



Carbon Management Technology Innovation

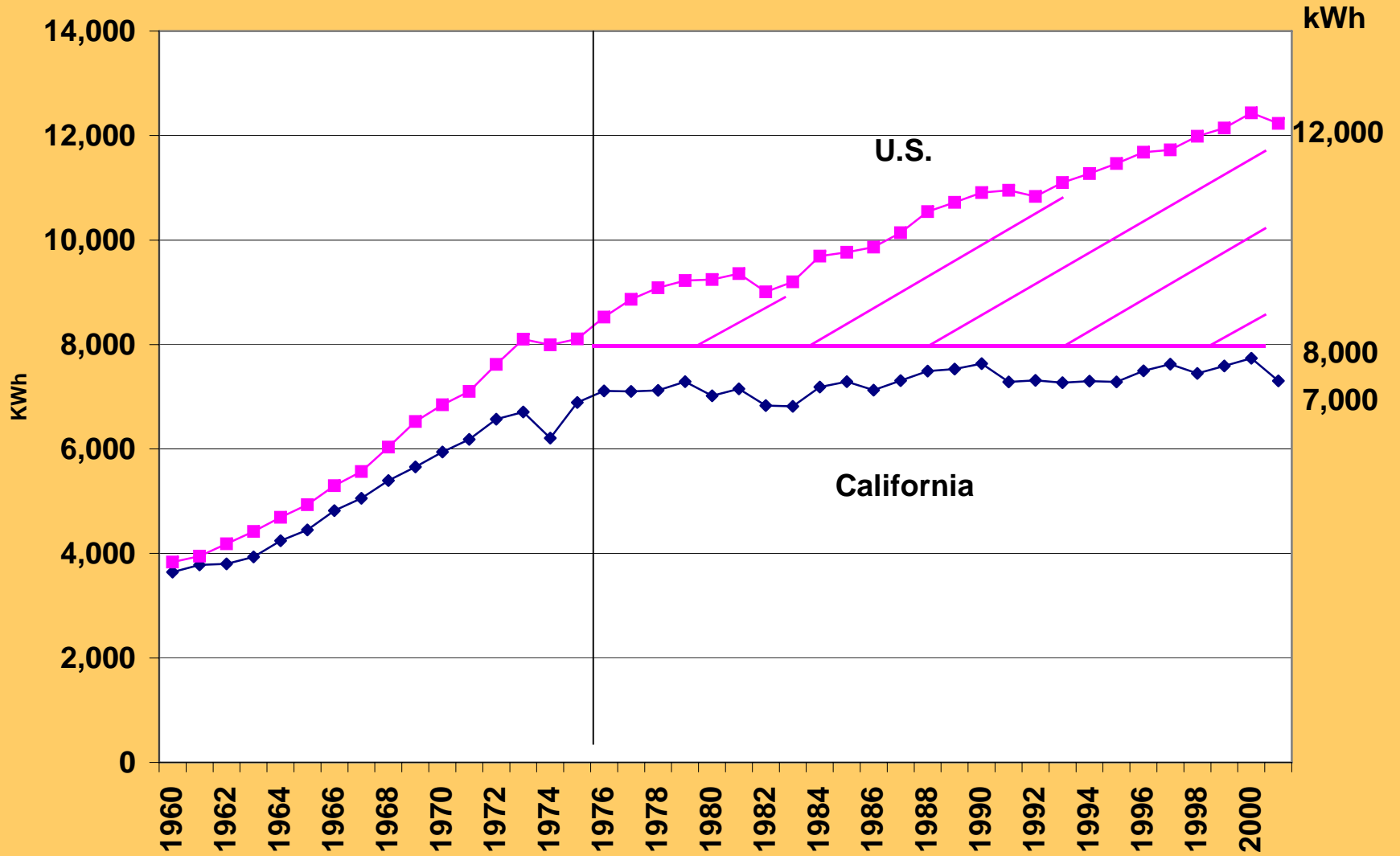
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Stabilizing Carbon Dioxide at 550 ppm_v

Carbon-free energy needed (EJ) in:	2050	2100
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Energy intensity falls 1%/yr	600	1500
Energy intensity falls 1.5%/yr	350	800
Energy intensity falls 2.0%/yr	180	350

