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SoCalGas
Low Emission Vehicle Program

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SoCalGas LEV Focus Areas

- Outreach to support expanded use of natural gas for transportation – clean, cost effective and domestic
- Advocacy to support even-handed, performance based standards
- Industry collaboration
- Technology advancement

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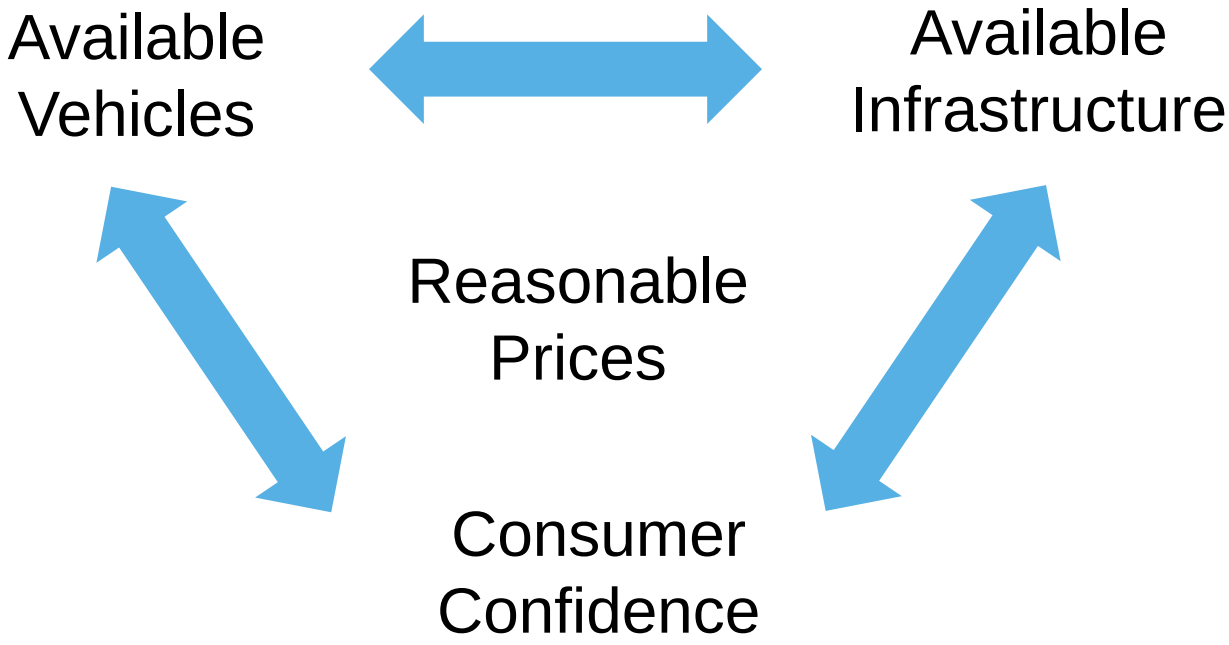
Several factors must come together for the markets to accelerate growth



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NGV Technology Advancement – Path to Near-zero and Zero Emissions

Opportunity Area	Comments
Engine Technology and Drive Trains	• Improvements of 35% to 60%+ in fuel economy predicted by some experts • Advanced combustion, control and drive trains • Aerodynamics, light-weight materials and peripherals can help as well • Fuel efficiency eliminates all tailpipe emissions -- #1 in the "loading order"
Advanced After-treatment	• Catalyst systems similar to those in use today • Has technical potential to reduce NOx to "near zero" levels (90% less than 2010 standards)
Carbon Reduction	• Biogas • Solar methane synthesis • Renewable hydrogen blending (Hythane)
"Supporting " advances -- On-board tanks -- Fueling infrastructure	• Helps reduce lifecycle emissions by reducing required compression energy • Convenience and elimination of range anxiety via home fueling • Low –cost, efficient fueling infrastructure is a key enabler • Efficiency improvements reduce lifecycle emissions

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Growing Awareness of the Possibilities for NG Technologies

- CEC AB118 technology program

- ARPA-e MOVE (Methane Opportunities for Vehicle Energy) program -- $30M+ focused on home refueling and tank design

- Note – many aspects of on-board tank, storage and compression R&D are synergistic with FCV

