BULK HAULING EQUIPMENT FOR CHG

Don Baldwin
Director of Product Development - Hexagon Lincoln
HEXAGON LINCOLN TITAN™ Module System

- **Compressed Hydrogen Gas**
  - **Capacity**
    - 250 bar – 616 kg
    - 350 bar – 809 kg
    - 540 bar – 1155 kg
  - **Gross Vehicle Weight (with prime mover)**
    - 250 bar – 28 450 kg
    - 350 bar – 30 820 kg
    - 540 bar – 39 440 kg
  - **Purchase Cost**
    - 250 bar – $510,000
    - 350 bar – $633,750
    - 540 bar – $1,100,000

- **Compressed Natural Gas**
  - **Capacity (250 bar at 15 C)** – 7412 kg
  - **GVW (With prime mover)** – 35 250 kg
  - **Purchase Cost (+/- 5%)** – $510,000
HEXAGON LINCOLN TITAN™ V Magnum Trailer System

- Compressed Hydrogen Gas
  - Capacity
    - 250 bar – 800 kg
    - 350 bar – 1050 kg
    - 540 bar – 1500 kg
  - Gross Vehicle Weight (with prime mover)
    - 250 bar – 31 000 kg
    - 350 bar – 34 200 kg
    - 540 bar – 45 700 kg
  - Purchase Cost (+/- 5%)
    - 250 bar – $595,000
    - 350 bar – $745,000
    - 540 bar – $1,295,000

- Compressed Natural Gas
  - Capacity (250 bar at 15 C) – 9649 kg
  - GVW (With prime mover) – 39 830 kg
  - Purchase Cost (+/- 5%) - $595,000
OPERATIONAL PARAMETERS FOR BULK HAULING EQUIPMENT

- More Hydrogen Capacity and Lower GVW Reduces Operating Expenses
- Bulk Hauling Equipment Options
  - Steel Tube Trailers/Skids – Lower Acquisition Cost, Low Capacity, High GVW
    - Good value for stationary storage at 200 bar
    - Large footprint – takes 4 to 6 tube trailers to offload 1 TITAN™ V Magnum
  - High operating costs for rolling stock
  - T4 Tube Trailers/Modules – Higher Acquisition Cost, High Capacity, Low GVW
    - Smaller cluster packs for small projects/consumers
    - Large tank trailers/modules for hauling large quantities over long distances

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10-ft. Smartstore</td>
<td>15163</td>
<td>616</td>
<td>163</td>
<td>0</td>
</tr>
<tr>
<td>20-ft. Smartstore</td>
<td>21866</td>
<td>616</td>
<td>293</td>
<td>0</td>
</tr>
<tr>
<td>TITAN (30 FT)</td>
<td>25429</td>
<td>444</td>
<td>326</td>
<td>0</td>
</tr>
<tr>
<td>TITAN</td>
<td>28450</td>
<td>444</td>
<td>326</td>
<td>0</td>
</tr>
<tr>
<td>TITAN V Magnum</td>
<td>30991</td>
<td>444</td>
<td>326</td>
<td>0</td>
</tr>
<tr>
<td>CMIC ENRIC (200 bar)</td>
<td>31739</td>
<td>444</td>
<td>326</td>
<td>0</td>
</tr>
<tr>
<td>FIBA Jumbo 8 Tube</td>
<td>32567</td>
<td>444</td>
<td>326</td>
<td>0</td>
</tr>
<tr>
<td>FIBA Super Jumbo 14 Tube</td>
<td>57698</td>
<td>444</td>
<td>326</td>
<td>0</td>
</tr>
</tbody>
</table>
Operational Parameters for Bulk Hauling Equipment

Gross Vehicle Weight, Trailer/Module Mass and H₂ Mass of Truck and Semitrailer (350 bar)

- Gross Vehicle Weight [full load of CHG]
- Semitrailer Mass [Trailer or Module/Chassis]
- Module Mass
- Hydrogen Gas Mass

Gross Vehicle Weight, Trailer/Module Mass and H₂ Mass of Truck and Semitrailer (540 bar)

- Gross Vehicle Weight [full load of CHG]
- Semitrailer Mass [Trailer or Module/Chassis]
- Module Mass
- Hydrogen Gas Mass
CAPITAL EXPENDITURE FOR BULK HAULING EQUIPMENT

- For large consumption, total CapEx for Large T4 systems about the same as steel tube trailers
- Charts assume dump-off mode of operation
- Dump/unload trailer at point of use
  - Reduce CapEx for expensive rolling stock
  - Keep rolling stock moving to minimize OpEx
  - Drive-unload-drive-fill each cycle
  - Requires stationary storage (eg; 200 bar steel tube skids)
- Assumptions for charts
  - 2 deliveries per trailer per day (12 hr cycle)
  - 90% efficiency on trailer capacity
  - Includes cost for stationary storage ($600/kg)

---

**Capital Expenditure Relative to Daily H₂ Mass Delivered (250 bar)**

![Graph showing capital expenditure relative to daily H₂ delivery requirement for different systems.](Image)
CAPITAL EXPENDITURE FOR BULK HAULING EQUIPMENT

Capital Expenditure Relative to Daily H₂ Mass Delivered (350 bar)

Capital Expenditure Relative to Daily H₂ Mass Delivered (540 bar)