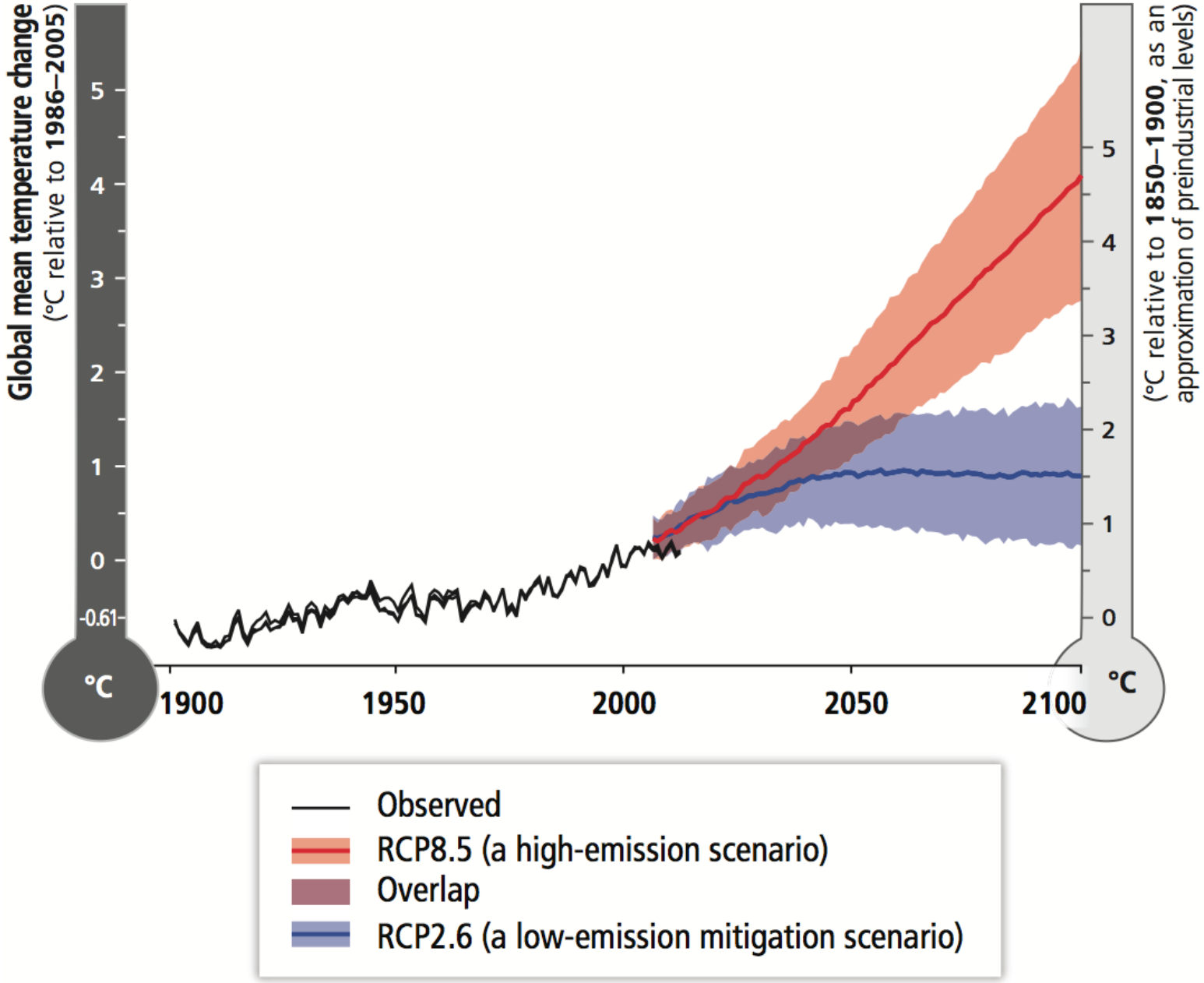
LED Lighting Off the Grid

Peter Alstone

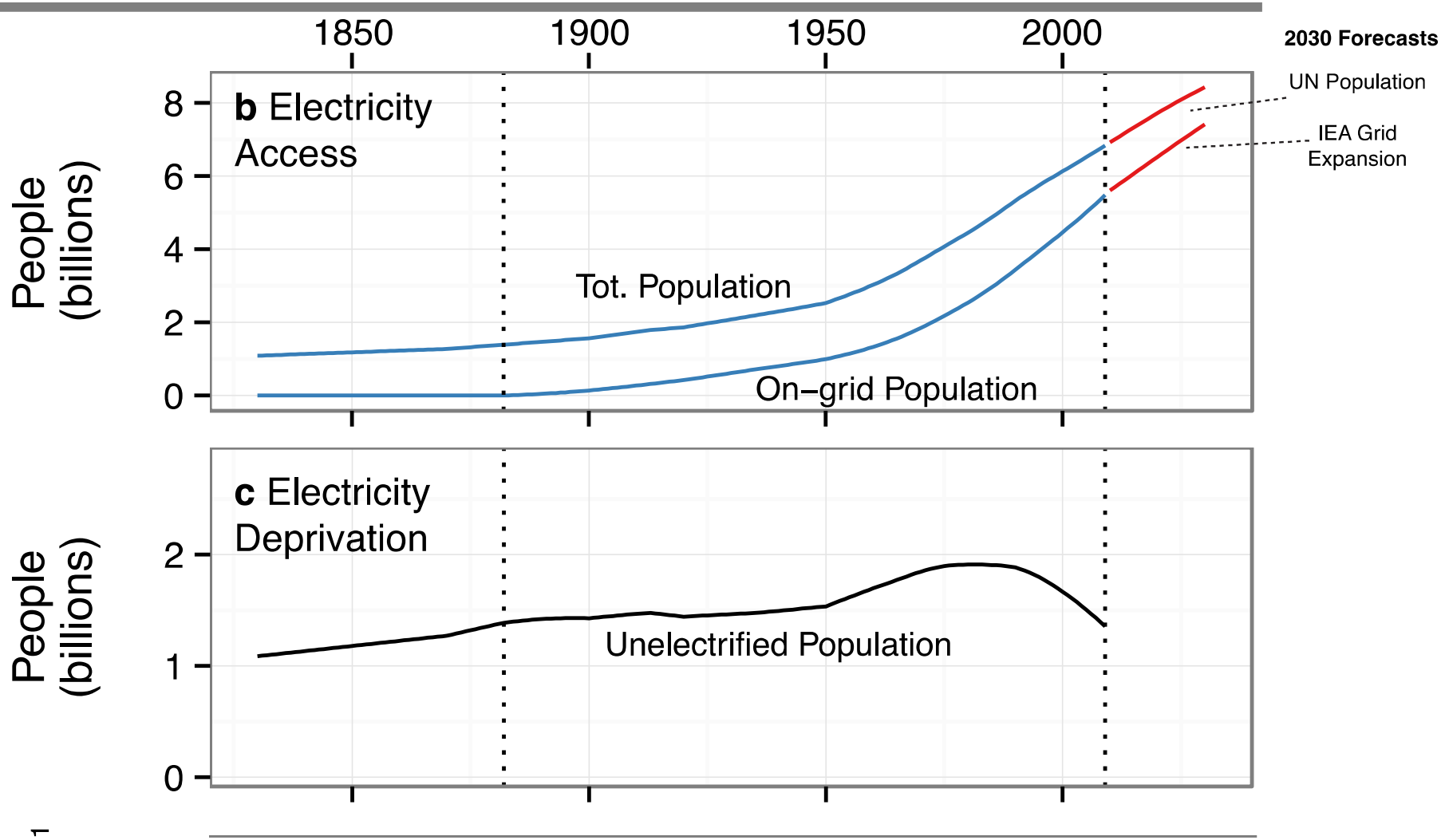
DOE SSL R&D Workshop 2015

January 27 2015



From IPCC AR5 Impacts Summary

Pace of electrification is fast but fails to be universal



