Energy Savings Through South Sioux City Community Projects

Project Energy Nebraska - Jadon Basilevac, Anne Kluthe, Awinita Bunner, David Gosselin, Baillie Luff

Collaborators

- University of Nebraska Lincoln
  - Environmental Studies Program
    - David Gosselin
    - Baillie Luff
  - Rural Prosperity Network
    - Anne Kluthe
  - Nebraska Center for Energy Sciences Research
- City of South Sioux City
  - Lance Hedquist
  - Oscar Gomez
  - Kent Zimmerman
- Conservation Nebraska
  - Summer AmeriCorps Program
    - Jadon Basilevac
    - Awinita Bunner

- Veterans Victory Housing & Small Business Centers
  - Kim Kuhle

Goals and Objectives

Goals

- Create a greenhouse gas inventory for South Sioux City
- Project “business-as-usual” emissions growth to 2050 in South Sioux City
- Forecast the emissions impact of implementation of the VA Housing project
- Forecast the emissions impact of improving energy efficiency in new residential and commercial construction

Visiting the Community

Above: Future site of Veterans Victory Housing & Small Business Center

Right: Shed/classroom constructed with ash trees

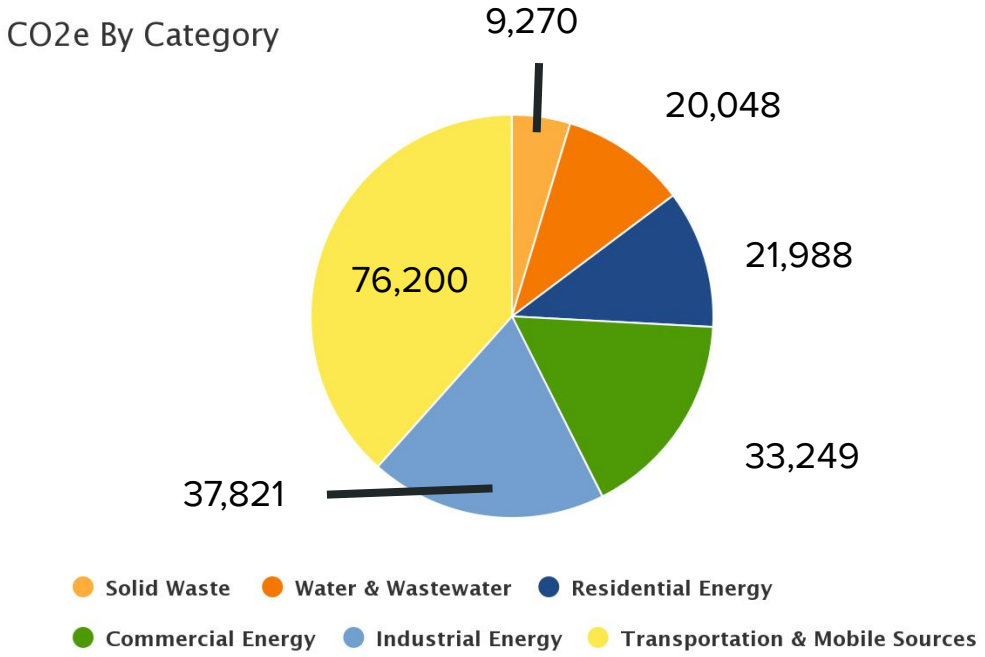
Communication

Communication with Stakeholders

- Remote work presents a unique challenge when communicating with team members and stakeholders
- Several meetings with city officials
  - Clarifying project goals and structure
  - Obtaining contacts for specific carbon reduction efforts in the community
- Meeting with project developers
  - Projects are in early stages of development - pulling raw data to be entered into ClearPath presented a challenge
- Email
  - Obtaining data necessary for creating greenhouse gas inventory in ClearPath

