I. INTRODUCTION

Although aircraft consume large amount of the fuel for their flights in the air, they also use a significant amount to taxi on the ground. Conventionally, aircraft taxi at about 7% of the total thrust, which is the idling thrust of jet engines [1]. Considering that the Airbus A320, which is a narrow body aircraft, consumes approximately 0.1 kg of fuel per second for taxiing [2] and taxi time exceeds 30 minutes at busy and major airports [3], it is seen that the aircraft emits a high amount of pollutants at airports.

Electric taxi systems have been produced by various companies to reduce the environmental pollution at the airports. These systems are structurally divided into two as on-board and external ETS. On-board ETSs are systems that obtain the electrical energy from the auxiliary power unit (APU) already on the aircraft, however APU cannot provide the sufficient power in all conditions to taxi the aircraft without causing congestion at the airports. External systems have the advantages of not adding extra weight to the aircraft and not requiring any modifications to the aircraft, but the disadvantages of these systems are that they can greatly reduce the autonomy of the aircraft and increase the congestion between gates and runways due to the increase in the number of tow trucks running [2].

III. RESULTS AND DISCUSSIONS

Considering the taxi-in and taxi-out times were 420 seconds and 1140 seconds, respectively, and the engine power setting was determined as 7%, it has been calculated that the aircraft consumes a total of 293.28 kg of fuel for taxi movement. In addition, when the taxi-in and taxi-out movements are considered together, a total of 8.80 kg of CO, 1.82 kg of HC, 1.11 kg of NOx, and 923.83 kg of CO2 are emitted. The amounts of volatile organic, volatile sulphuric, non-volatile, and total PM resulting from such a taxi movement are 11.22 g, 14.36 g, 0.90 g, and 26.48 g, respectively. In Table 3 below, the fuel consumption and pollutant gas amounts are given for 420 seconds of taxi-in and 1140 seconds of taxi-out using the CFM56 model jet engine of the A319 aircraft at idle.

Tab. 3: Fuel and pollutant gas flow rates of the CFM56-5B/P jet engine at 7% power settings [4].

<table>
<thead>
<tr>
<th>Engine Power Setting</th>
<th>Fuel Flow [kg/s]</th>
<th>CO [kg/s]</th>
<th>HC [kg/s]</th>
<th>NOx [kg/s]</th>
<th>CO2 [kg/s]</th>
<th>PMnon-volatile</th>
<th>PMvolatile</th>
<th>PMtotal Total PM [kg/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idle: 7%</td>
<td>28.9600</td>
<td>2.0088</td>
<td>0.0087</td>
<td>0.0087</td>
<td>0.0087</td>
<td>0.0087</td>
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</table>

IV. CONCLUSIONS

With the use of this system, the planned emission-free electric taxi operation in the future will be realized and therefore large amounts of CO2 and other pollutant emissions will be eliminated at airports. In addition to eliminating emissions, ground operations can be carried out nearly noiselessly. Moreover, moving the aircraft around the airport without using its engines will reduce the risk of foreign object damage (FOD) and reduce engine maintenance costs. Finally, with the parallel parking facility to the terminal building, the use of two airport bridges for the passenger boarding procedure can be allowed, which will shorten the boarding time of the passengers.