Alstone, P., Gershenson, D. & Kammen, D. M. Decentralized energy systems for clean electricity access. *Nature Climate Change* accepted, in press, (2015).

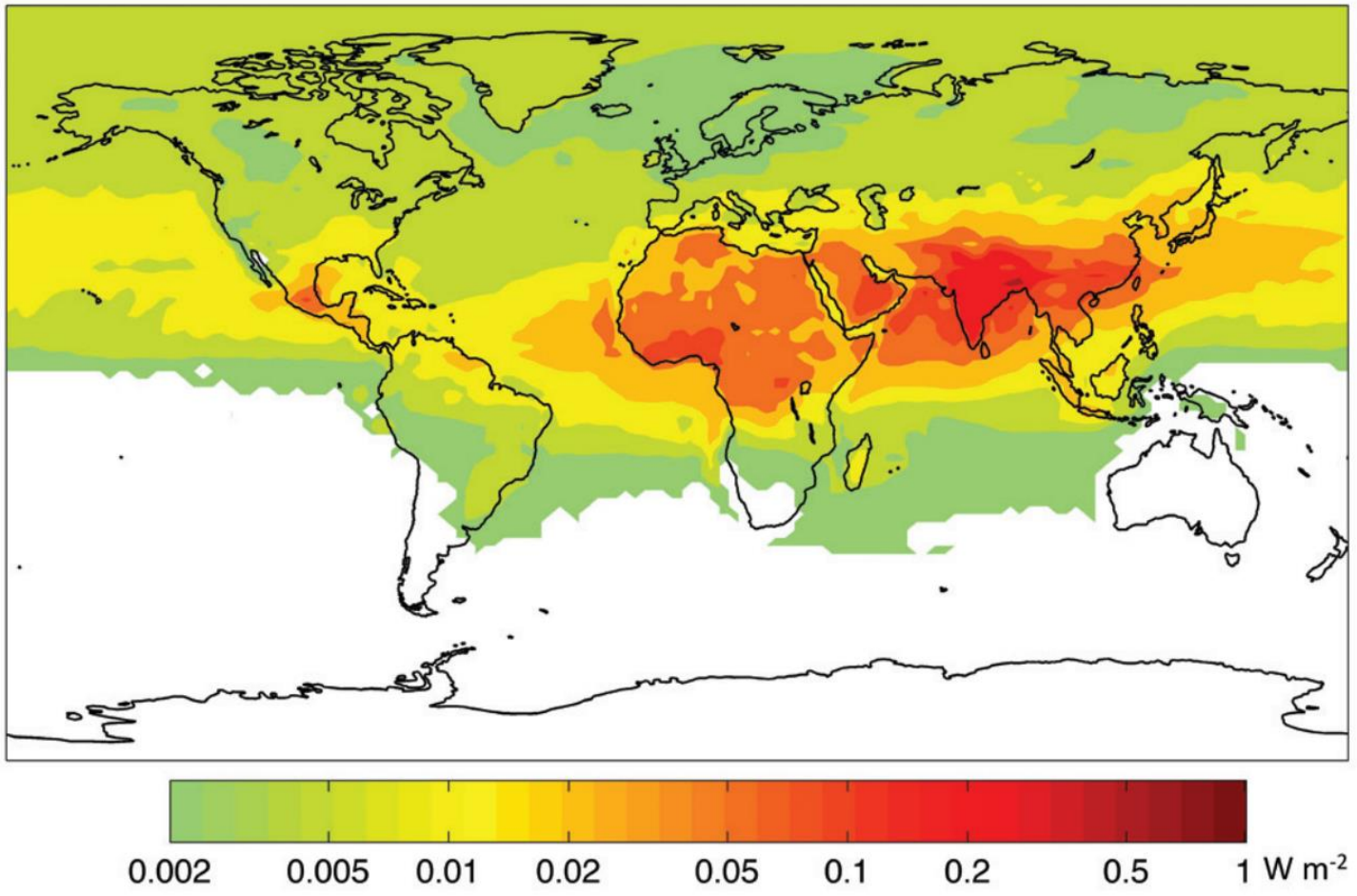
Off-Grid Status Quo :