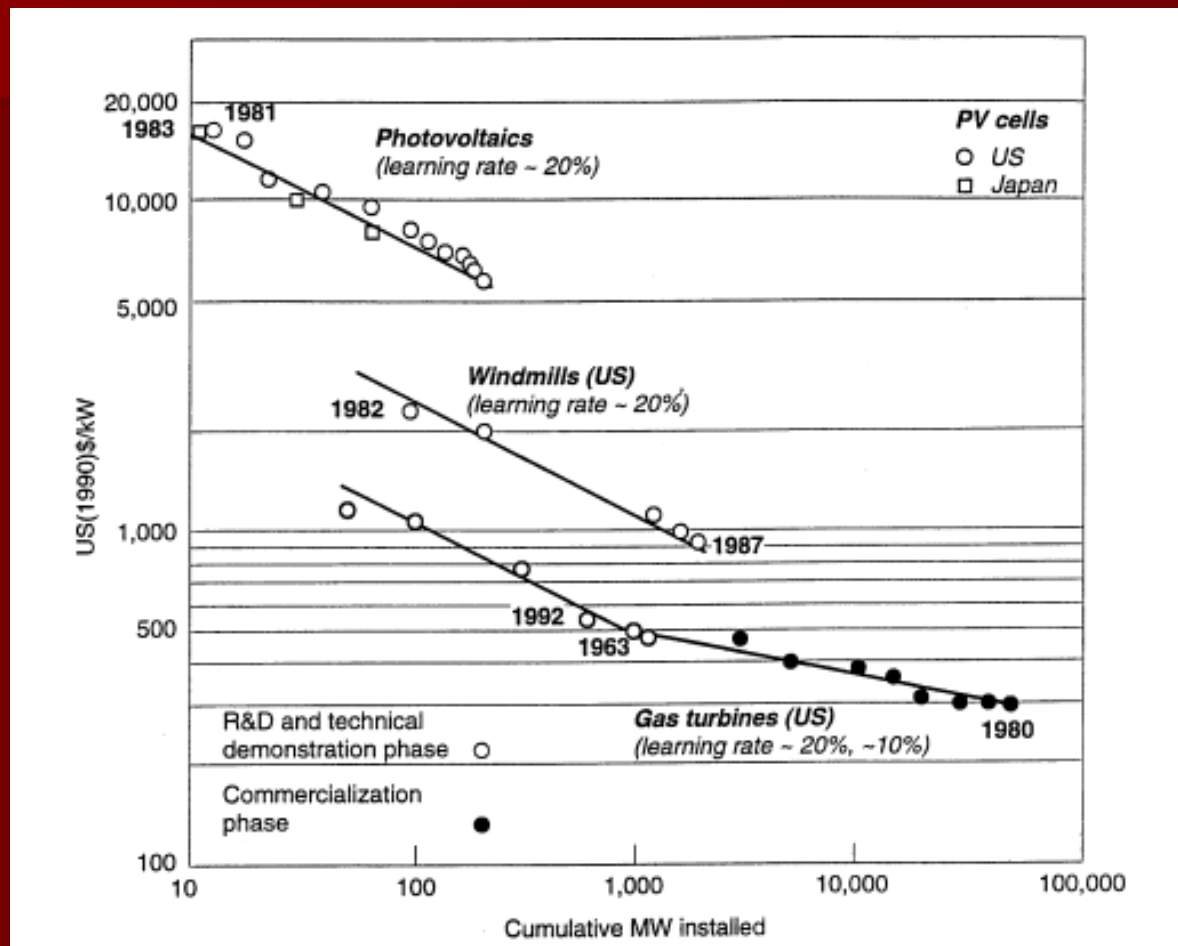
- Assumes business-as-usual world economic growth
- Energy intensity = Energy/GDP (a measure of energy efficiency of the economy)
- Carbon-free energy includes renewables, nuclear, and advanced fossil with CO₂ storage and sequestration

