



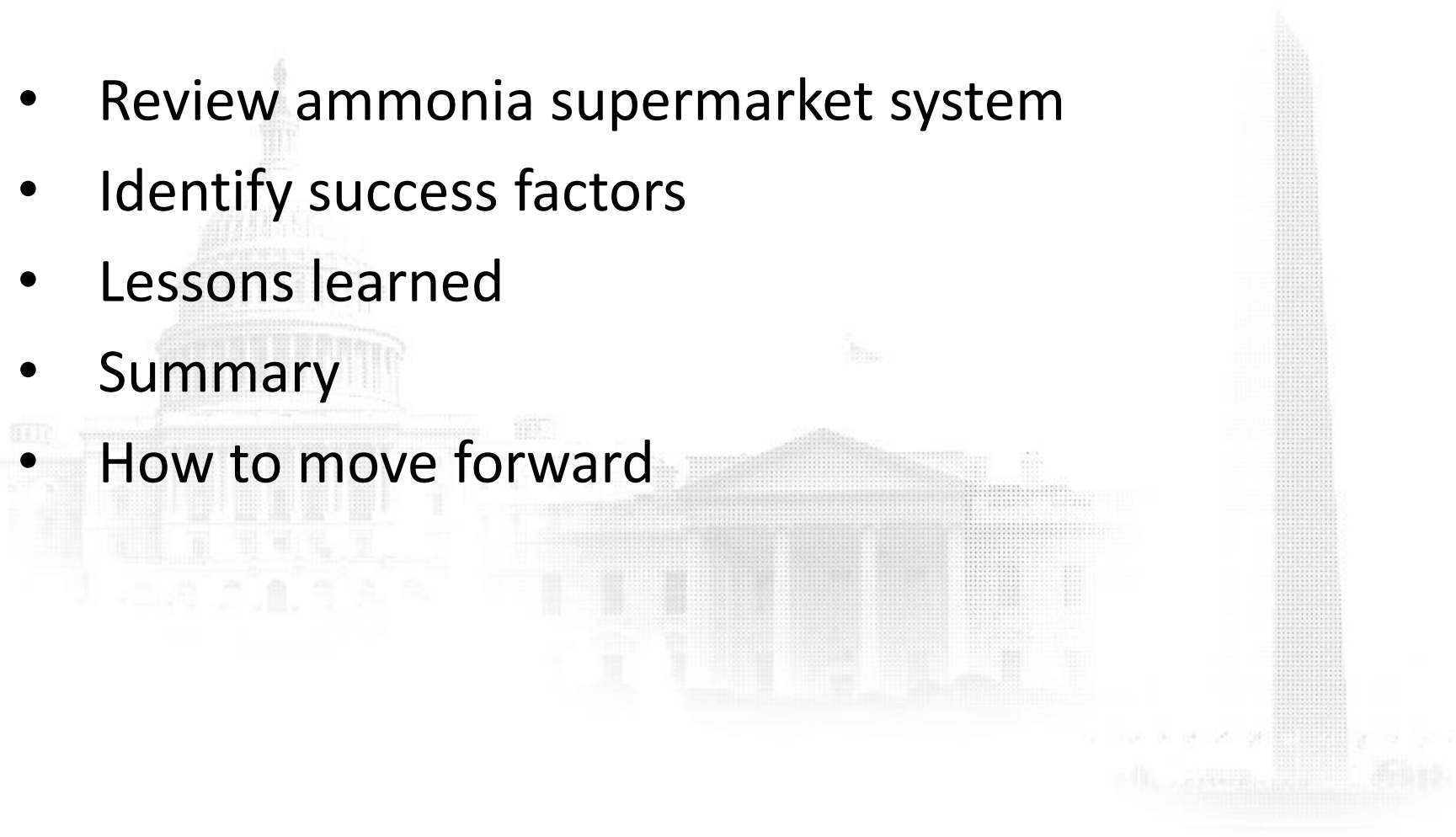
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