

# Carbon neutral planning for a sustainable senior community



## How can Valle Verde become carbon neutral by 2020?

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### Introduction

Climate change is *the* global issue of the future. We have already seen increased average global temperatures, melting of arctic and glacial ice, sea level rise, and a higher frequency of extreme weather events.<sup>1</sup> Failure to mitigate these impacts may lead to catastrophic and irreversible changes to the earth as we know it. Greenhouse gas (GHG) emissions are the primary cause of climate change; therefore, we must find ways to reduce these emissions.

The fastest growing age group in the U.S. consists of individuals 85 years or older, and 20% of Americans will be at retirement age by 2030.<sup>2</sup> As a result, retirement communities can play an important role in reducing current and future GHG emissions.

Valle Verde, a retirement community in Santa Barbara, California, is a leader in sustainability within its industry. Through its Green Initiative, Valle Verde has already reduced its impact on the environment. Now management has a greater goal: to become carbon neutral by the end of 2020.



To help Valle Verde achieve its goals, this Master's Thesis Project:

- Conducted a GHG inventory to assess current emissions
- Defined carbon neutrality within Valle Verde's framework
- Evaluated the effects of the existing Green Initiative
- Projected Valle Verde's GHG emissions to the year 2020
- Recommended reduction strategies to achieve carbon neutrality