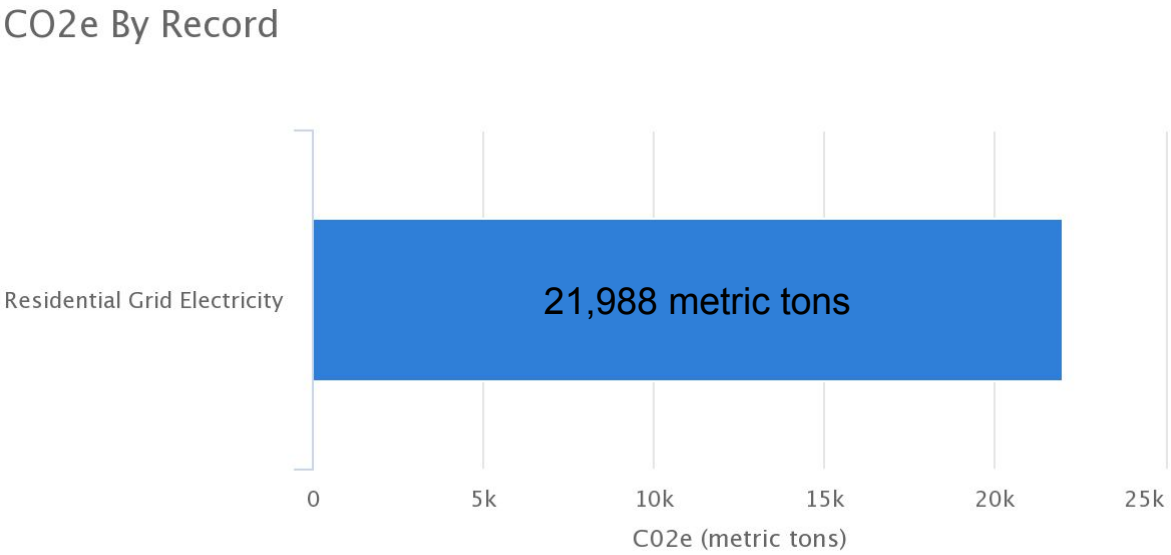
ClearPath

Creating a GHG Inventory



A greenhouse gas inventory enables South Sioux City to identify its largest sources of carbon emissions

