INTRODUCTION
In 2012, the City of Ann Arbor enacted a Climate Action Plan involving three community-wide targets for greenhouse gas emission reductions (from 2000 baseline levels):
- 8% reduction of CO₂ emissions by 2015
- 25% reduction of CO₂ emissions by 2025
- 90% reduction of CO₂ emissions by 2050

In 2016, the Ann Arbor Public Schools consumed 25 GWh of electricity, with an associated 16 Mtonnes of CO₂ emissions. The Ann Arbor Public Schools have an opportunity to make significant contributions to community-wide emission reductions, save significantly on energy spending, and lead an educational community effort towards increasing renewable energy on-site in schools, all without significantly impacting land use.

METHODOLOGY
The schools within the district were assessed individually for solar feasibility. This involved a visual assessment for area and feasibility of roof space. Annual energy production was estimated assuming 3.8 average daily peak sun hours for Southeast MI, 250W PV panels with 15% efficiency, with 16% total losses due to weather conditions and system failure. These assumptions were based on existing projects in Southeast MI of similar scale. Cost and payback period were calculated using 2016 billing data for AAPS, $2/Watt cost of PV installation, and a 2.5% growth rate for electricity costs from the utility. Emission reduction estimates were calculated using DTE’s 2016 fuel mix and emission factors from the NREL LCA Harmonization Project.

SITE SELECTION
The Ann Arbor Public Schools consist of 32 schools serving the City of Ann Arbor and surrounding communities.

EMISSION REDUCTIONS
Annual emission estimates were calculated for each school’s 2016 electric consumption supplied by DTE’s 2016 fuel mix and a combination of DTE’s fuel mix plus the contribution of Solar PV at each school. Life Cycle Analysis (LCA) emission factors were used, so as to represent all associated emissions from a particular energy source, including infrastructure construction and material transportation, fuel supply, production of energy, maintenance, and retirement/dismantlement of infrastructure. Many of the schools could feasibly reduce their CO₂ emissions by 50% or more via rooftop solar PV.

ENERGY PRODUCTION
The Ann Arbor Public Schools could feasibly generate 8 GWh annually from onsite rooftop solar PV, which represents 32% of the district’s 25 GWh 2016 electric load. Many of the schools could individually satisfy a majority of their respective load via on-site rooftop solar PV.

COST AND PAYBACK PERIOD
While the installation cost of each project was based on a fixed rate of $2/Watt, many schools show variable payback periods due to varying billing rates among different schools.

If the upfront cost were to be levelized over the annual generation estimates of these solar installations for a lifetime of 30 years, the cost of electricity would be $0.077/kWh.

The average payback period for the district was estimated to be approximately 15 years.

RESULTS
This assessment estimates that the Ann Arbor Public Schools could feasibly generate 33% of their total annual electric load using on-site rooftop solar PV. This would reduce the district’s annual CO₂ emissions by 30%. These contributions towards the City’s community-wide Climate Action Plan goals could be made with minimal impact on school land use and with an average payback period of 15 years.

The Ann Arbor Public Schools have an advantageous opportunity to make cost-effective contributions to community carbon-reduction goals. This could be a collaborative and educational project that benefits the schools, the community, and the students.

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REFERENCES