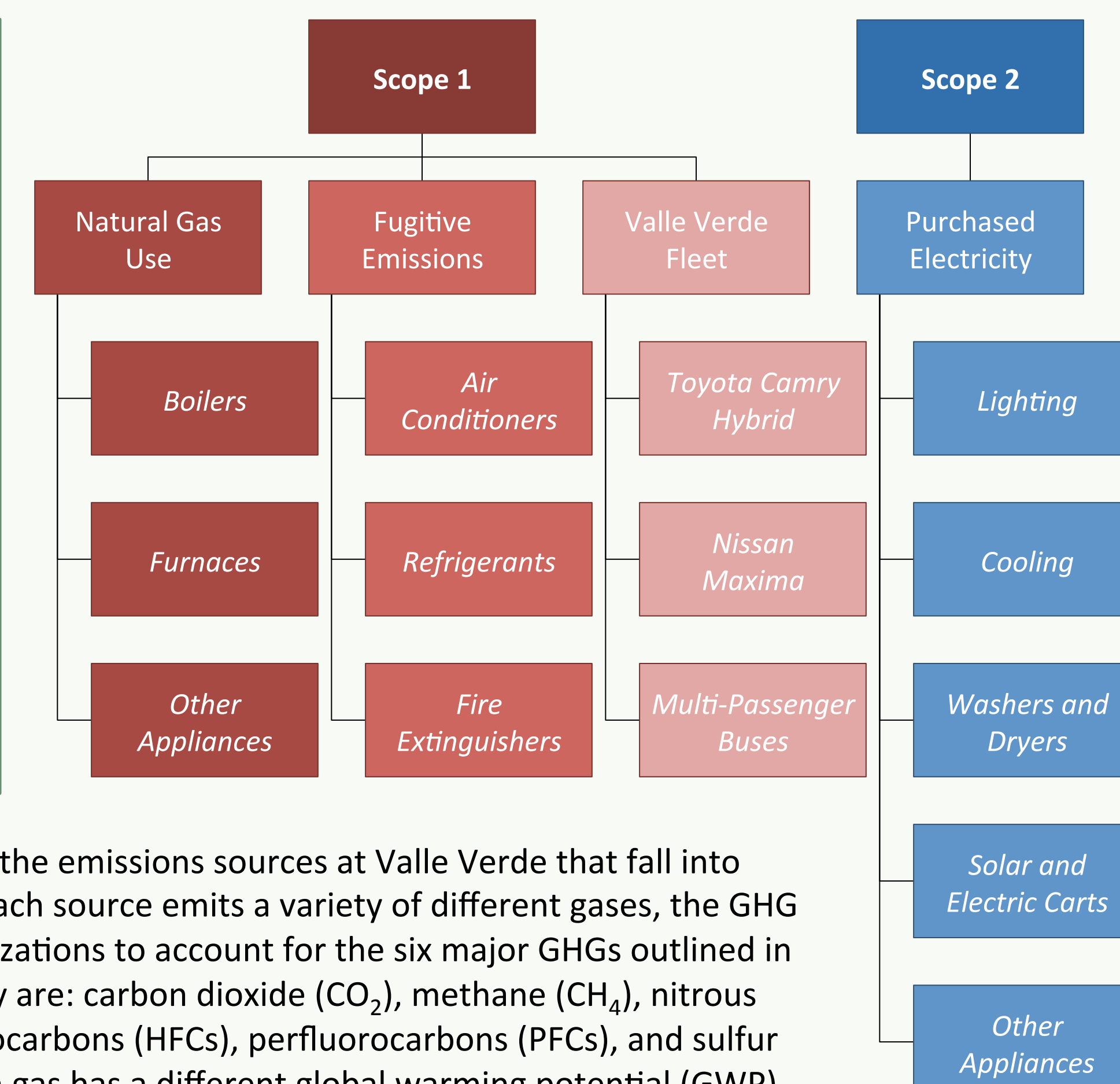
### Methods

We followed the globally recognized Greenhouse Gas Protocol to evaluate Valle Verde's 2009–2010 fiscal year GHG emissions. The Protocol divides up an organization's emissions into three categories, referred to as Scopes.

- Scope 1:** Direct emissions from stationary and/or mobile combustion, and fugitive emissions
- Scope 2:** Indirect emissions from purchased electricity