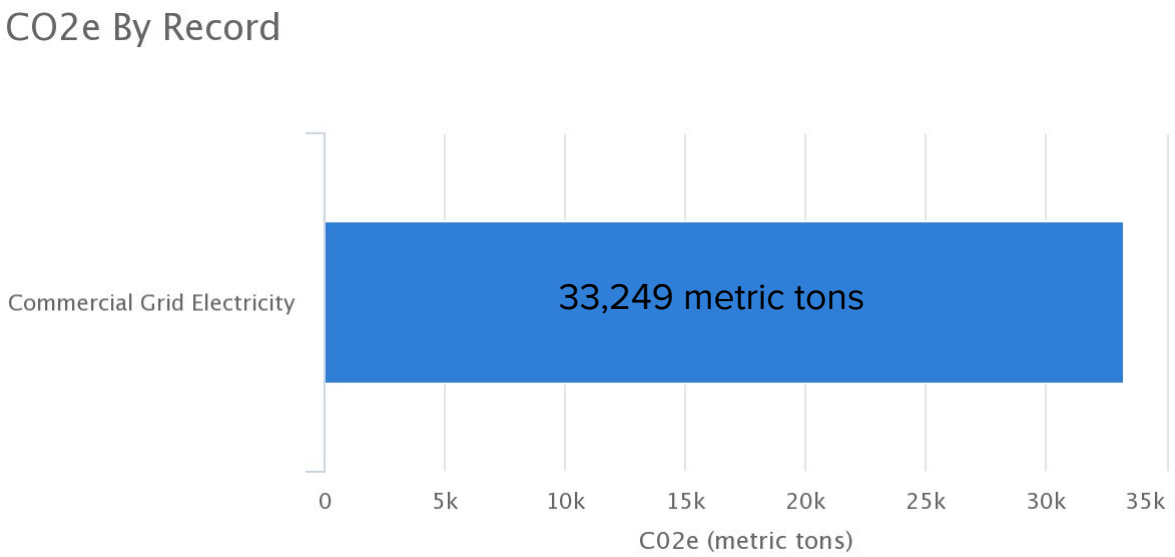
Residential Energy



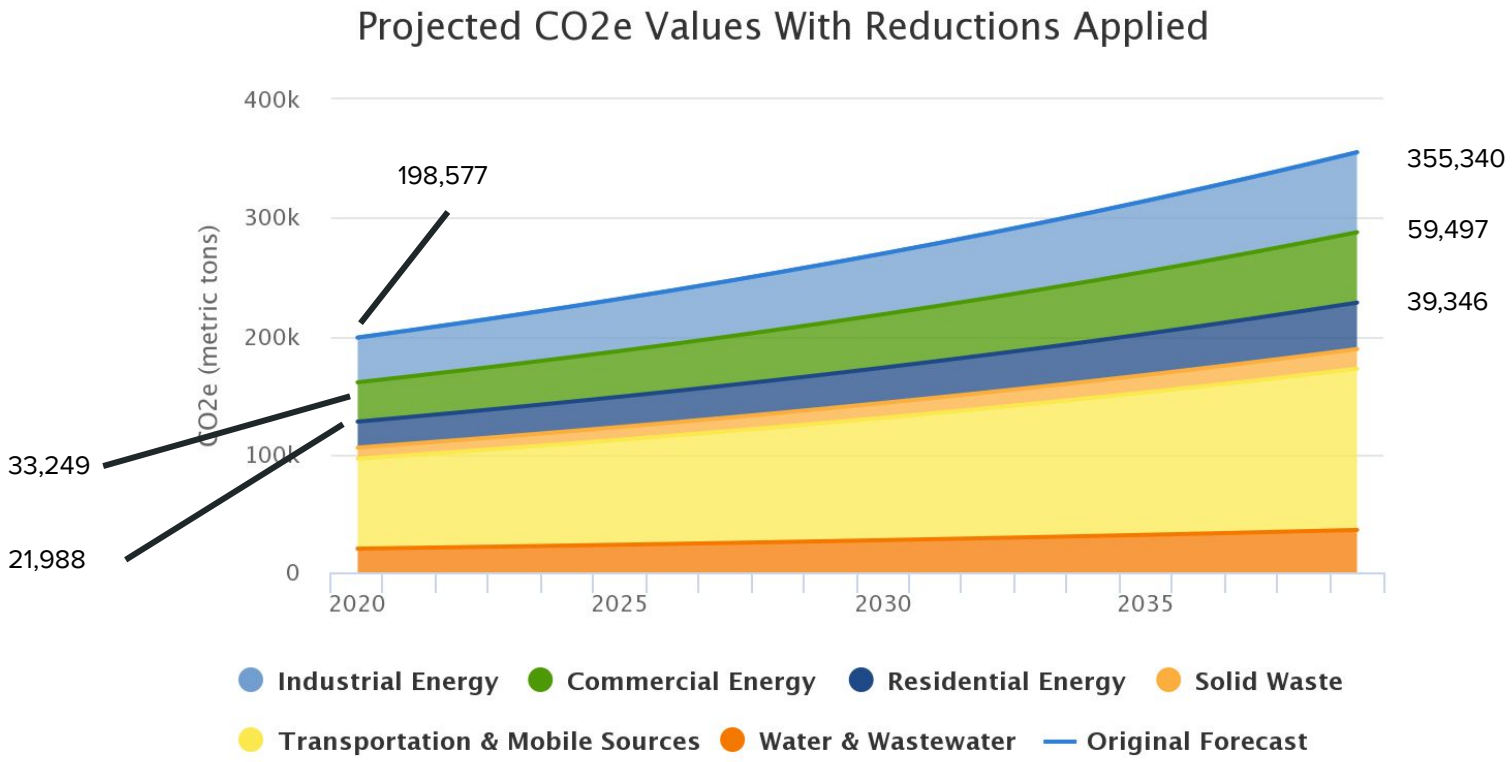
- 21,988 metric tons of CO2e
  - 4th largest source of emissions in South Sioux City
- South Sioux City is exploring options for improving energy efficiency in new residential buildings
- Veterans Victory Housing provides green-constructed, energy efficient housing with renewable energy integration

Commercial Energy

- 33,249 metric tons of CO2e
    - 3rd largest output of carbon emissions in South Sioux City
- South Sioux City is exploring options for reducing commercial emissions through better energy efficiency
- Veterans Victory Housing includes small business center that could minimize construction of additional commercial buildings



