

The background of the slide is a traditional Zillij mosaic, a form of Islamic geometric art. It features a complex, repeating pattern of interlocking lines in white and black, creating a lattice of various polygons. The spaces between these lines are filled with small, irregular tiles in shades of blue, green, and brown. The overall effect is a dense, intricate, and colorful geometric design.

Preservation and Progress

The Socio-Economic and Environmental
Effects of Modernizing Zillij Production

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In association with:

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Arabesque Inc.



WPI

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UNIVERSITY



Arabesque

Moresque Design and Decoration

Purpose

- Our project's goal is to reduce the environmental impact of zillij production while retaining the authenticity and quality of traditional methods

Arabesque Inc.

- Arabesque design
 - Plaster
 - Painted and carved wood
 - Zillij
- Established in 1928
- Internationally recognized
 - Metropolitan Museum of Art
 - One of the biggest Mosques in the US
- Assists the Moroccan government in efforts to reduce zillij emissions



1 2
3 4





1 2
3 4





Artisans and Morocco

- Zillij production is part of Morocco's massive artisanal industry
 - Handicraft industries count for 20% of the Moroccan labor force and 10% of the national GDP
- Morocco's trying to foster its artisanal industry

Millennium Challenge Corporation

- Offers aid to countries that apply based on “good governance, economic freedom, and investments in their citizens”
- Granted Morocco a 5-year compact for \$697.5 million
 - \$111.87 million for Artisan and Fes Medina Project



Pollution in Morocco

- Traditional zillij produces a multitude of harmful pollutants
- Smog from kilns can cause health issues
- Morocco is very susceptible to the effects of climate change

Gas Kilns

- The Moroccan government proposed gas kilns are proposed to replace wood fired kilns
- Cleaner burning
 - No particulate matter
- Reasonably priced fuel
 - Subsidized
 - Imported from Algeria