- Scope 3:** All other emissions, such as those from waste, employee travel, and consumer goods<sup>3</sup>

#### Carbon Neutrality

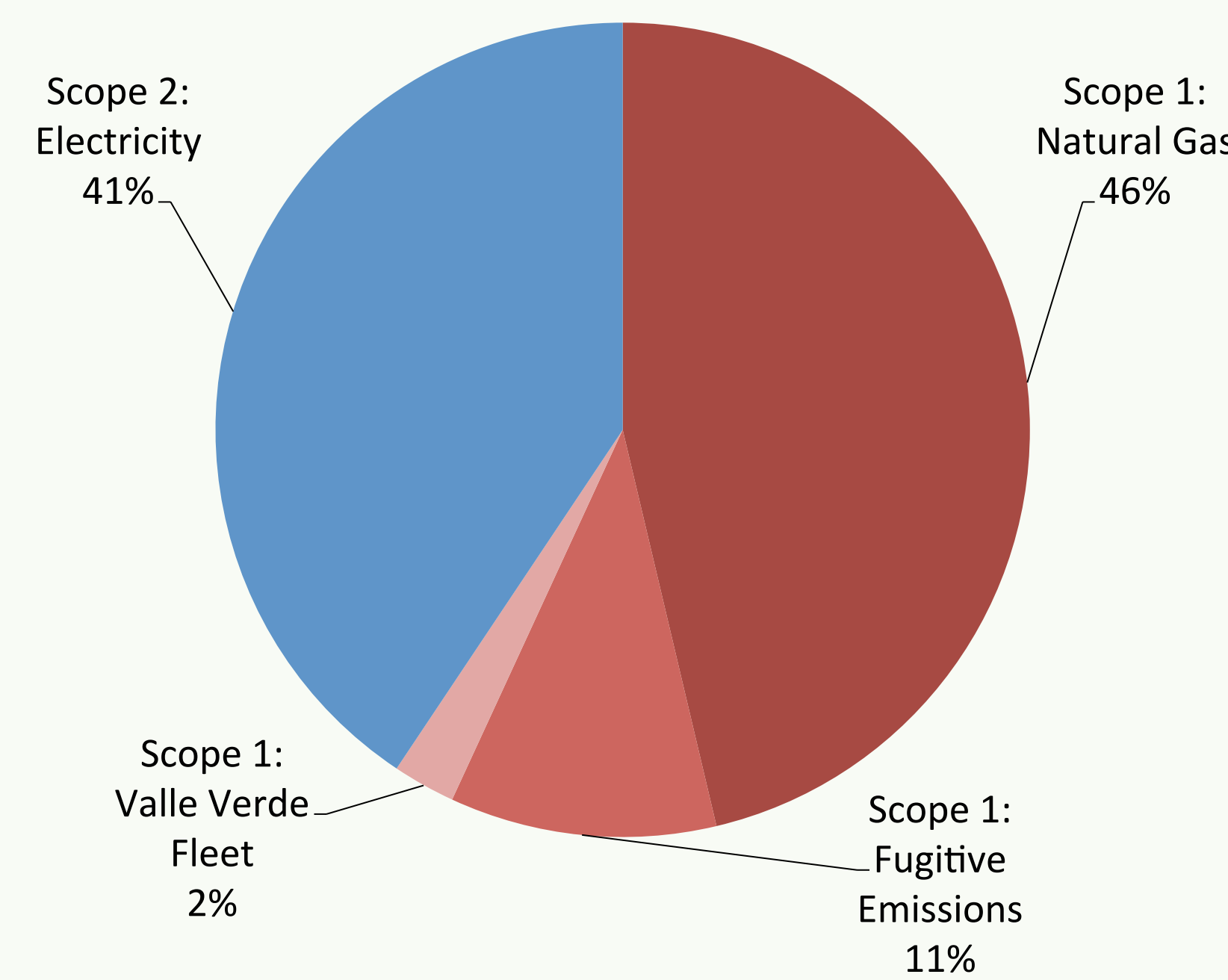
According to the GHG Protocol, Scopes 1 and 2 are mandatory for reporting purposes, while Scope 3 is voluntary.<sup>3</sup> Given this, we consulted with Valle Verde and decided that, for our purposes, carbon neutrality is reached when net annual GHG emissions from only Scopes 1 and 2 equal zero.