Projections

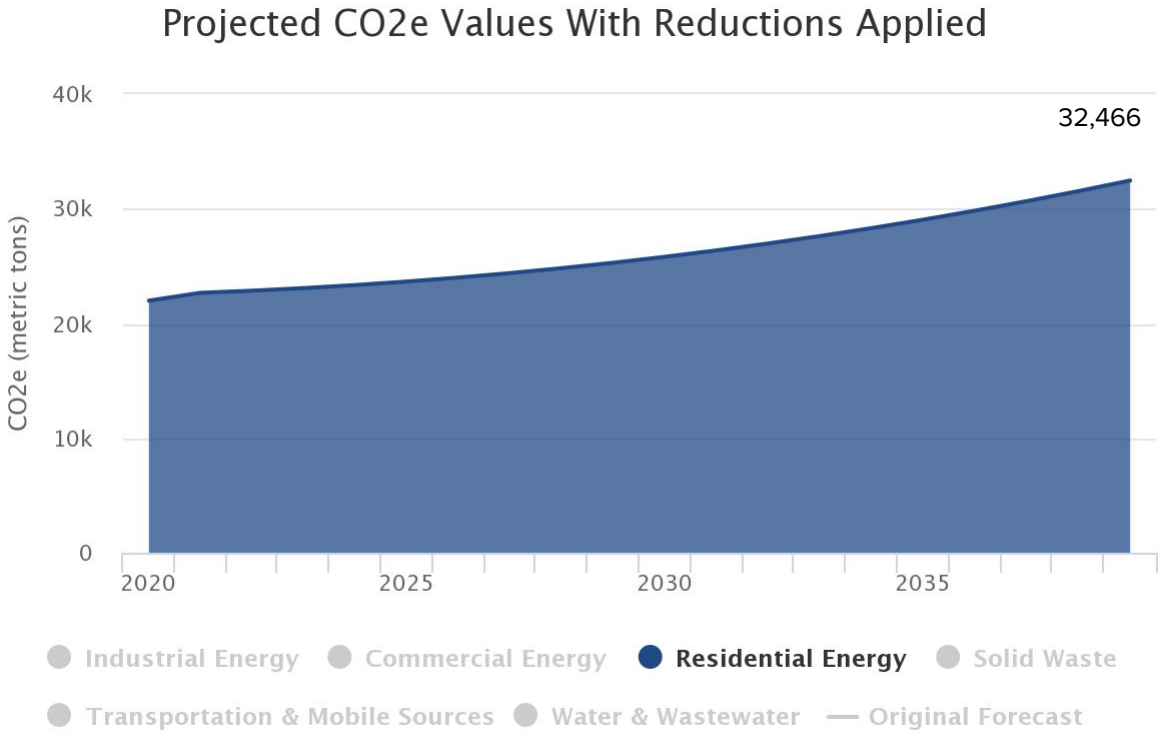


Normal Growth in CO2e by 2050

Growth is based on the medium population increase forecasted in the South Sioux City Comprehensive Plan and traditional development on 20 acres planned for the VA housing project.

Veterans Victory Housing Impact

- Project is expected to incorporate a number of emissions reducing aspects:
  - Low flow faucets
  - Low flow showerheads
  - Compact development (20 acres)
  - Solar power
  - Recycling
  - General energy efficiency improvements/construction
  - Energy efficiency education
- Measurable reduction in overall emissions as opposed to traditional development on the 20 acres utilized



Energy Savings of VA Project Aspects

- Increased resident solar energy
  - -3,412 MMBtu grid energy per year
- Energy efficiency education
  - -665.29 MMBtu electric savings per year
  - -1,764 MMBtu natural gas savings per year
- Low flow faucets
  - -8 MMBtu electric savings per year
  - -102 MMBtu natural gas savings per year
- Low flow showerheads
  - -32 MMBtu electric savings per year
  - -434 MMBtu natural gas savings per year
- Compact development
  - -2,200,200 VMT annually
- Recycling
  - -0.077176 tons of waste diverted per year

Name	Value
Annual Electricity Production (kWh / Year)	1.0000×10^6
Grid Electricity Energy Reduced (MMBtu / Year)	-3412
Annual Residential Electricity Cost Savings ($ / Year)	
Annual Program Costs ($/ Year)	0
Electricity Savings Real Discount Rate	
Program Costs Real Discount Rate	

Solar

Name	Value
Baseline Condition VMT	3.5979×10^6
Smart Growth VMT	1.3977×10^6
Total VMT Change	-2.2002×10^6
Annual VMT Change	-2.2002×10^6

Compact Development

Name	Value
Quantity of Diverted Newspaper (tons / Year)	-0.019294
Quantity of Diverted Office Paper (Tons / Year)	-0.019294
Quantity of Diverted Corrugated Cardboard (Tons / Year)	-0.019294
Quantity of Diverted Magazines/3rd Class Mail (Tons / Year)	-0.019294