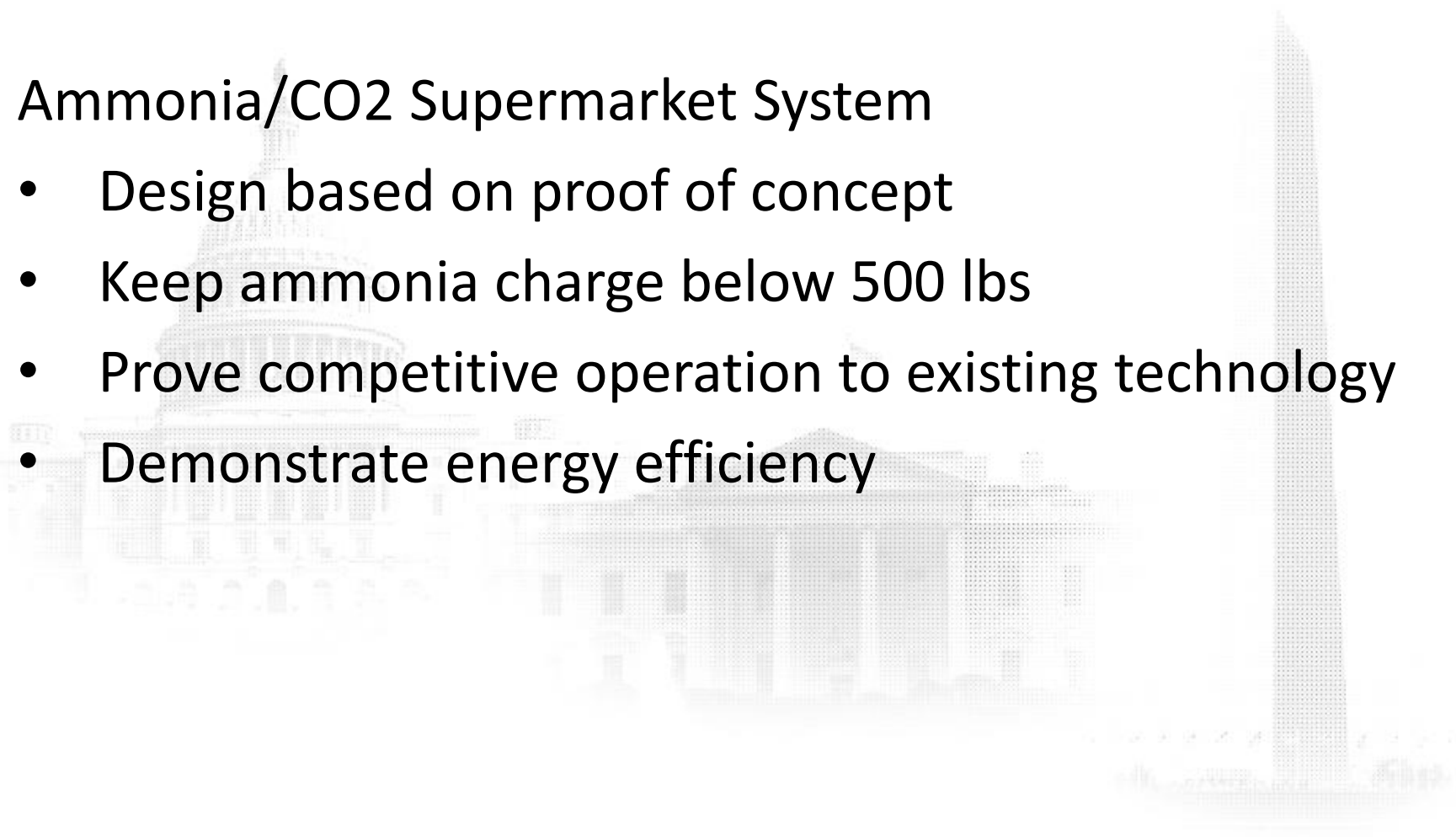
A Manufacturers Approach to Building and Promoting Natural Refrigerants