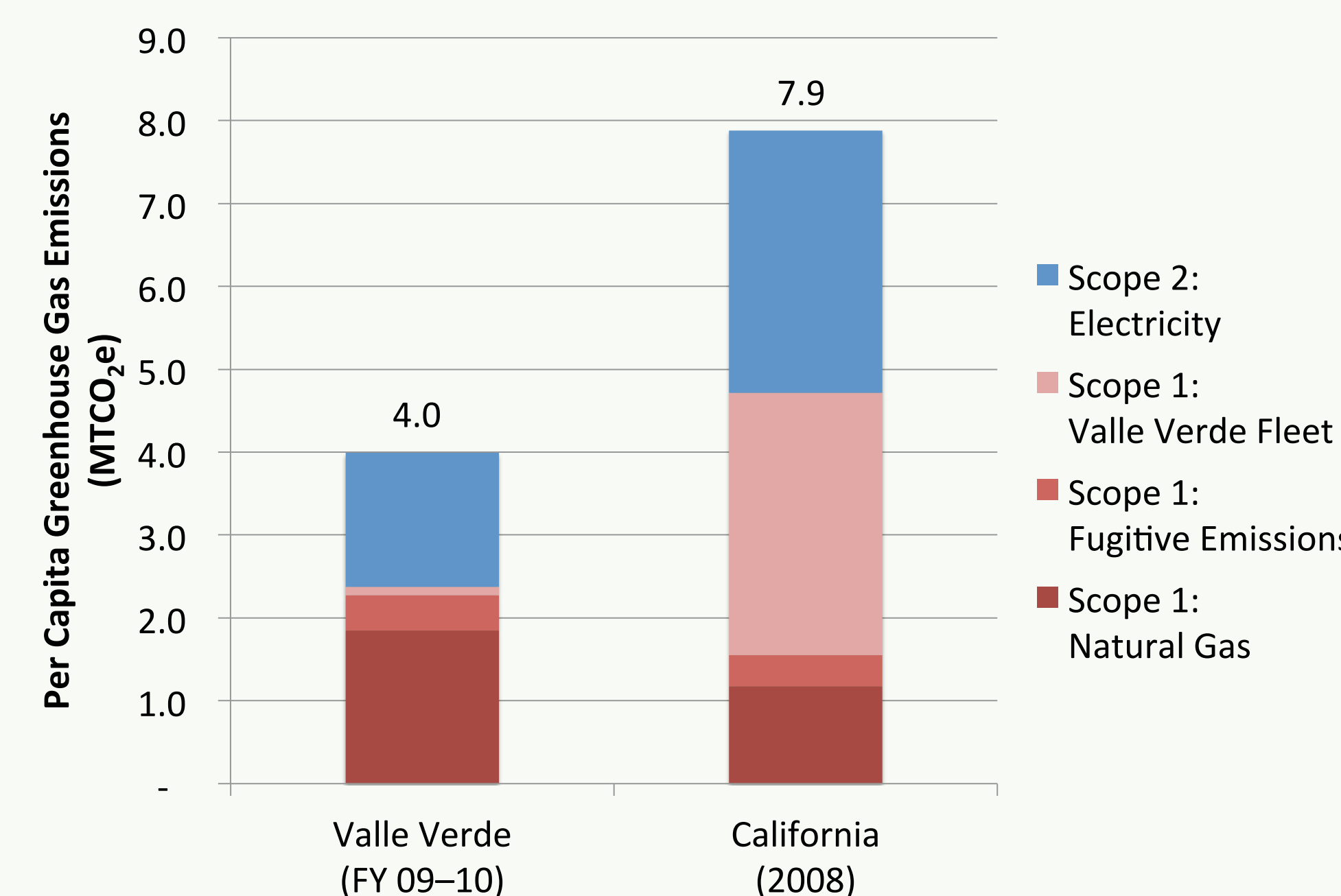
The figure above shows the emissions sources at Valle Verde that fall into Scopes 1 and 2. While each source emits a variety of different gases, the GHG Protocol requires organizations to account for the six major GHGs outlined in the Kyoto Protocol. They are: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>).<sup>3</sup> Each gas has a different global warming potential (GWP), which is used to obtain a common accounting metric: carbon dioxide equivalents (CO<sub>2</sub>e).