Fuel Based Lighting

Expensive, Unhealthy, and Inefficient

Kerosene for lighting is a **$10-40 billion per year** industry
(sources: CCAC, 2014, UNEP, 2013; Lighting Global, 2012)

Black Carbon (BC)



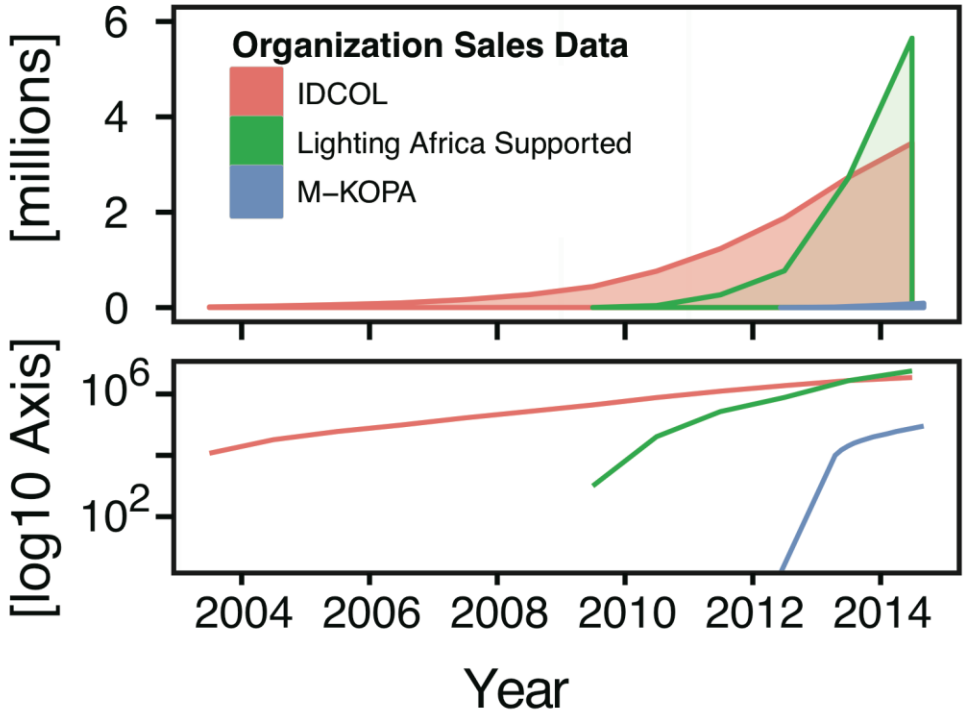
Reproduced from Lam, et al., 2012

Pico-power (~0.1 – 10 Watt solar PV) and solar home systems (10-100 W)