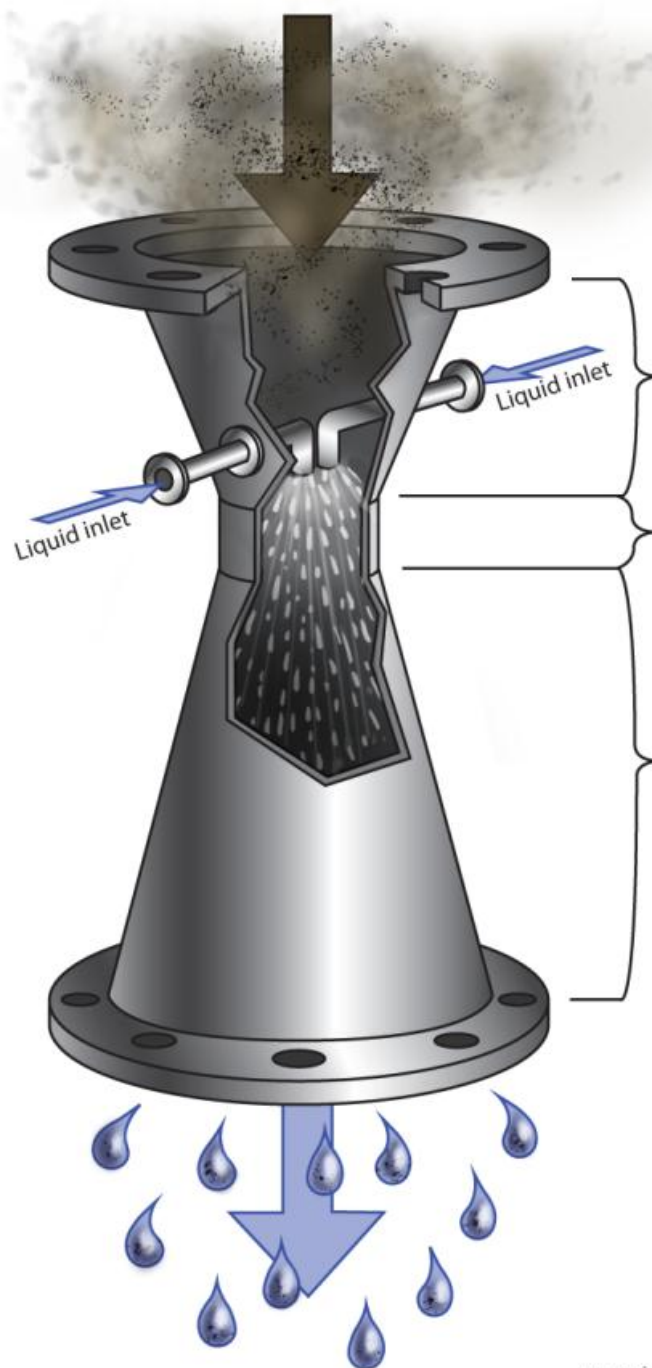
Gas Kilns in Practice

- Traditional glazes don't work
 - Colors are wrong
 - Finish is rippled
- Tiles are brittle
 - Excess sintering causes unpredictable failure
- More airflow needed
 - Cost and pollution increase

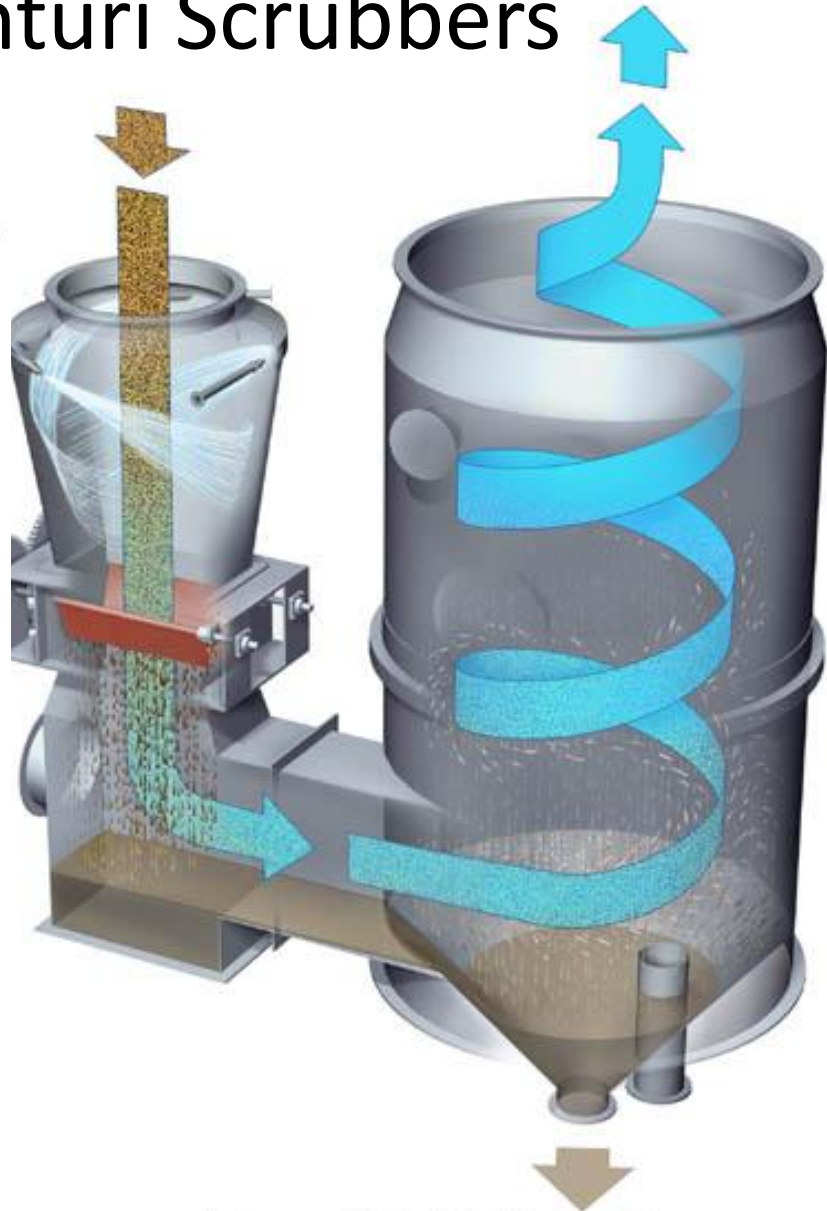
Scrubbers

- Attachment for traditional kiln
 - Re-use existing infrastructure
- Clean emissions to those of natural gas kilns
- Lower capital cost