Recycling

Name	Value
Electricity Savings (kWh / Year)	-194985
Natural Gas Savings (Therms / Year)	-17640
Electric Energy Savings (MMBtu / Year)	-665.29
Natural Gas Energy Savings (MMBtu / Year)	-1764
Electricity Cost Savings ($ / Year)	
Natural Gas Cost Savings ($ / Year)	
Annual Program Costs ($ / Year)	0
Electricity Real Discount Rate	
Natural Gas Savings Real Discount Rate	
Implementation Costs Real Discount Rate	
One Year Emissions Savings (MTCO2e)	-204.14

Energy Efficiency

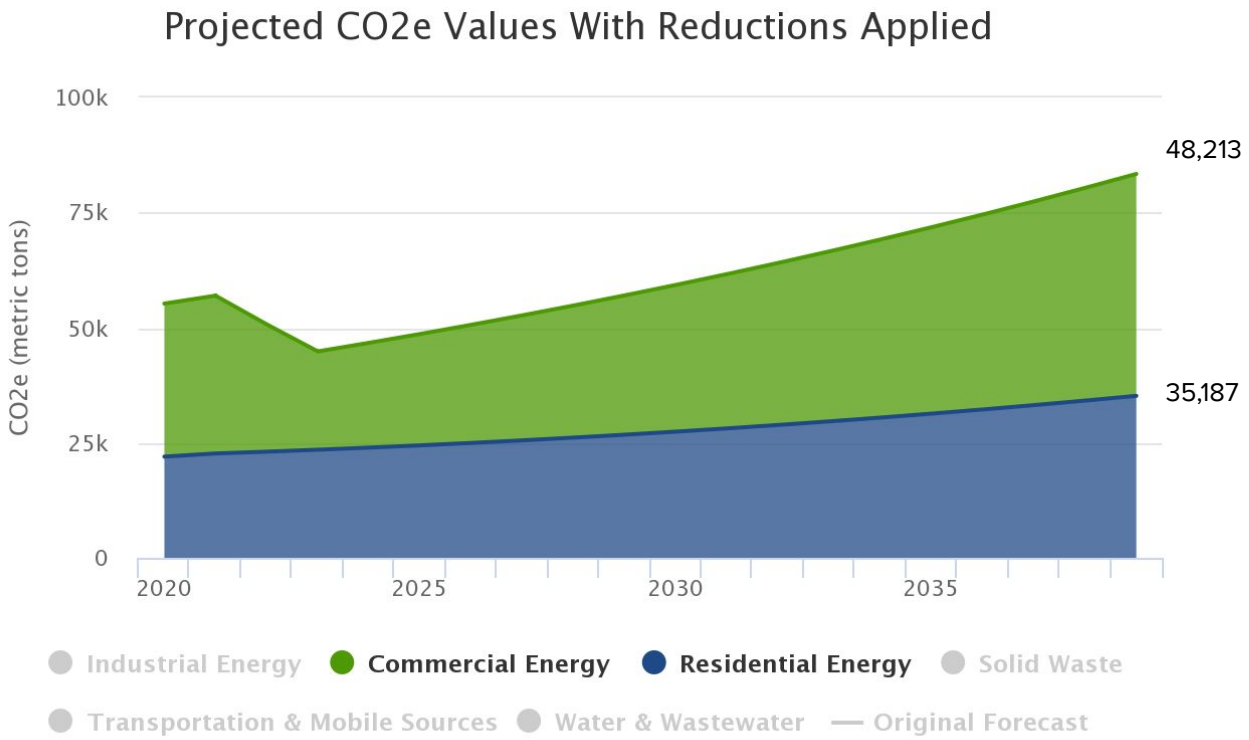
Name	Value
Total Water Savings (Gallons)	-179550
Reduced Electrically Heated Water (Gallons / Year)	-12569
Electricity Savings (kWh / Year)	-2218.3
Electric Energy Savings (MMBtu / Year)	-8
Reduced Gas Heated Water (Gallons / Year)	-113117
Natural Gas Savings (Therms / Year)	-1018.0
Natural Gas Energy Savings (MMBtu / Year)	-102
Program Administration Costs ($ / Year)	0
Residential Water Cost Savings ($ / Year)	0
Residential Electricity Cost Savings ($ / Year)	
Residential Gas Cost Savings ($ / Year)	
Total Rebate Value ($ / Year)	0
Program Administration Real Discount Rate	
Water Cost Savings Real Discount Rate	
Electricity Savings Real Discount Rate	
Gas Cost Savings Real Discount Rate	
Rebate Value Real Discount Rate	