Kellie Jo Brown 2012


Peter Alstone 2014

Fast-growing market for packaged off-grid solar energy systems



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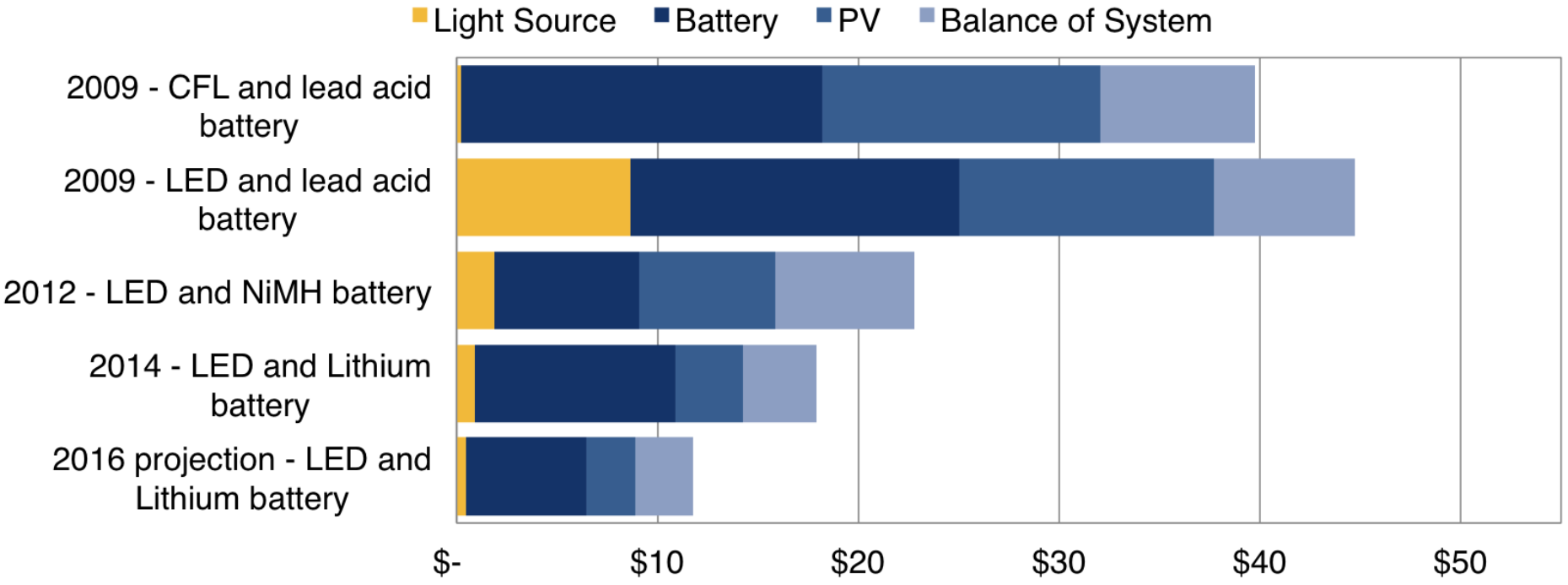
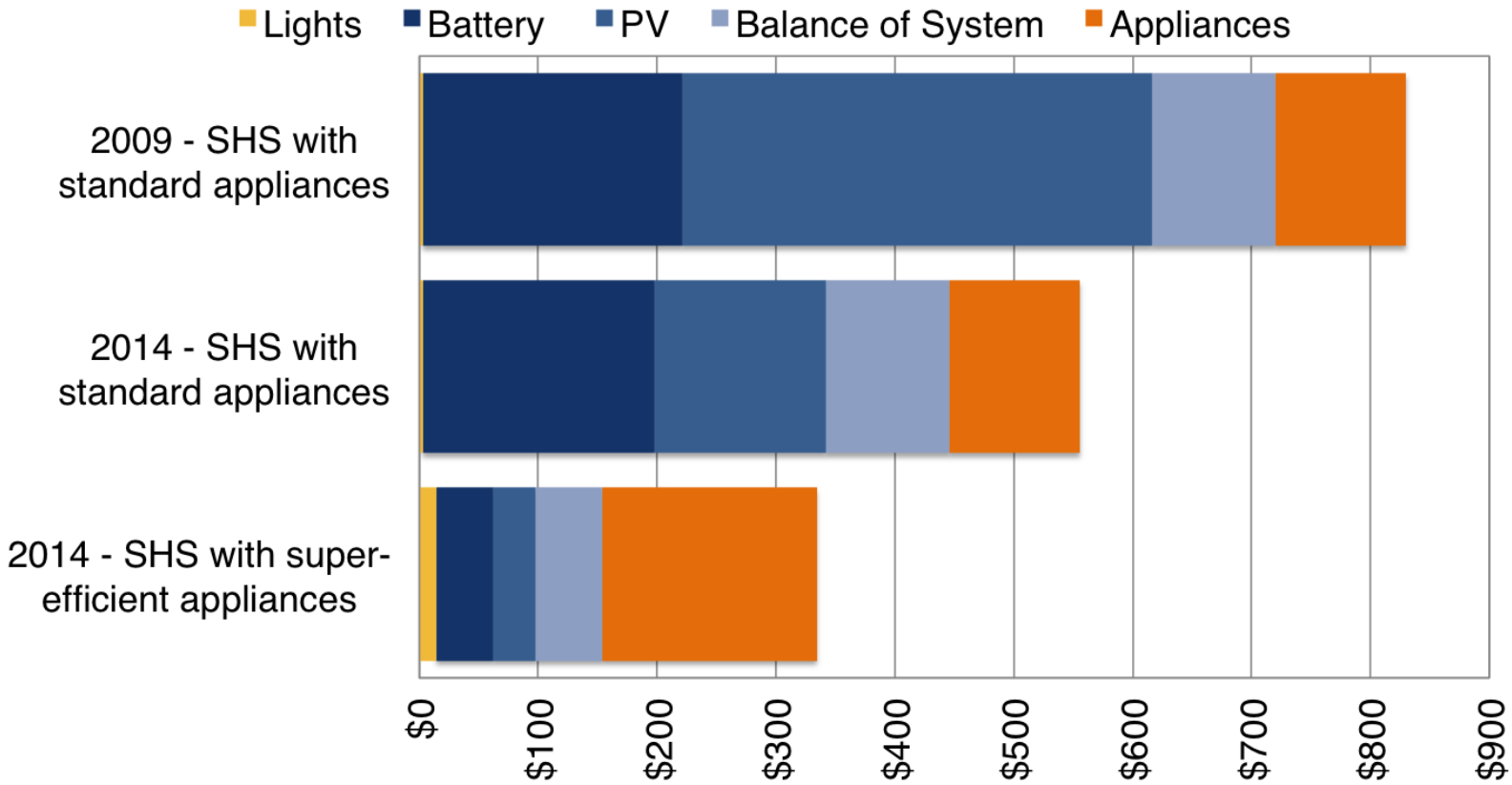
Superefficiency in action: **pico-solar cost declines**



Phadke, A., Jacobson, A., Park, W.Y., Lee, G.R., **Alstone, P.**, and Khare, A. *Super-Efficient Appliances Can Enable Expanded Energy Access Using Off-grid Solar Power Systems* (in preparation for early 2015)