Venturi Scrubbers



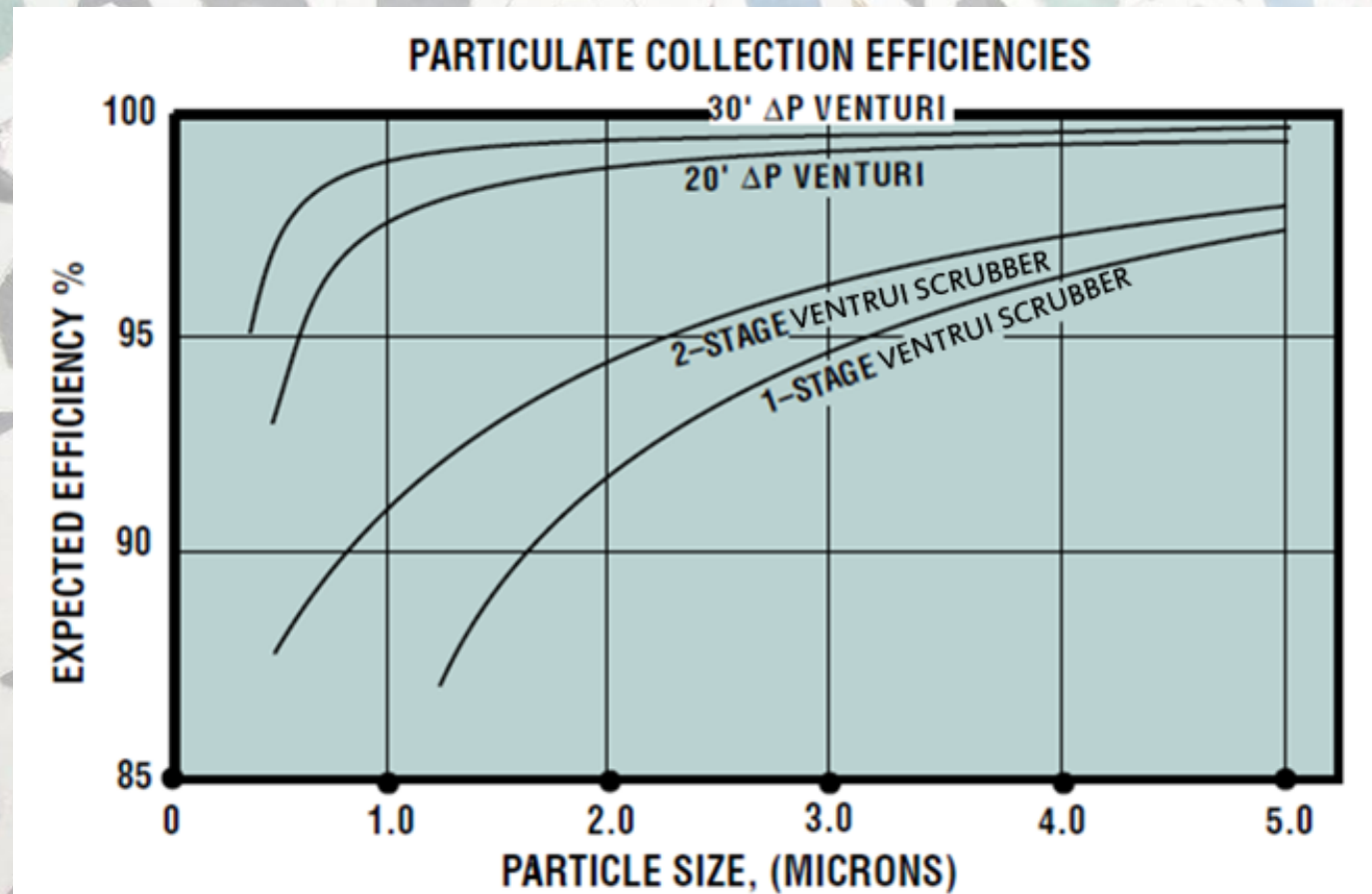
Converging section
Throat
Diverging section

