



Chico Energy plan: Commercial Parking Area

By Jose Torres & Jonas Chanh

Department of Geography and Planning
California State University, Chico

Introduction

With a tight budget and a 8% employment rates, the City of Chico is estimated to use up to 3 kilowatts from participating residential solar homes (Gallo). According to Gallo's research, a estimation of 20MW would be a ideal projection range to fully supporting the City of Chico electricity usage.

Hypothesis:

Is it possible to sustainably replace the City of Chico current electricity usage with solar parking coverage infrastructure on Commercial zoned parcels.

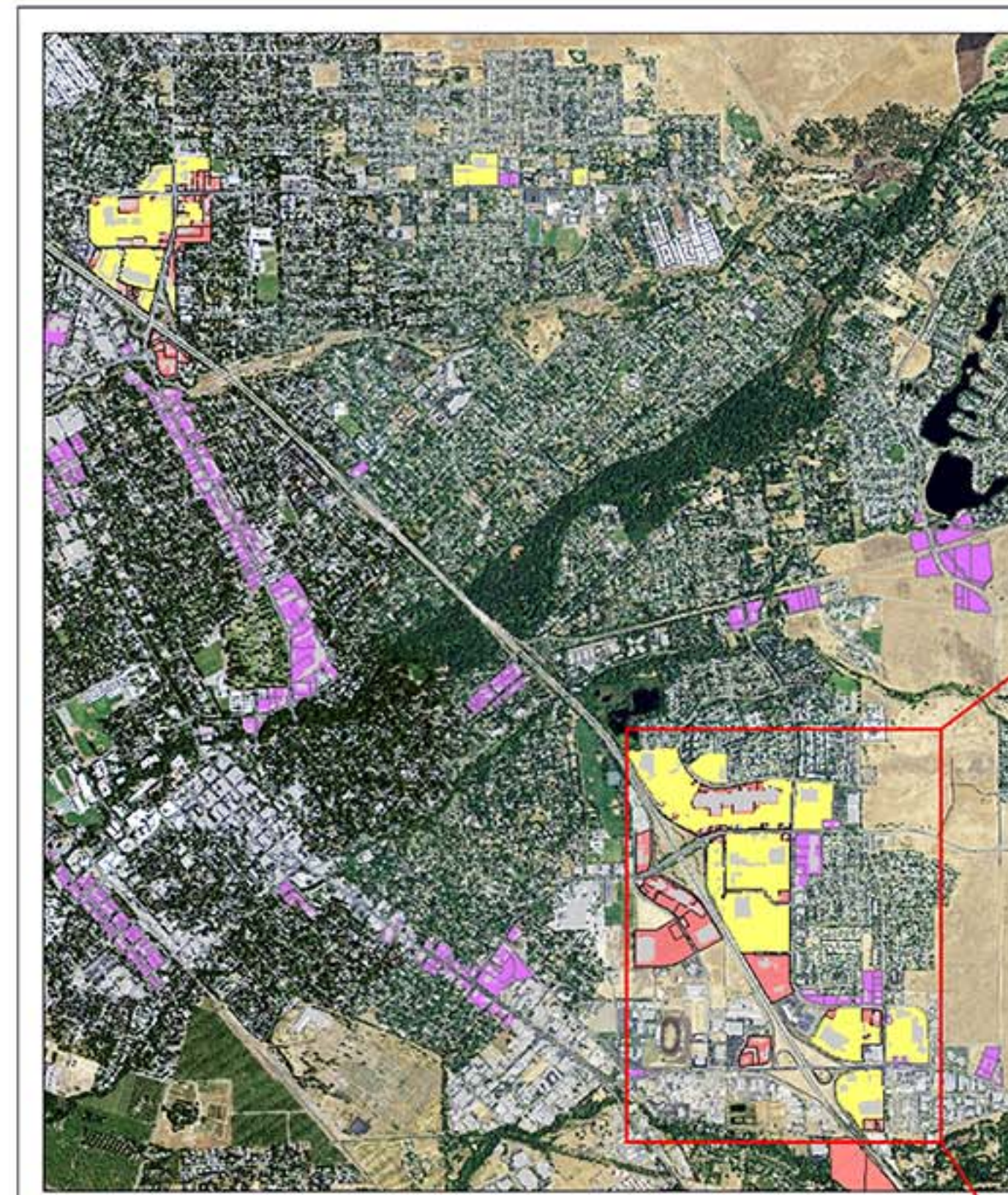
Data & Method

Data
From California State University, Chico
• Chico City Limits
• Chico Plan Area
• NAIP 2012
From Grid Alternative
• Solar Panel

ArcMap 10.2 Tools
• Clip
• Merge
• Erase
• Selection
By Attribute
• Dissolve
• Editor
Construction tool
Polygon

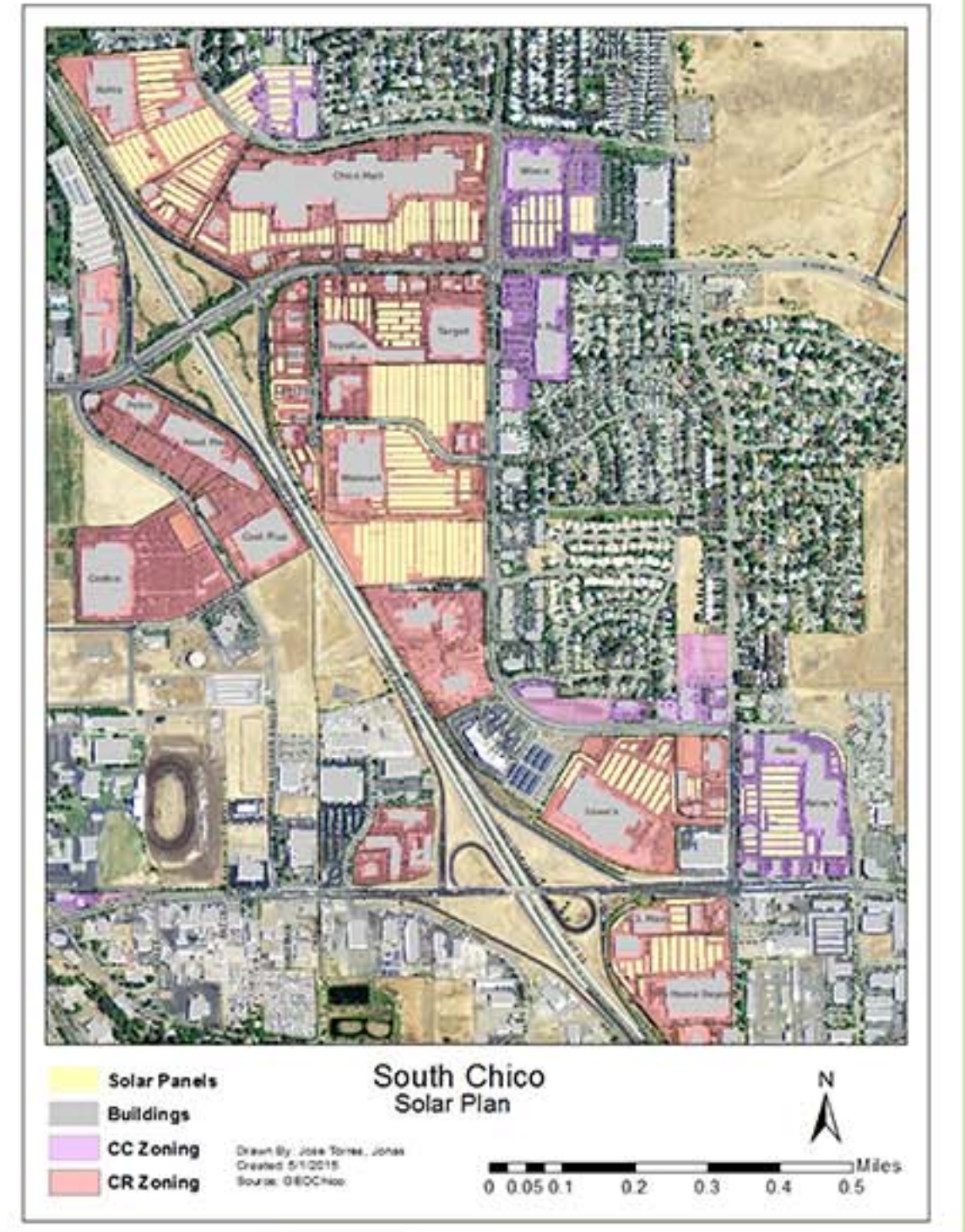
Method
• Dissolve "Chico City Limit"
• "Clip" NAIP 2012 imagery with New "Chico City Limit_Diss"
• Creating Polygon with clipped NAIP imagery
• Merge CR & CC zoning