Low Flow Faucets

Name	Value
Total Water Savings (Gallons)	-724500
Reduced Electrically Heated Water (Gallons / Year)	-53613
Electricity Savings (kWh / Year)	-9462.7
Electric Energy Savings (MMBtu / Year)	-32
Reduced Gas Heated Water (Gallons / Year)	-482517
Natural Gas Savings (Therms / Year)	-4342.7
Natural Gas Energy Savings (MMBtu / Year)	-434
Program Administration Costs ($ / Year)	0
Residential Water Cost Savings ($ / Year)	0
Residential Electricity Cost Savings ($ / Year)	
Residential Gas Cost Savings ($ / Year)	
Total Rebate Value ($ / Year) ?	0
Program Administration Real Discount Rate ?	
Water Cost Savings Real Discount Rate ?	
Electricity Savings Real Discount Rate ?	
Gas Cost Savings Real Discount Rate ?	
Rebate Value Real Discount Rate ?	

Low Flow Showerheads

Energy Efficiency Improvement Impact



- HoChunk Inc. is planning to handle energy efficiency improvements (primarily solar) in new housing and commercial buildings
  - Estimates are based upon the 2,466 new units expected to be constructed in South Sioux City by 2040 and the 200+ acres owned by HoChunk Inc.

Energy Savings of Energy Efficiency Improvements

- Weatherization of new units
  - -2,280 MMBtu electric savings per year
  - -17,755 MMBtu natural gas savings per year
  - -18,495,000 $/year annual program costs (based on average estimate of $7,500 per home provided by Nebraska Weatherization Assistance Program)
- Residential Energy Conservation Ordinance (RECO)
  - -212.19 MMBtu electric savings per year
  - -342.49 MMBtu natural gas savings per year
  - -2,900 $/year cost per homeowner
- Commercial Energy Conservation Ordinance (CECO)
  - -60,773 MMBtu electric savings per year
  - -33,977 MMBtu natural gas savings per year
  - -7,013,200 $/year total cost to property buyers per year

Name	Value
Electricity Savings (kWh / Year)	-668286
Natural Gas Savings (Therms / Year)	-177552
Electric Energy Savings (MMBtu / Year)	-2280
Natural Gas Energy Savings (MMBtu / Year)	-17755
Fuel Oil Energy Savings (MMBtu / Year)	0
Propane Energy Savings (MMBtu / Year)	0
Electricity Cost Savings ($ / Year)	
Natural Gas Cost Savings ($ / Year)	
Annual Program Costs ($ / Year)	-1.8495×10^{7}
Electricity Real Discount Rate	
Natural Gas Savings Real Discount Rate	
Implementation Costs Real Discount Rate	
One Year Emissions Savings (MTCO2e)	-1322.4