Superefficiency in action: **solar home systems**



Source: ibid

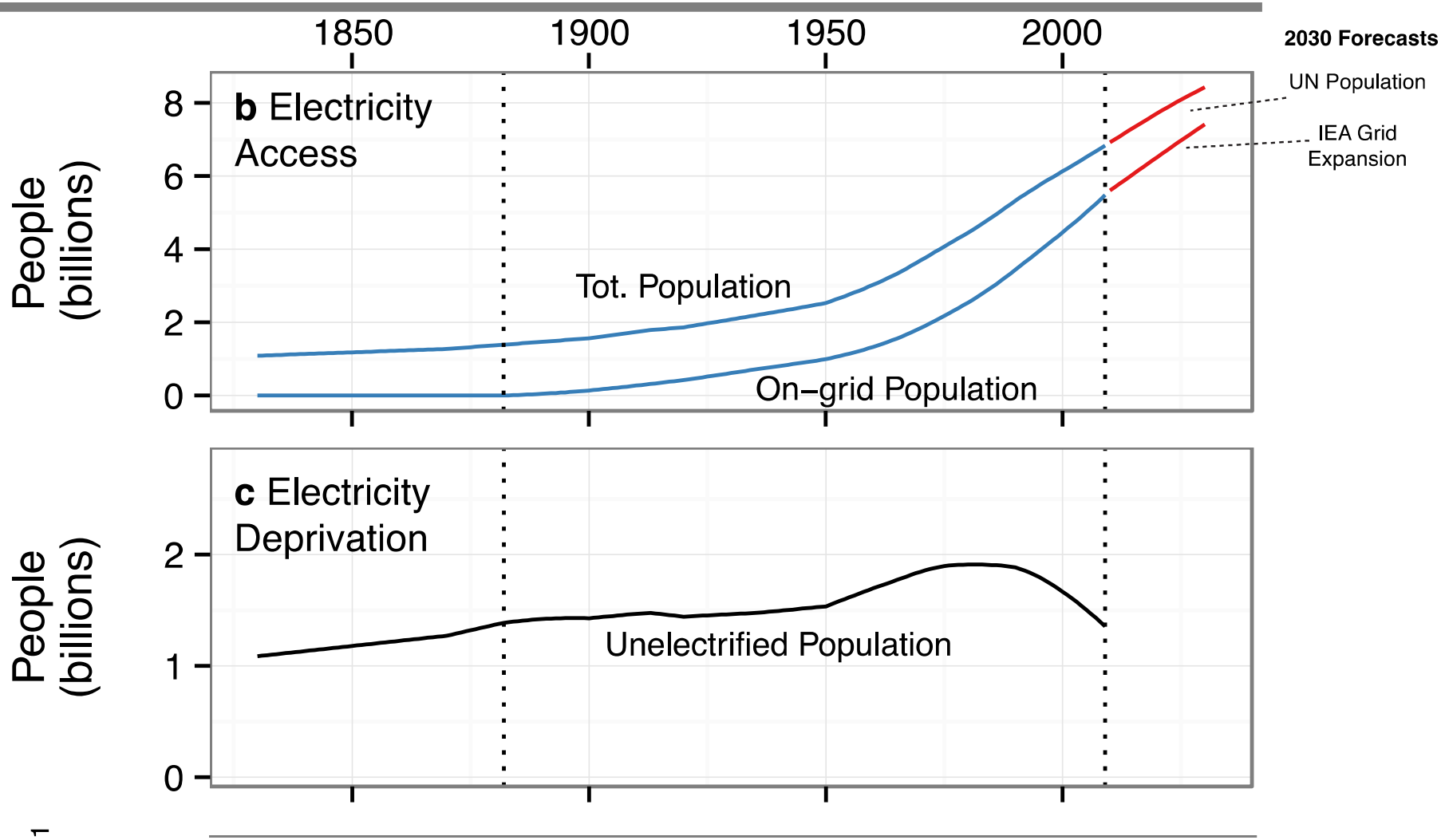
Achieving Universal Access

LED R&D Needs for off-grid power:

- Continued improvements in efficacy, cost, and durability
- Backlighting efficiency in TVs and devices increasingly important

Extra slides

Simultaneous progress possible on access and climate?