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Analysis and Results

- Analysis searched within the Chico City Limits for possible construction site according to zoning code
- Selecting the attribute of CR zoning parcel from Chico Plan Area for polygon constructing references
- Solar panel selection was determine base on the existing building's directional orientation, preferring southerly positioned parking lots
- Creating solar polygon
- NAIP imagery reveal several open CR with no development; not sure if the areas were considered brownfield or greyfield
- CR zoned parcel did not meet the goal
- Additional zoning parcel (CC) was merge to CR to help support our goal
- With CR & CC zoning parcel, we were able to reach our goal
- 9.9 % of parcel used from merge CR & CC
- Field calculation with 50% shade law, resulting a 246MW available
 - $[Zone Area] - [Building Area] = (A) * (.5) = A/17.5 = Potential Panel$



Equations & Conversion

key
W = Watts
MW = Megawatts
V = Volts
A = Amps

1W = 0.000001MW
1MW = 1,000,000W

Equation/Conversion:

Megawatts to watts
 $P_{(W)} = 1000000 \times P_{(MW)}$
 • $1,000,000 \times 20MW$
 = 20,000,000W

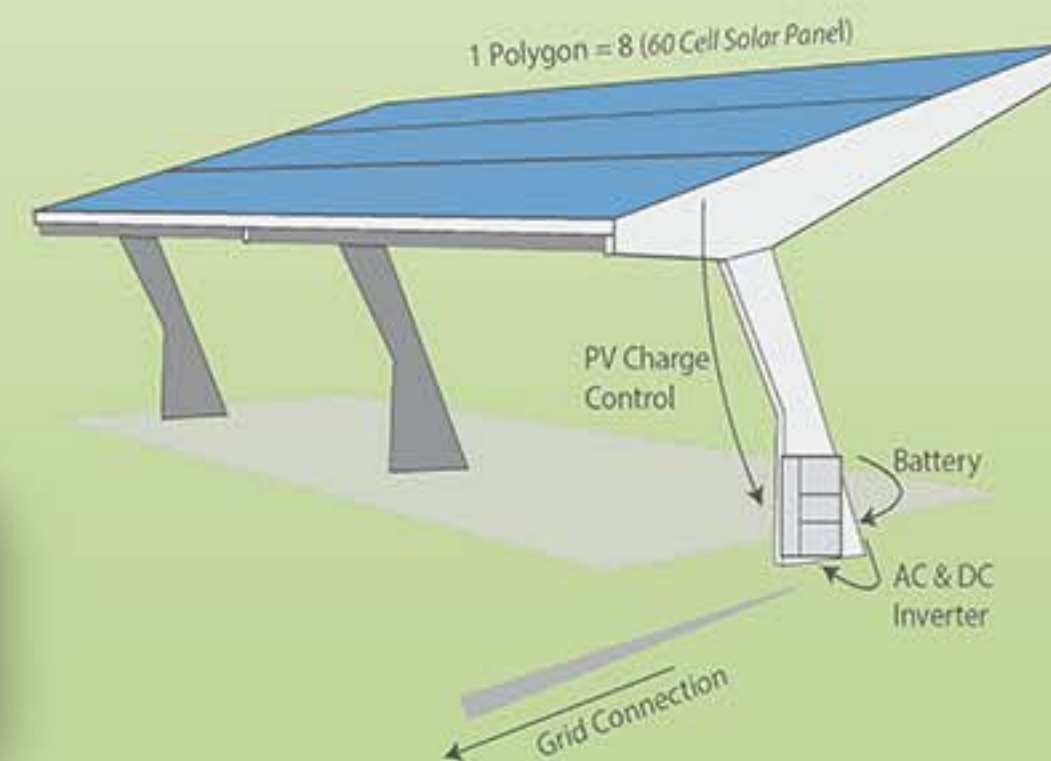
Watts to megawatts

• $P_{(MW)} = P_{(W)} / 1000000$
 • $20,000,000W / 1,000,000$
 = 20MW

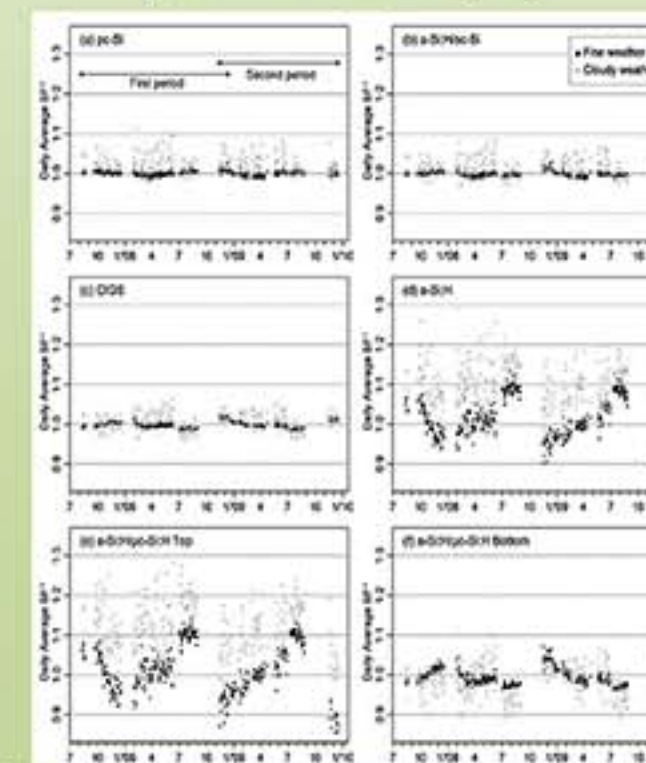
DC volts o watts calculation

$$P_{(W)} = V_{(V)} \times I_{(A)}$$