Total Electricity Use, per capita, 1960 - 2001



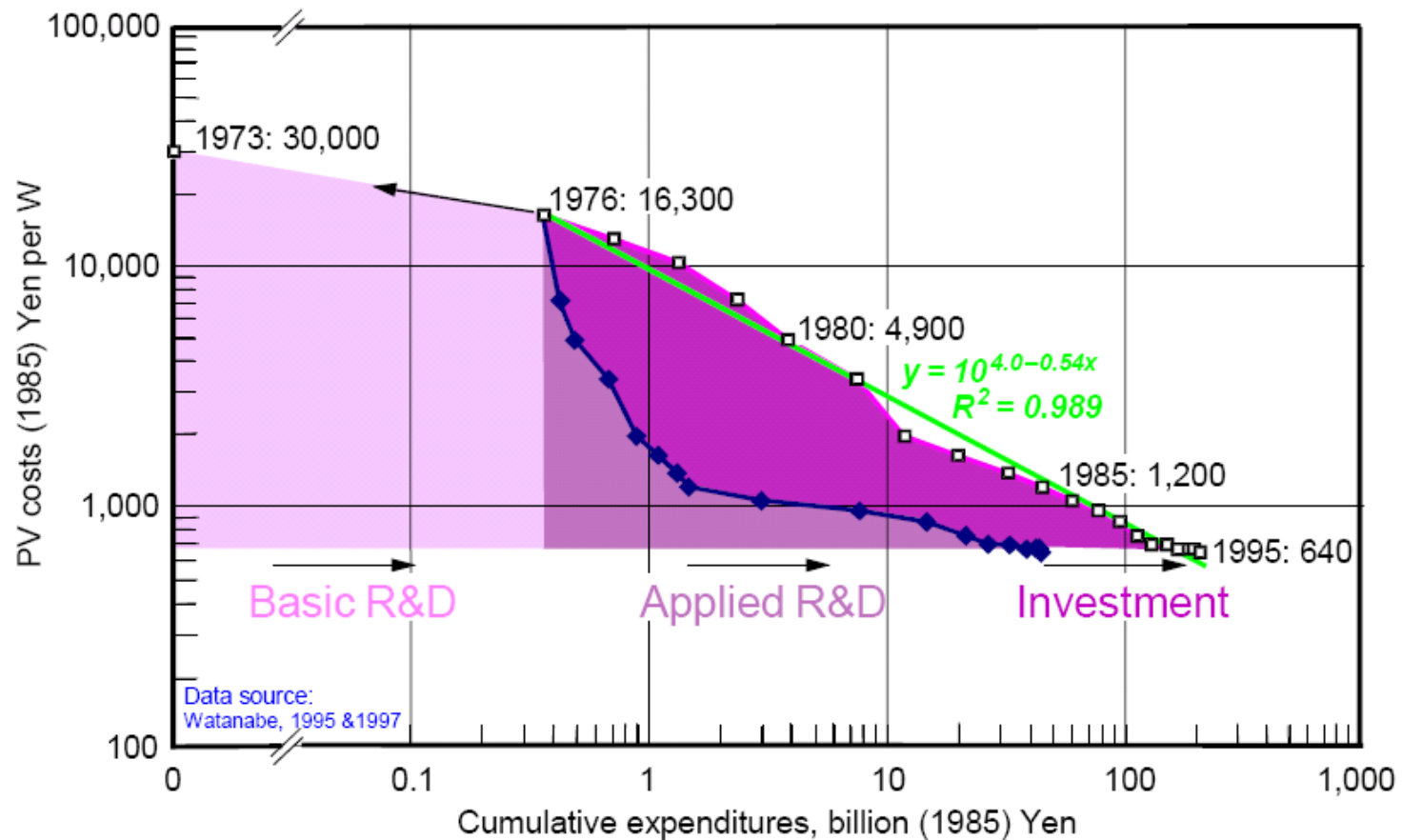
Source: Art Rosenfeld, California Energy Commission, 2004

"Learning Curves"



Source: Grubler, A, Nakicenovic, and D. Victor, "Dynamics of Energy Technologies" and Global Change, *Energy Policy*, 1999.

Declines in Unit Costs for PV



Declines in Unit Costs for PV in USA

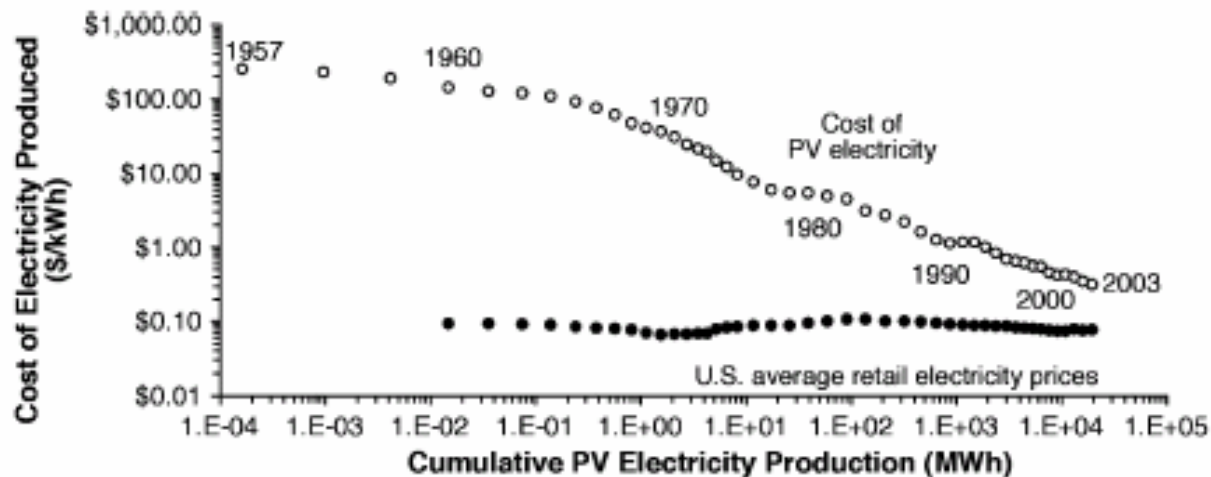


Fig. 8. US electricity prices and levelized cost of electricity produced from PV modules. Data: module and BOS prices (Wolf, 1974; Maycock, 2002; Strategies-Unlimited, 2003), lifetime (see Fig. 3), interest rates (Census, 2005), and retail electricity prices (EIA, 2004).

Source: Nemet, Gregory, "Beyond the Learning Curve," Energy Policy 2006