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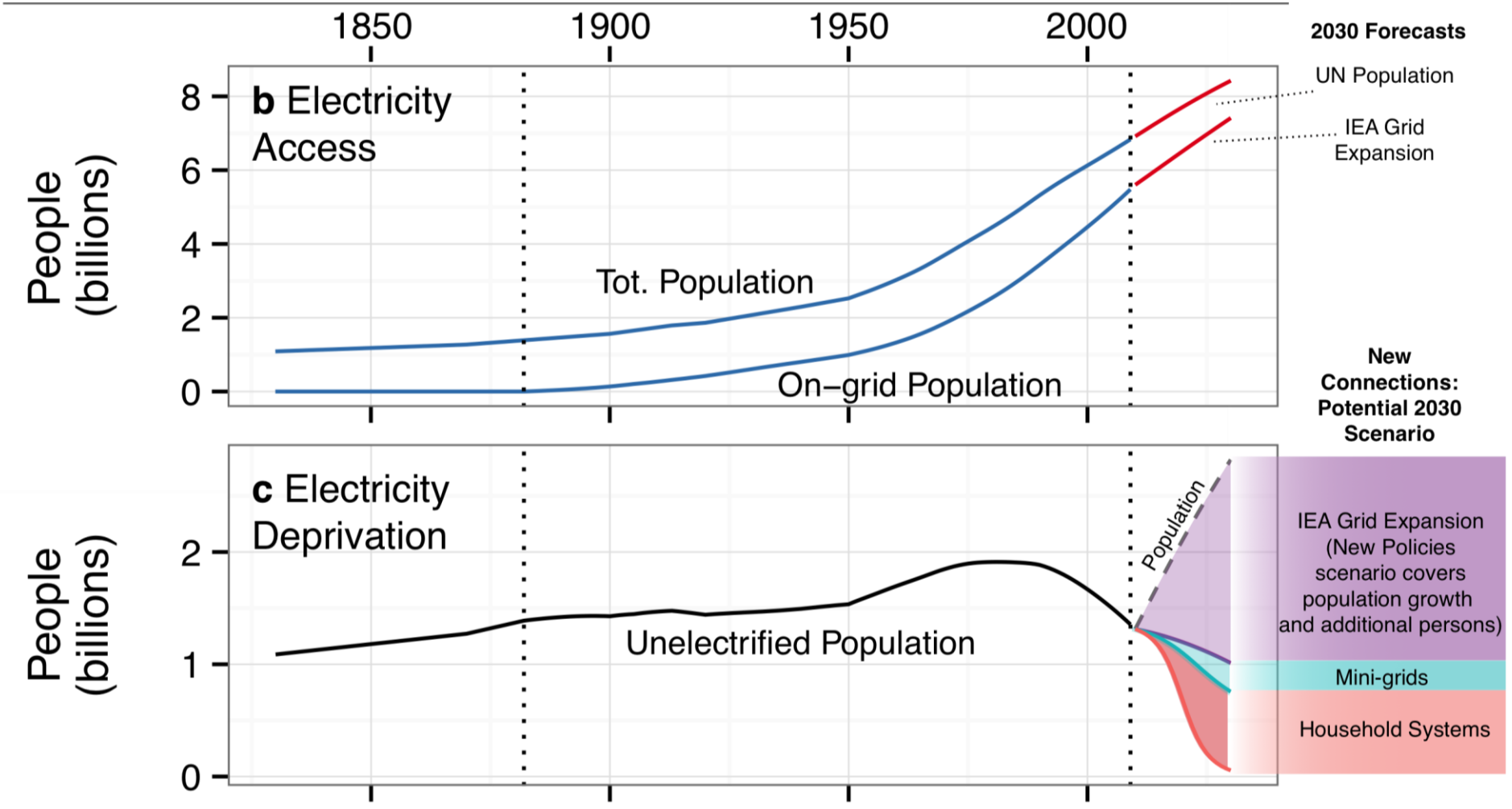
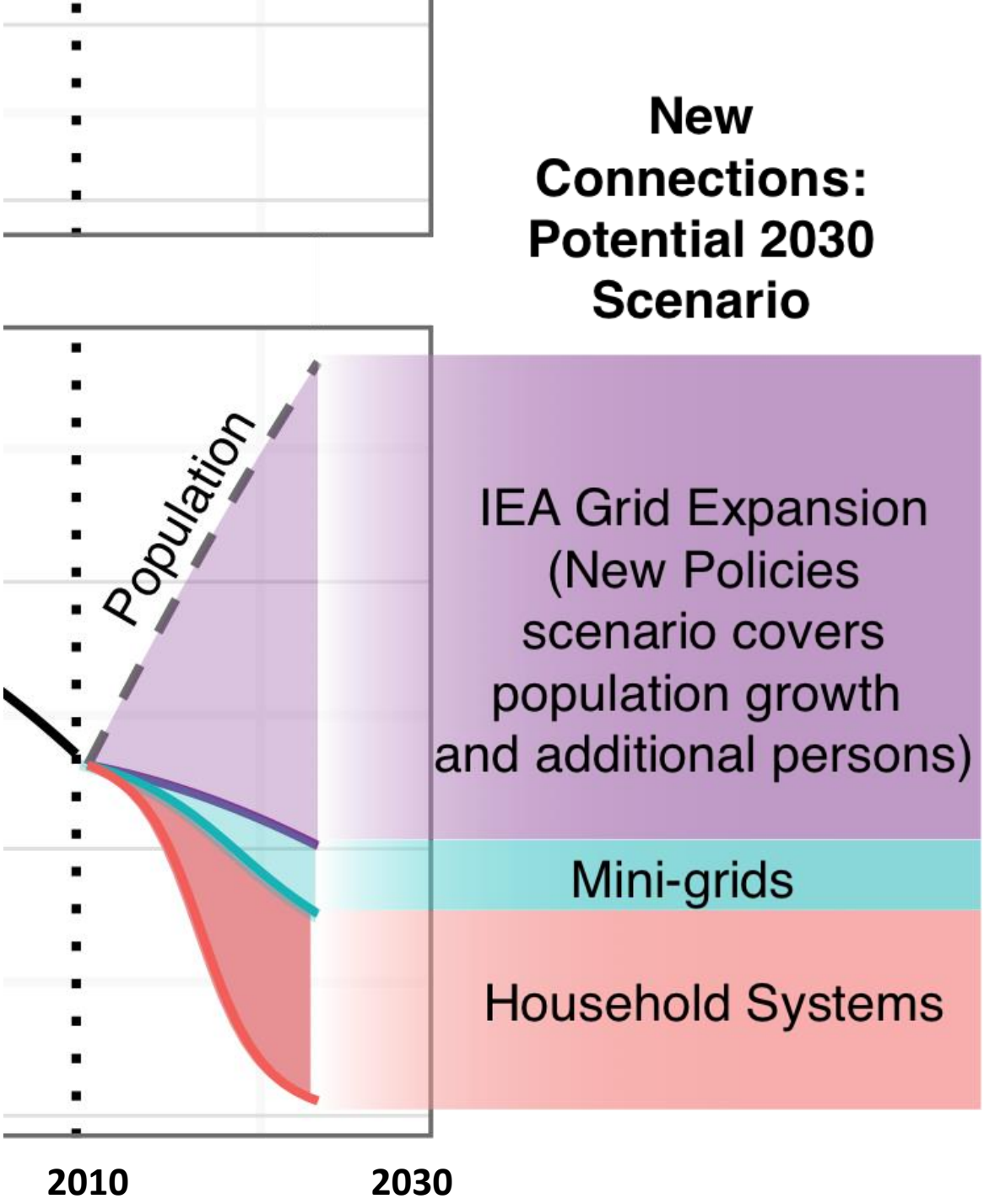
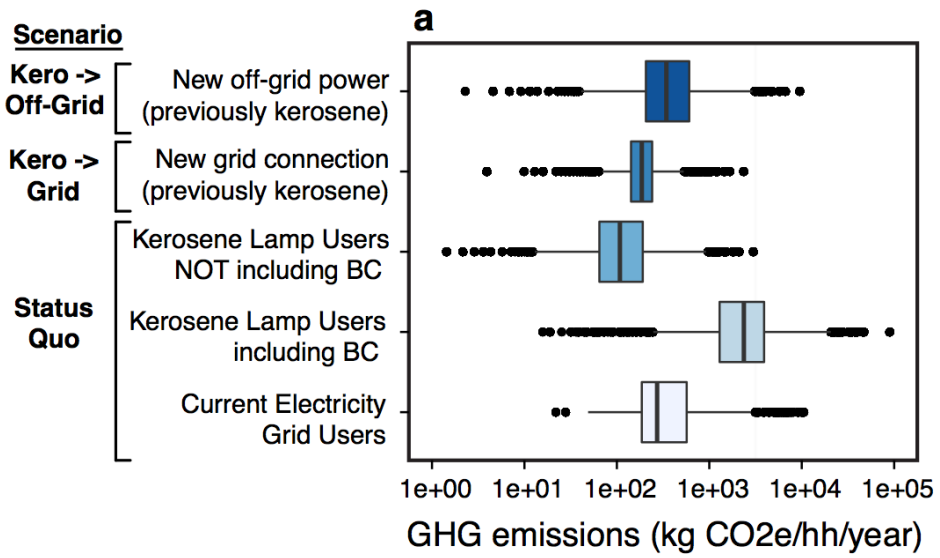
Opportunity for universal electrification with clean power.



