



Wisdom to guide mobility transformations at U.S. ports



# Optimization and Electrification of Airport Shuttle Bus Fleets

Electrification and optimized scheduling of airport shuttle fleets can lead to significant cost, emissions, and energy savings.

## The Opportunity

Dallas-Fort Worth International (DFW) Airport is one of the world’s largest airports to achieve carbon-neutral status while continuing to seek new ways to reduce carbon emissions.<sup>1,2</sup>

Athena results show DFW Airport could continue to reduce carbon emissions and operational costs by adjusting its shuttle services—a significant source of greenhouse gas emissions and cost for U.S. airports. By switching its central terminal area shuttle services to an electric fleet and/or optimizing bus operations, DFW Airport could see significant savings in emissions, energy, and cost.



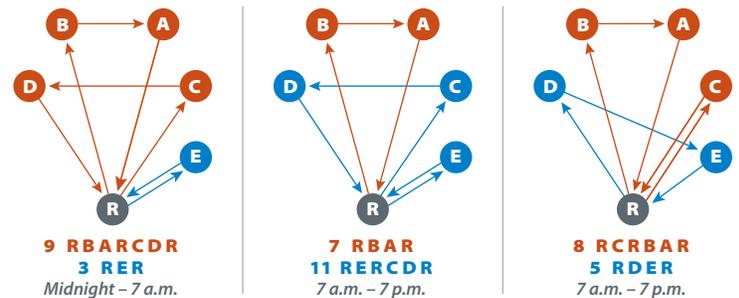
Idle times for existing shuttle routes demonstrate opportunities for on-route and between-service electric vehicle charging. Figure by Andrew Kotz, NREL

## Our Approach

Using a data-driven approach for route and schedule optimization, the Athena research team considered four areas for improved energy efficiency of shuttle operations at DFW Airport:

1. Demand-adaptive shuttle schedules that consider demand fluctuations throughout the day and week
2. New, more efficient shuttle bus routing options that explore the tradeoff between energy efficiency and passenger experience

3. Opportunities for electrification of shuttle buses using commercially available technology
4. The economics and return on investment of fleet electrification, providing a general approach to understanding heavy vehicle electrification and route optimization opportunities at U.S. airports.



Optimized routes and schedules for a typical Friday at DFW Airport for the rental car shuttle (R) and five terminals (A, B, C, D, & E). This new route would save the airport as much as 40% fuel and emissions compared to existing routes and schedules. Figure by Christopher Schwing, NREL

## Results

The model results indicate that electrification is possible and cost-effective immediately for some existing routes, including rental car and aircraft hardstand airport shuttle services; other routes may require technology improvements or creative strategies to be effective.

By optimizing routes and schedules, a 20% reductions in energy use and emissions are possible with minimal impact on passenger wait times. If passengers can tolerate more moderate ride and wait times, up to 50% savings can be achieved.

## Impact

This data-driven approach for fleet optimization and electrification provides new ways for airport operations staff to weigh efficiency gains with economics and customer experience. This approach can be applied to other similar-sized international airports participating in the Athena project and beyond.

For more information, visit [athena-mobility.org](http://athena-mobility.org) or contact [athena.mobility@nrel.gov](mailto:athena.mobility@nrel.gov).

Photos by Dennis Schroeder, NREL.



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<sup>1</sup> Dallas Fort Worth Airport, “DFW Airport Achieves Carbon Neutral Accreditation for Third Year,” 2016. [Online]. Available: <http://dfwairport.mediaroom.com/181108-DFW-Achieves-Carbon-Neutral-Accreditation-for-Third-Year>.

<sup>2</sup> Dallas Fort Worth Airport, “Dallas Fort Worth International Airport: Carbon Footprint,” Fort Worth, TX, 2018.