- 1 polygon = 8 solar panel (SP)
- $8 \times 250W = 2,000W$ per polygon
- $20,000,000W / 2,000W = 10,000$ polygon



Spectral Factor (SF)



This is a study done in Japan to determine whether if Solar panel are more efficient on cloudy days then on clear days. The variation of the SF is plus or minus 10%.

References

Casey, R. (2015, April 20). Solar Information [Online interview].
 Gallo, D. (2013). Chico Community Solar. J(1), 12-12. Retrieved February 17, 2014, from <http://chicosolargardens.org/resources/Chico-Community-Solar-Report.pdf>
 Ishii, T., Otani, K., Takashima, T., & Xue, Y. (2013). Solar spectral influence on the performance of photovoltaic (PV) modules under fine weather and cloudy weather conditions. *Progress In Photovoltaics*, 21(4), 481. doi:10.1002/ppv.1210

Conclusion

Our analysis indicated that with the regional Commercial (CR) parcel zoning there was not enough space for solar coverage infrastructure, to support the plan but with Community Commercial's (CC) zoning parcel, there was more than enough room to build Solar parking coverage.

Additionally, if this plan was ever to be implemented:

- An environmental impact analysis would need to be done to evaluate any possible environmental impact.
- Parking lots must have a 50% tree shade cover according to Chico Municipal Code (CMC) 19.70-26, this code would have to be amended for solar plan approval.