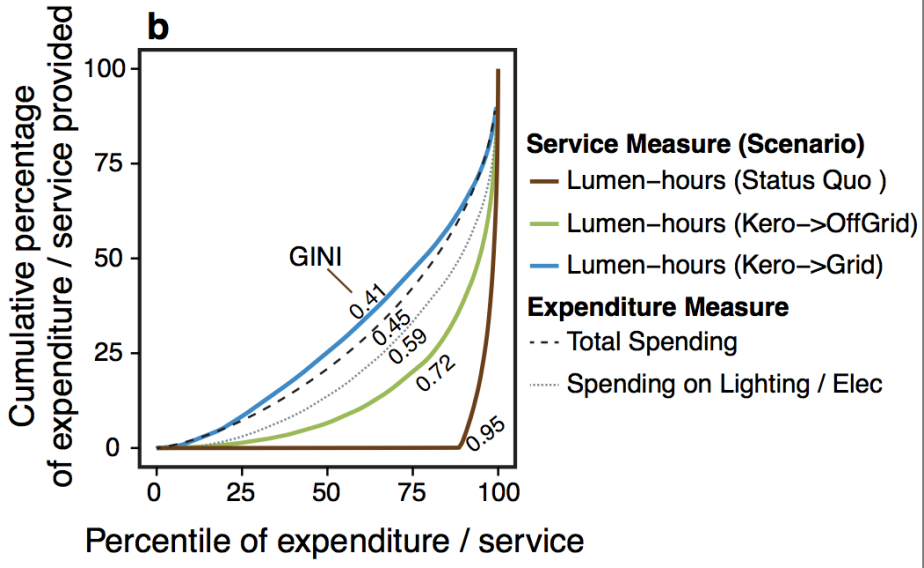

New Connections: Potential 2030 Scenario
Population
IEA Grid Expansion (New Policies scenario covers population growth and additional persons)
Mini-grids
Household Systems
2010
2030

Transitions to modern power (on- or off-grid) improves on both **climate and equity** dimensions

10x reduction possible in GHG emissions intensity (20 year GWP, including black carbon)



Significant improvements in equal access to service



Black Carbon estimates from: Lam, N. L. et al. Household light makes global heat: high black carbon emissions from kerosene wick lamps. Environmental science & technology 46, 13531–13538 (2012).