### Results

During fiscal year 2009–2010, Valle Verde emitted an estimated **1,494 metric tons** of carbon dioxide equivalents (MTCO<sub>2</sub>e), which is equal to the annual GHG emissions of 293 passenger vehicles.<sup>4</sup>



Valle Verde's fiscal year 2009–2010 GHG emissions per capita was 4.0 MTCO<sub>2</sub>e. When comparing these results to California's 2008 emissions per capita (7.9 MTCO<sub>2</sub>e), it is clear that Valle Verde residents have smaller carbon footprints than the average Californian.<sup>5</sup>



In 2004 Valle Verde staff and residents implemented a campus-wide Green Initiative to improve the environment. Through the Green Initiative, the campus has reduced its Scopes 1 and 2 GHG emissions by 36–51% annually. This is equivalent to removing 106–148 passenger cars from U.S. roads each year.<sup>4</sup>

In order to help Valle Verde further reduce its GHG emissions, we researched numerous strategies and evaluated each based on the feasibility of implementation, potential to lower GHG emissions, financial costs or benefits, and overall cost-effectiveness. Below are two common reduction strategies shown in this context.

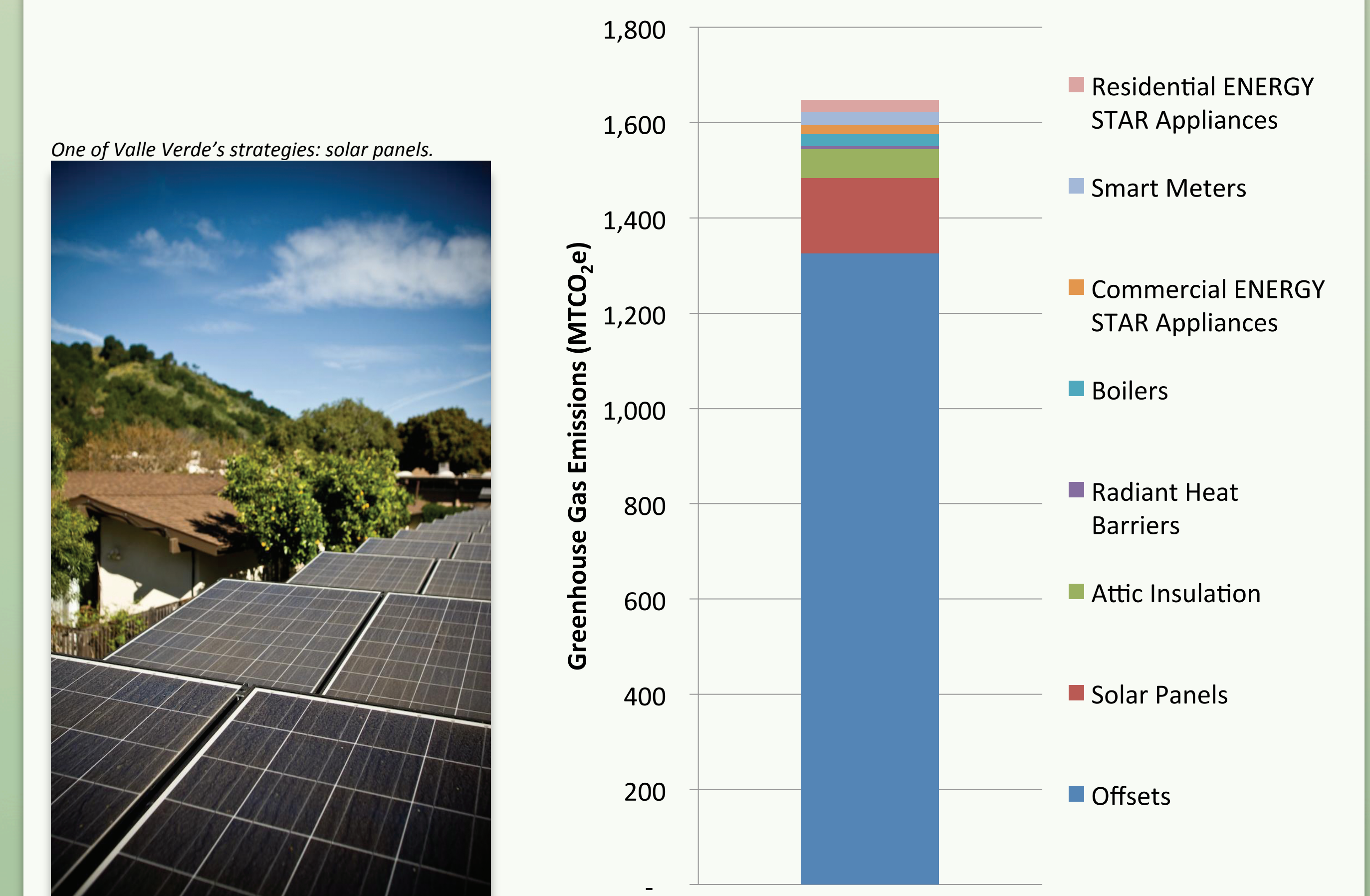
Strategy	Strategy Lifetime (Years)	Annual GHGs Abated (MTCO <sub>2</sub> e)	Net Present Value (NPV)	Cost-Effectiveness (\$/MTCO <sub>2</sub> e)
Solar Panels	20	158	-\$18,830 (with rebates)	-\$10
Residential ENERGY STAR Appliances	10	25	\$68,730	\$270

### Conclusions

In 2020, Valle Verde will emit approximately **1,648 MTCO<sub>2</sub>e**, an increase of 10% from the baseline of fiscal year 2009–2010. This expected increase is due to Valle Verde's current plans to expand the campus to accommodate approximately 60 more residents.

Considering Valle Verde's financial, operational and institutional constraints, we found that the technology-based strategies that are both feasible and relatively cost-effective can reduce Valle Verde's GHG emissions by **322 MTCO<sub>2</sub>e** annually, or by approximately 20%.

It will therefore be necessary for Valle Verde to purchase **1,326 MTCO<sub>2</sub>e** worth of carbon offsets in 2020 to achieve carbon neutrality. The graph below displays our recommended strategies and their effects on reducing Valle Verde's GHG emissions in 2020.



### Acknowledgements and Sources

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<sup>1</sup>IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

<sup>2</sup>U.S. Census Bureau. (2006, March 9). Dramatic changes in the U.S. aging highlighted in new census, NIH Report. Press release. Retrieved from <http://www.nia.nih.gov/NewsAndEvents/PressReleases/PR2006030965PlusReport.htm>

<sup>3</sup>The Greenhouse Gas Protocol Initiative. 2010. *Greenhouse Gas Protocol*. Retrieved from <http://www.ghgprotocol.org>

<sup>4</sup>EPA. (2010, March 23). *Greenhouse gas equivalencies calculator*. Retrieved from <http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>

<sup>5</sup>U.S. Census Bureau. (2008, December 22). *Annual estimates of the resident population for the United States, regions, states, and Puerto Rico: April 1, 2000 to July 1, 2008*. Retrieved from <http://www.census.gov/popest/states/tables/NST-EST2008-01.xls>