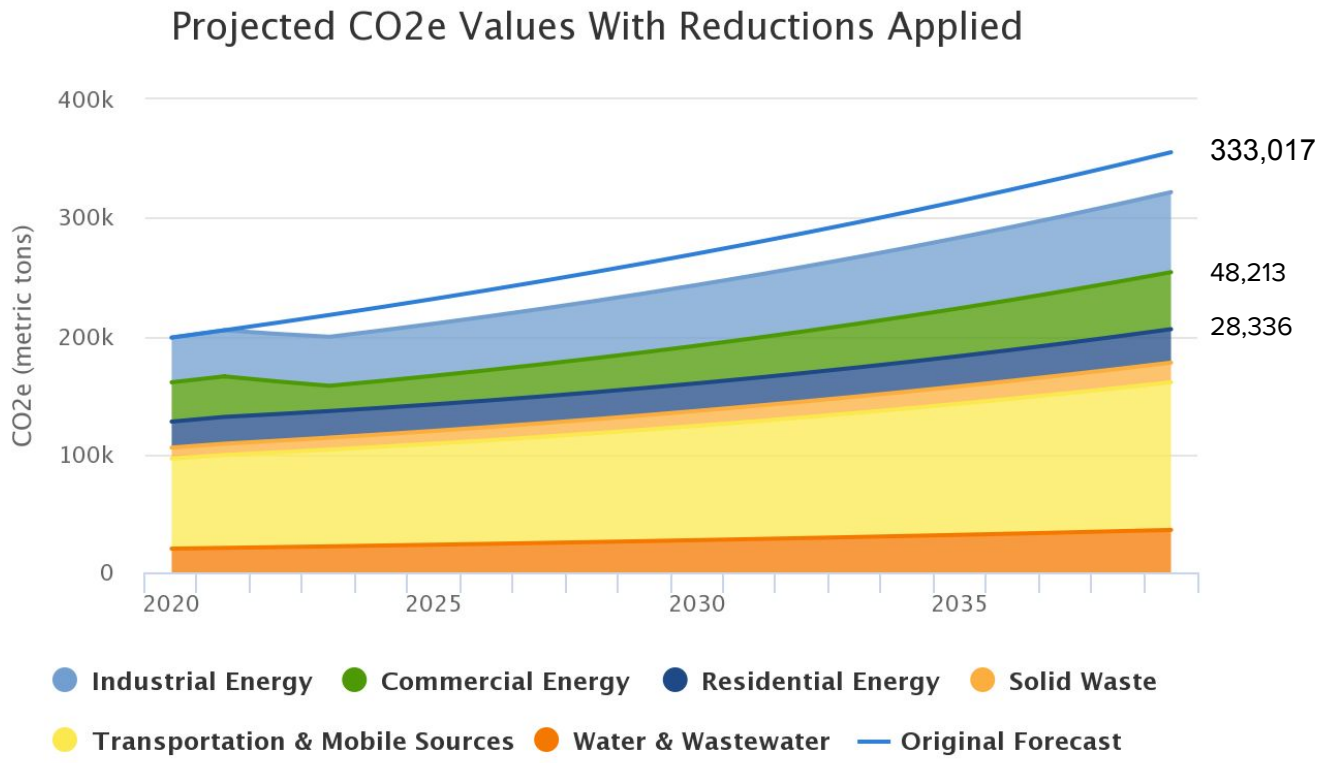
Weatherization

Name	Value
Electricity Savings (kWh / Year)	-62189
Gas Savings (Therms / Year)	-3424.9
Electric Energy Savings (MMBtu / Year)	-212.19
Natural Gas Savings (MMBtu / Year)	-342.49
Cost to Home Buyers ($ / Year)	-287100
Electricity Cost Savings ($ / Year)	
Natural Gas Cost Savings ($ / Year)	
Benefit to Local Firms ($ / Year)	297000
Cost to Local Government ($ / Year)	0
Cost to Home Buyers Real Discount Rate	
Electricity Cost Real Discount Rate	
Natural Gas Real Discount Rate	
Benefit to Firms Real Discount Rate	
Cost to Government Real Discount Rate	

RECO

Name	Value
Electricity Savings (kWh / Year)	-1.7812×10^{7}
Gas Savings (Therms / Year)	-339768
Electric Energy Savings (MMBtu / Year)	-60773
Natural Gas Savings (MMBtu / Year)	-33977
Cost to Property Buyers ($ / Year)	-7.0132×10^{6}
Electricity Cost Savings ($ / Year)	
Benefit to Local Firms ($ / Year)	1.4026×10^{7}
Natural Gas Cost Savings ($ / Year)	
Cost to Local Government ($ / Year)	0
Cost to Property Buyers Real Discount Rate	
Electricity Cost Savings Real Discount Rate	
Gas Cost Savings Real Discount Rate	
Benefit to Firms Real Discount Rate	
Cost to Government Real Discount Rate	

CECO



Combined Impact

Conclusions

Conclusions

- South Sioux City now has access to a GHG inventory (up to date to 2020) that accounts for emissions across all city sectors
  - Using this inventory, South Sioux City can then project how future emissions-reducing projects will save the city in terms of both carbon production and energy savings
  - The city can also estimate how emissions may increase due to a number of factors, one of which is population growth
- Projections of both the VA housing project and energy efficiency improvements support the implementation of not only these projects, but others of similar nature
  - South Sioux City can calculate exactly how these projects will benefit the community as a whole and individual residents
- Energy and economic savings accomplished with both reduction strategies