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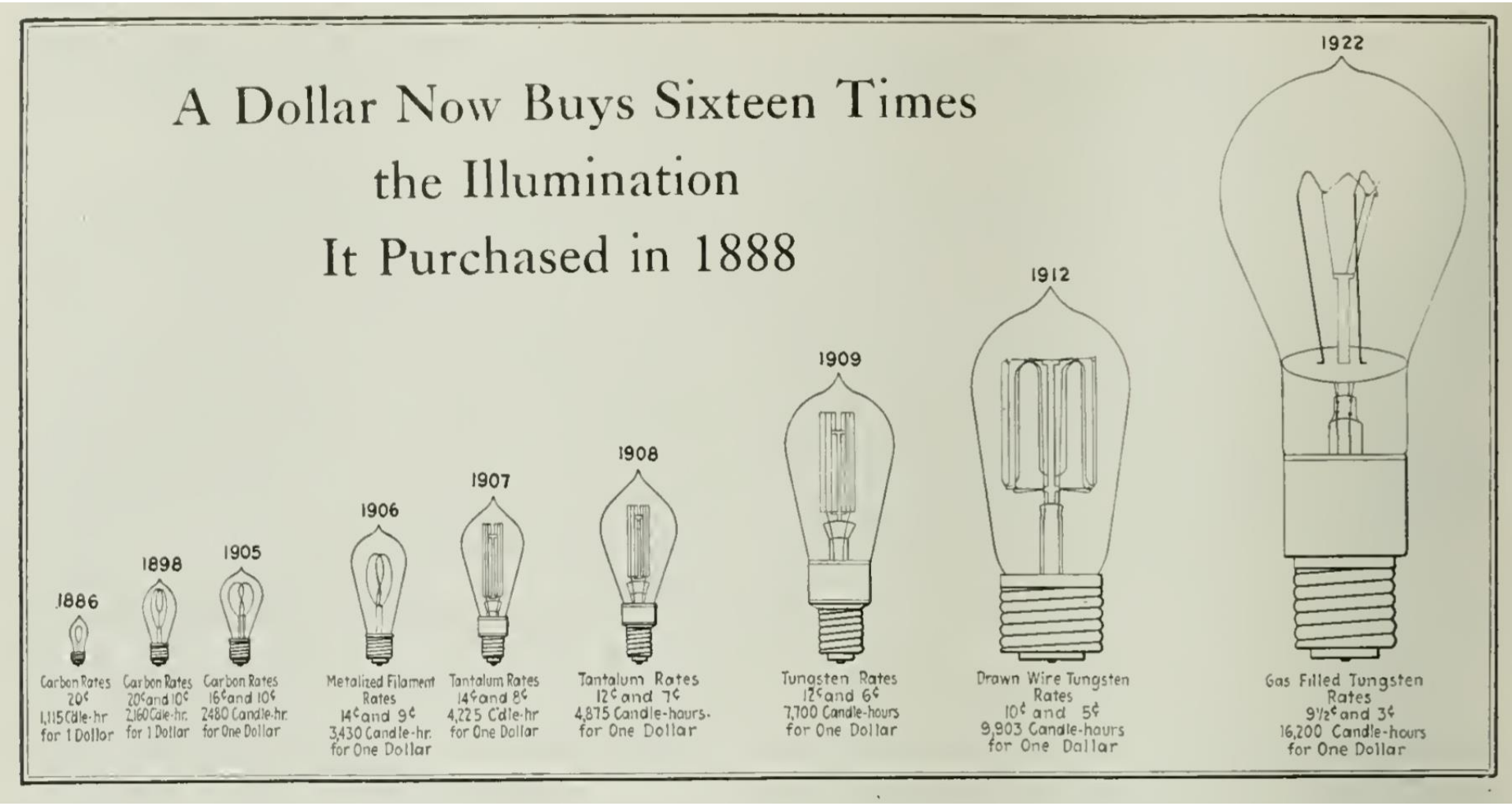
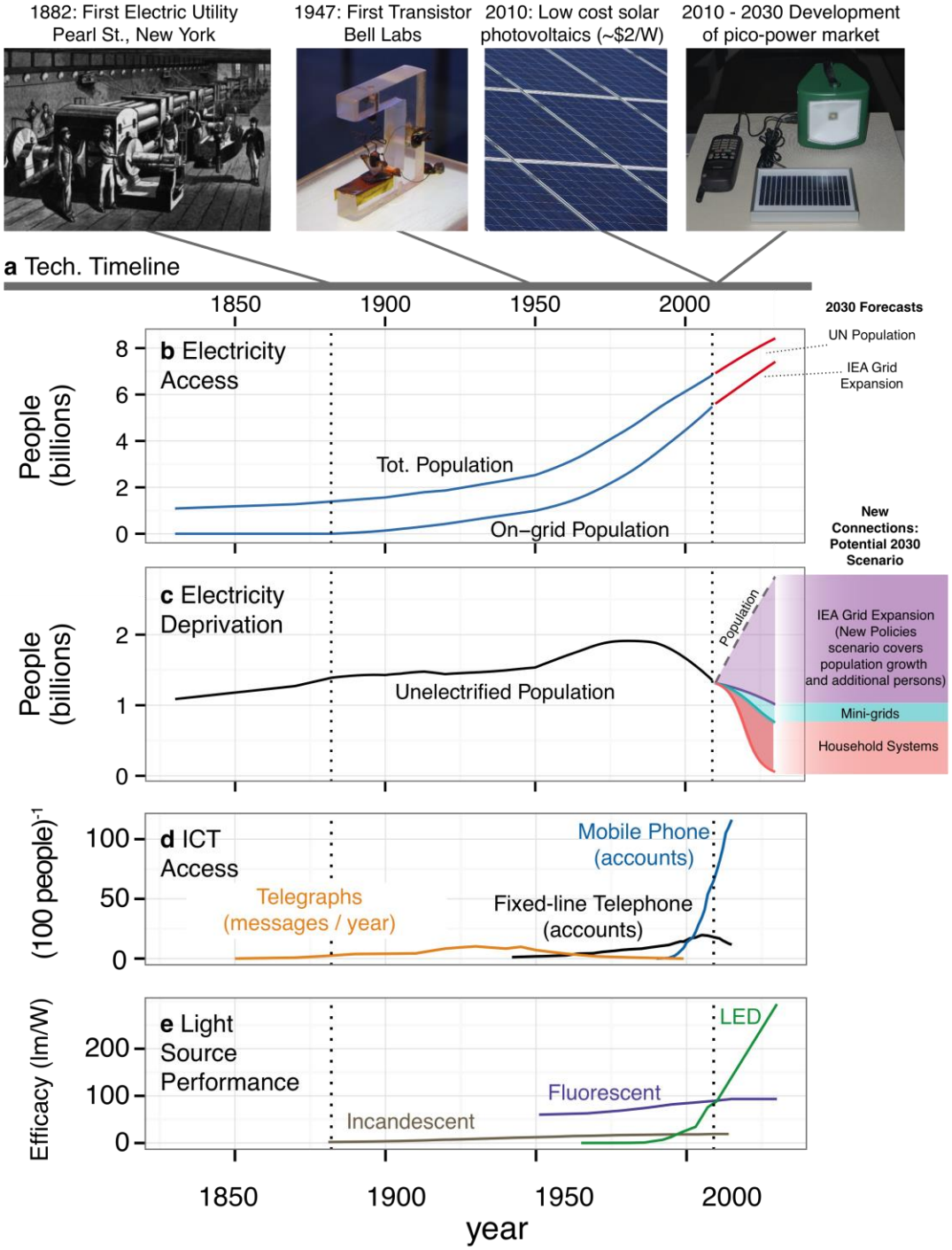


From "Electrical World Vol 80" (1922)

2030 Potential



New Business models

PV and LED's

Information Technology

OFF-GRID (Economically Remote)

OFF-GRID (Geographically Remote)


OFF-GRID (Politically / Geographically Remote)