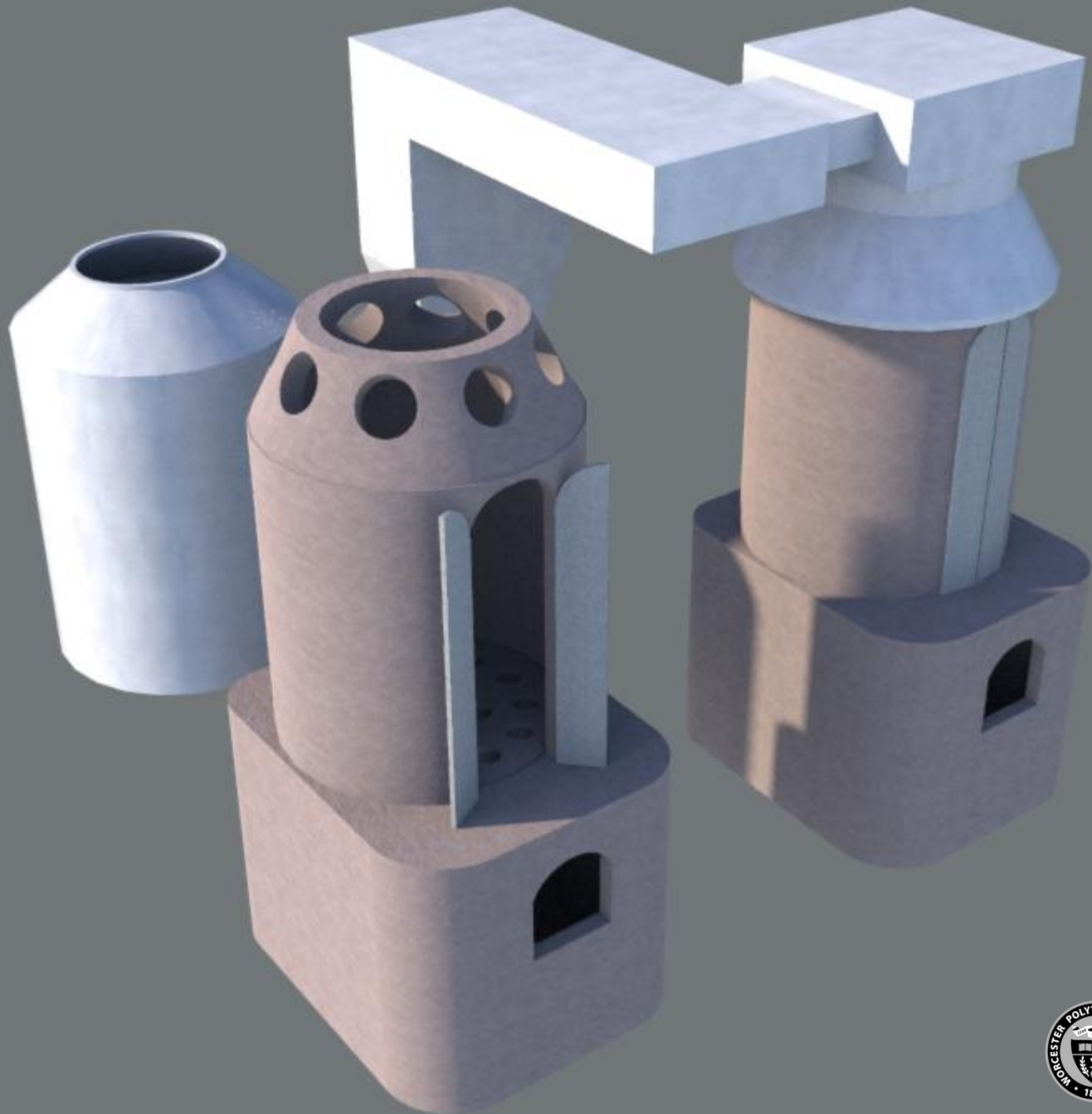


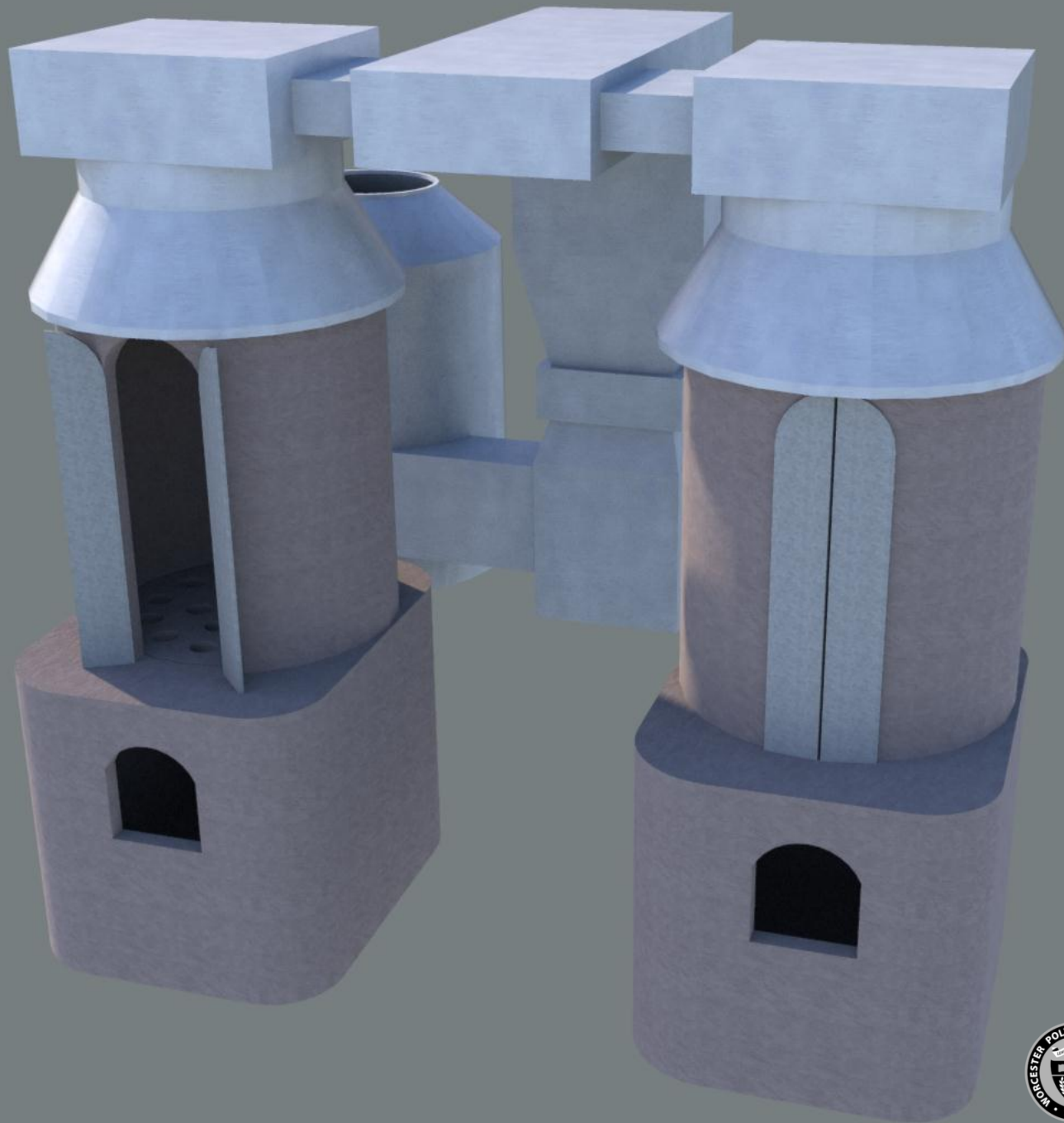
Proposed Solution

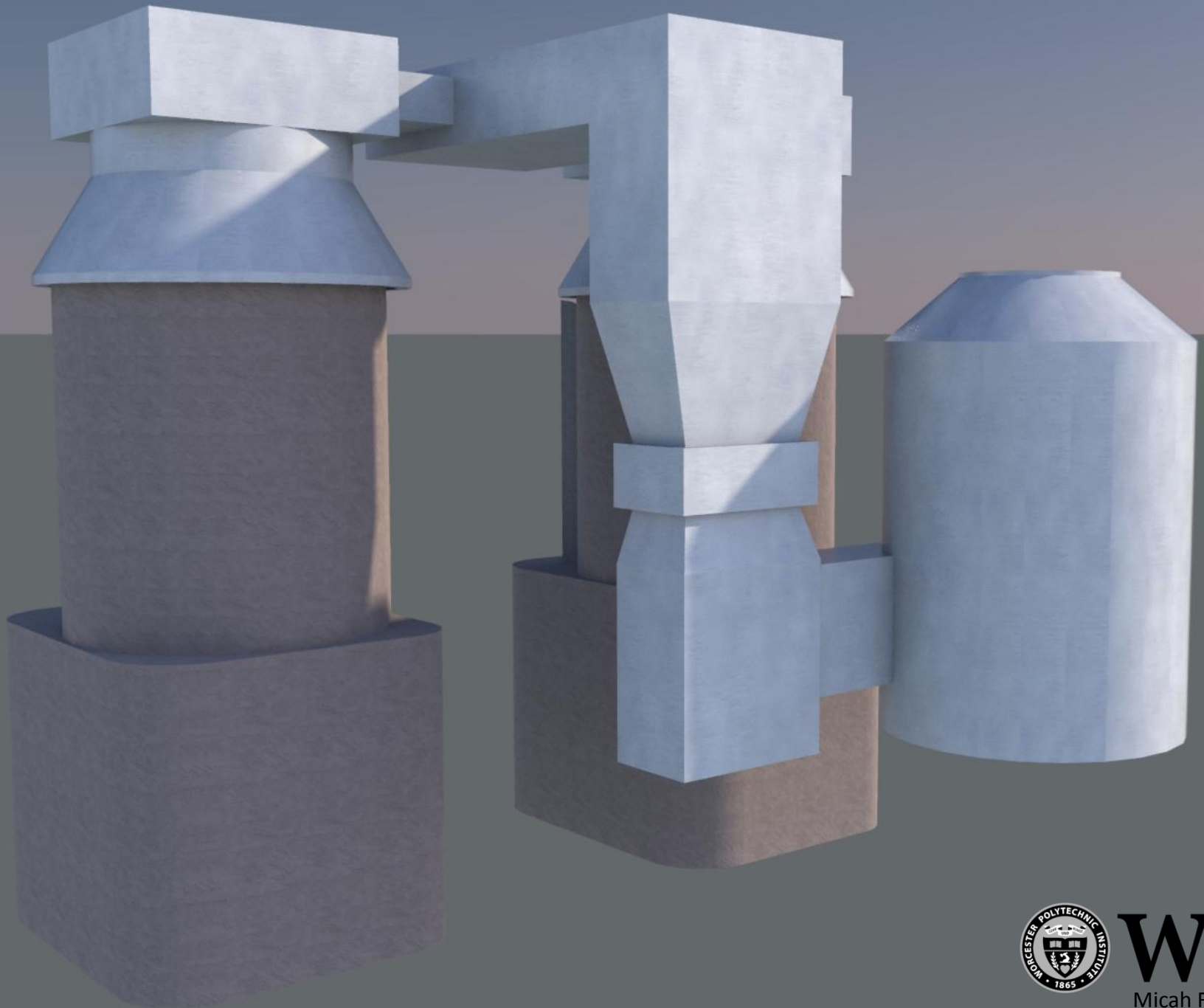
- Venturi scrubbers remove both particulate matter and gaseous pollutants
 - Highly efficient
- Low lifetime cost
- Minimal upkeep

Efficiency









Cost analysis

	Capital cost per kiln	Capital cost to replace 240 kilns	Additional operating expense per firing	Additional yearly operating expense per kiln including fuel and maintenance	Estimated 5 year cost including installation, maintenance, and fuel for all 240 kilns
Natural Gas Kiln	\$100,000	\$24,000,000	\$20	\$7,300	\$25,752,000
Case Study 1	\$77,000	\$9,240,000	\$33	\$12,045	\$12,130,800
Case Study 2	\$82,000	\$9,840,000	\$15	\$5,475	\$11,154,000

Conclusion

- Wood kilns with scrubbers and gas fired kilns have a comparable effect on the environment
- Artisans are able to preserve traditional methods and high standards of quality
- Our research justifies pursuing the testing of venturi scrubbers on wood fired kilns



Questions?

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