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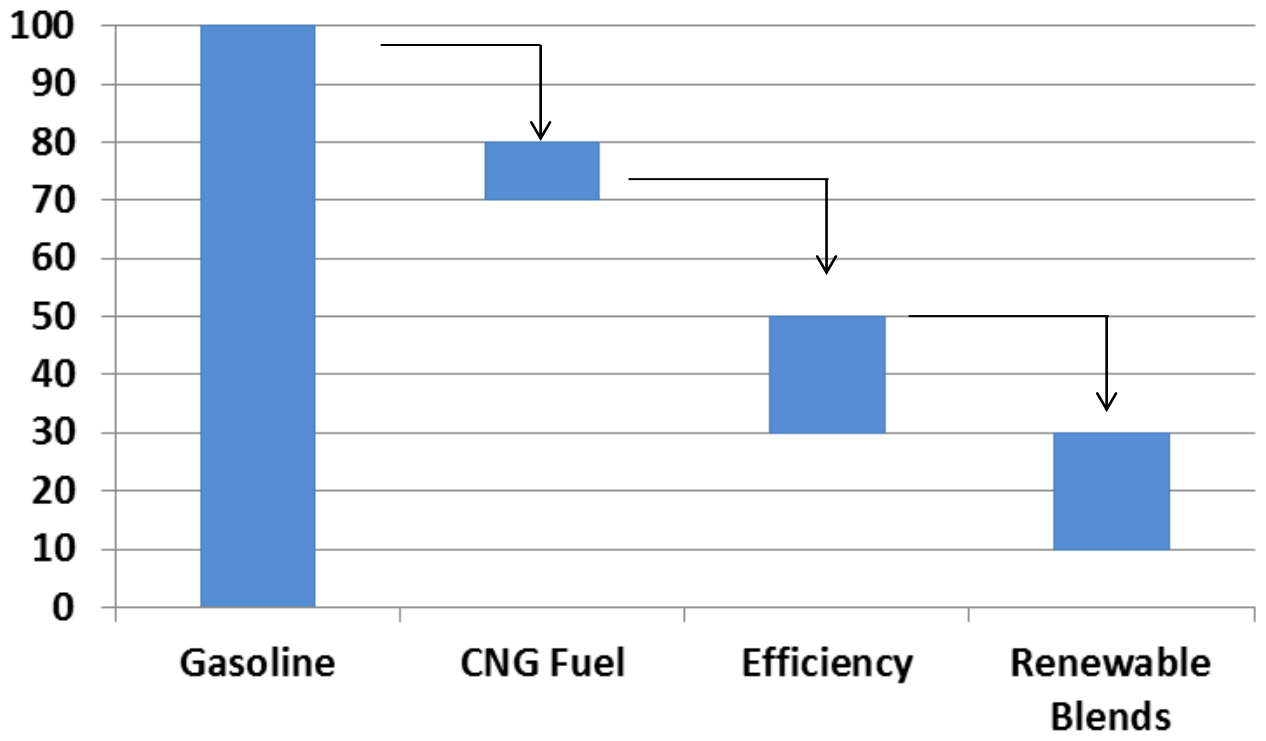
Path to 2050 Goals

Relative GHG Emissions



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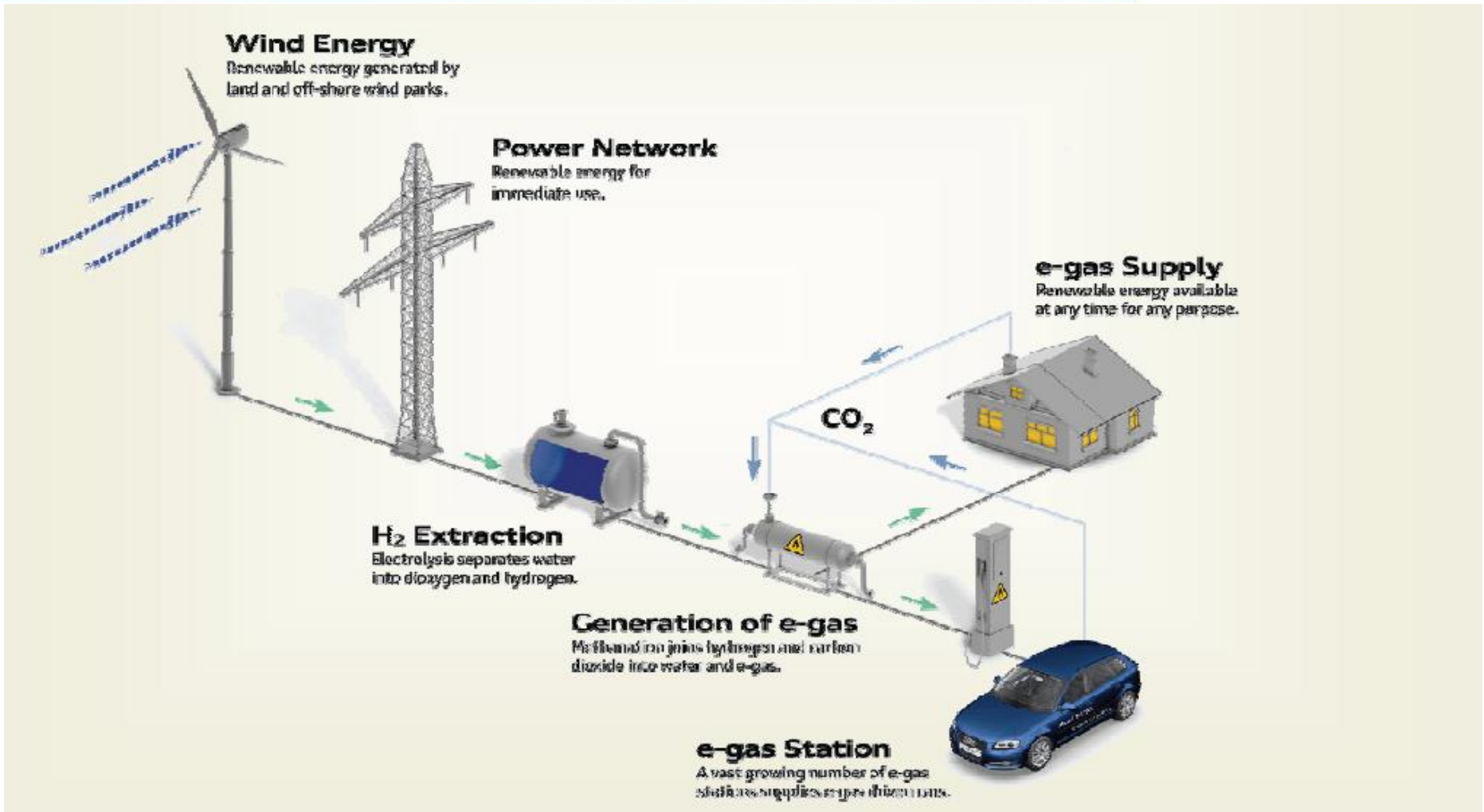
Renewable H2 and Methane (Concept from German gas association)



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