- Review ammonia supermarket system
- Identify success factors
- Lessons learned
- Summary
- How to move forward



Ammonia/CO2 Supermarket System

- Design based on proof of concept
- Keep ammonia charge below 500 lbs
- Prove competitive operation to existing technology
- Demonstrate energy efficiency



#3 New System

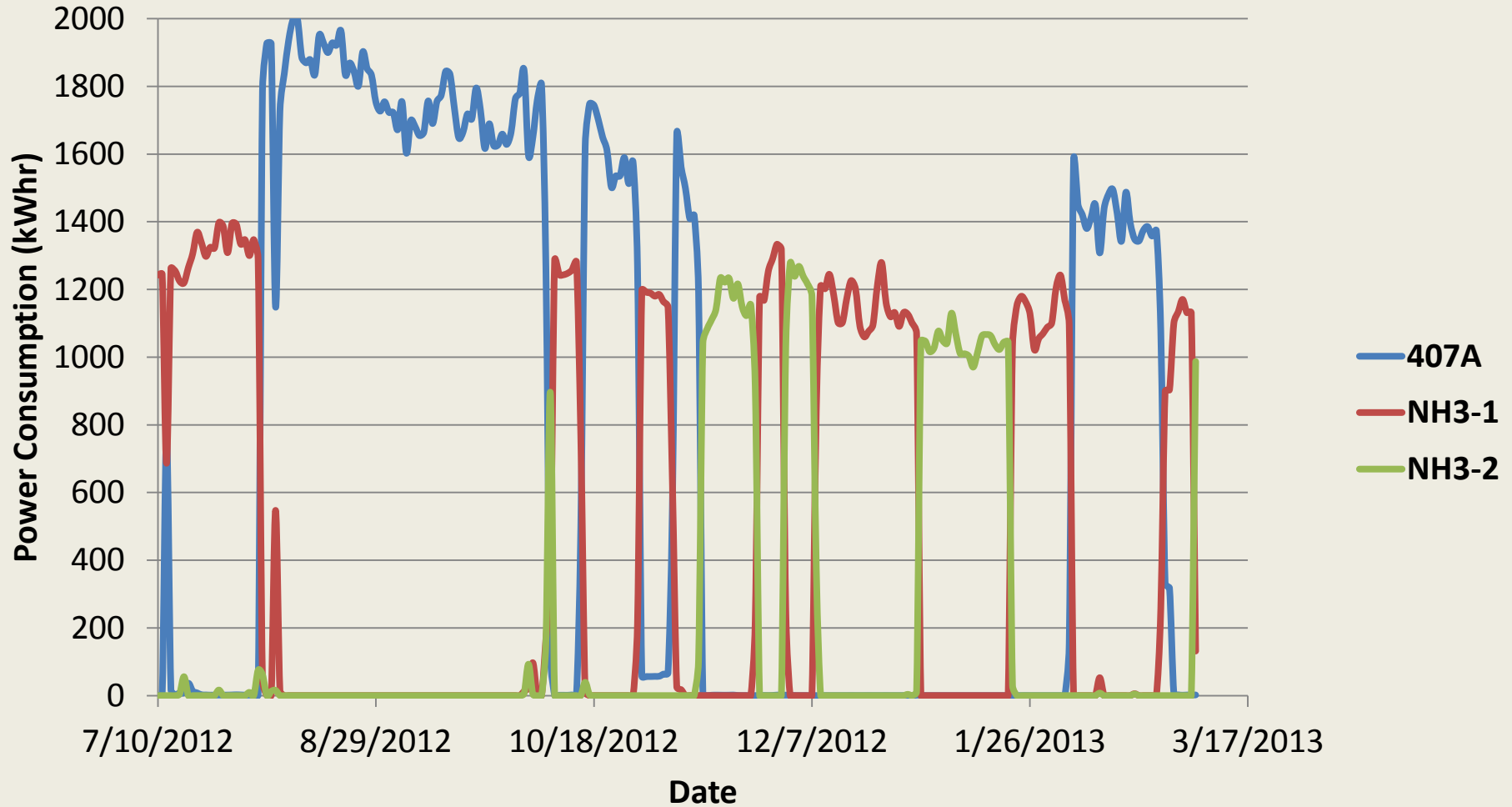
First Ammonia Supermarket Application

- 250 lbs ammonia charge
- Range of efficiency depending on analysis
- Successful proof of concept

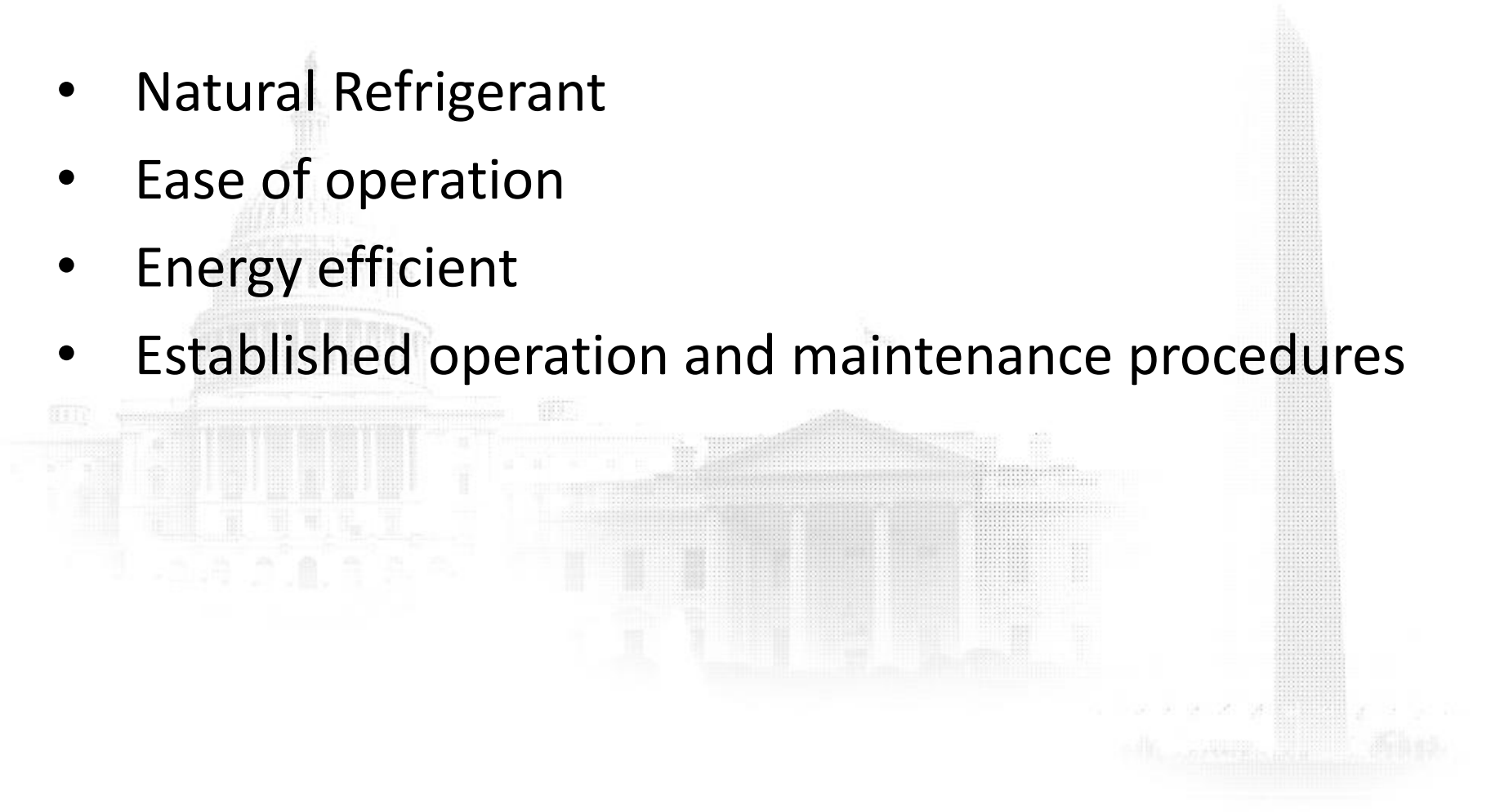


#4 New System

First Ammonia Supermarket Application



- Natural Refrigerant
- Ease of operation
- Energy efficient
- Established operation and maintenance procedures



#6 Lessons Learned



- Redesign of system approach
- Modular type units
- Compact construction
- Market priced solution

- Most commercial interest focused on CO2 applications
- Ammonia system interest increasing
- Characterizing system parameters key for next generation systems
- Industry education and information

- Initial projects should be collaboration based to capture best system knowledge
- Clear understanding of project requirements
- Set proper expectations and define goals clearly



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Thank you!