

BIG BLUE BUS

Emissions Reduction

BBB NOx Reduction Plan



Core Values

Sustainability

Fiscal Responsibility

Transit System Reliability

BIG BLUE BUS FLEET - CURRENT FLEET*

| BUS # SERIES | MAKE | YEAR | MODEL | # OF BUSES IN REVENUE SERVICE | FUEL | Engine Type | NOx | NOx extended | MPG | Ave Annual Hrs | lbs. NOx per year per bus | Total lbs. NOx per year |
|--------------------|-----------|------|---------------------|-------------------------------------|-----------|---------------|-----|-----------------|-----|-------------------------------|---------------------------------|-------------------------------|
| 1600-1603 | GILLIG | 2015 | G27E102N2 | 4 | CNG | ISL G 8.9 L | 0.2 | 0.80 | 3.5 | 2630 | 324 | 1,298 |
| 1500-1510 | GILLIG | 2015 | G27D102N4 | 11 | CNG | ISL G 8.9 L | 0.2 | 2.20 | 3.5 | 2630 | 324 | 3,568 |
| 1560 -1566 | NEW FLYER | 2015 | XN60 | 7 | CNG | ISL G 8.9 L | 0.2 | 1.40 | 3.5 | 2630 | 324 | 2,271 |
| 1300 - 1357 | GILLIG | 2013 | G27D102N4 | 58 | CNG | ISL G 8.9 L | 0.2 | 11.60 | 3.5 | 2630 | 324 | 18,816 |
| 5300 - 5320 | NABI | 2011 | 60BRT-14.02 | 21 | CNG | ISL G 8.9 L | 0.2 | 4.20 | 3.5 | 2630 | 324 | 6,813 |
| 3868 - 3876 | NABI | 2011 | 40LFW-14.01 | 9 | CNG | ISL G 8.9 L | 0.2 | 1.80 | 3.5 | 2630 | 324 | 2,920 |
| 2905 - 2914 | EL DORADO | 2011 | EZR II- BRT 32' | 10 | CNG | ISL G 8.9 L | 0.2 | 2.00 | 3.5 | 2630 | 324 | 3,244 |
| 2900 - 2902 | EL DORADO | 2010 | EZR II- BRT 32' | 3 | CNG | ISL G 8.9 L | 0.2 | 0.60 | 3.5 | 2630 | 324 | 973 |
| 2903 - 2904 | EL DORADO | 2010 | EZR II- BRT 32' | 2 | UL/HYBRID | Ford V12 UL | 1.2 | 2.40 | 4.0 | 2630 | 1,946 | 3,893 |
| 4090 - 4099 | NEW FLYER | 2006 | L40LF | 10 | LNG | C-Gas Plus | 2.2 | 22.00 | 1.5 | 2630 | 3,568 | 35,685 |
| 4038 - 4089 | NEW FLYER | 2004 | L40LF | 52 | LNG | C-Gas Plus | 2.2 | 114.40 | 1.5 | 2630 | 3,568 | 185,560 |
| 4001 - 4036* | NABI | 2002 | TOP BUS 40LFW-23 | 13 | LNG | 50 Series DDC | 4.0 | 0.00 | 1.5 | 2630 | 6,488 | 84,345 |
| Total Fleet | | | | 200 | | | | | | Total lbs NOx per year | | 349,384 |

* As of Today

**Retiring thirteen 2002 NABI buses that
produced 4.0 NOx hp/hr
and
twelve 2004 New Flyer buses that
produce 2.2 NOx hp/hr**

BIG BLUE BUS FLEET - INCLUDING 25 GILLIG BUSES WITH CUMMINS NEAR ZERO ENGINES & RETROFIT 2 HYBRID BUSES TO CNG*

| BUS # SERIES | MAKE | YEAR | MODEL | # OF BUSES IN REVENUE SERVICE | FUEL | Engine Type | NOx | NOx extended | MPG | Ave Annual Hrs | lbs. NOx per year per bus | Total lbs. NOx per year |
|--------------|-----------|------|-----------------|-------------------------------|------|-----------------------|------|------------------------|-----|----------------|---------------------------|-------------------------|
| 1700-1724 | GILLIG | 2016 | G27D102N4 | 25 | CNG | ISL G 8.9 L Near Zero | 0.02 | 0.50 | 3.5 | 2630 | 32 | 811 |
| 1600-1603 | GILLIG | 2015 | G27E102N2 | 4 | CNG | ISL G 8.9 L | 0.2 | 0.80 | 3.5 | 2630 | 324 | 1,298 |
| 1500-1510 | GILLIG | 2015 | G27D102N4 | 11 | CNG | ISL G 8.9 L | 0.2 | 2.20 | 3.5 | 2630 | 324 | 3,568 |
| 1560 -1566 | NEW FLYER | 2015 | XN60 | 7 | CNG | ISL G 8.9 L | 0.2 | 1.40 | 3.5 | 2630 | 324 | 2,271 |
| 1300 - 1357 | GILLIG | 2013 | G27D102N4 | 58 | CNG | ISL G 8.9 L | 0.2 | 11.60 | 3.5 | 2630 | 324 | 18,816 |
| 5300 - 5320 | NABI | 2011 | 60BRT-14.02 | 21 | CNG | ISL G 8.9 L | 0.2 | 4.20 | 3.5 | 2630 | 324 | 6,813 |
| 3868 - 3876 | NABI | 2011 | 40LFW-14.01 | 9 | CNG | ISL G 8.9 L | 0.2 | 1.80 | 3.5 | 2630 | 324 | 2,920 |
| 2905 - 2914 | EL DORADO | 2011 | EZR II- BRT 32' | 10 | CNG | ISL G 8.9 L | 0.2 | 2.00 | 3.5 | 2630 | 324 | 3,244 |
| 2900 - 2902 | EL DORADO | 2010 | EZR II- BRT 32' | 3 | CNG | ISL G 8.9 L | 0.2 | 0.60 | 3.5 | 2630 | 324 | 973 |
| 2903 - 2904 | EL DORADO | 2010 | EZR II- BRT 32' | 2 | CNG | ISL G 8.9 L | 0.2 | 0.40 | 3.5 | 2630 | 216 | 648 |
| 4090 - 4099 | NEW FLYER | 2006 | L40LF | 10 | LNG | C-Gas Plus | 2.2 | 22.00 | 1.5 | 2630 | 3,568 | 35,685 |
| 4038 - 4089 | NEW FLYER | 2004 | L40LF | 40 | LNG | C-Gas Plus | 2.2 | 88.00 | 1.5 | 2630 | 3,568 | 142,738 |
| Total Fleet | | | | 200 | | | | Total lbs NOx per year | | | | 219,784 |

* As of 1/15/2017

**Replacing current ISL-G
Engines with ISL-G Near Zero
Engines on thirty 2011 NABI
buses**

BBB FLEET - INCLUDING 25 GILLIG BUSES & 30 BUSES RETROFITTED WITH CUMMINS NEAR ZERO ENGINES*

| BUS # SERIES | MAKE | YEAR | MODEL | # OF BUSES IN REVENUE SERVICE | FUEL | Engine Type | NOx | NOx extended | MPG | Ave Annual Hrs | lbs. NOx per year per bus | Total lbs. NOx per year |
|--------------|-----------|------|-----------------|-------------------------------|------|-----------------------|------|------------------------|-----|----------------|---------------------------|-------------------------|
| 1700-1724 | GILLIG | 2016 | G27D102N4 | 25 | CNG | ISL G 8.9 L Near Zero | 0.02 | 0.50 | 3.5 | 2630 | 32 | 811 |
| 1600-1603 | GILLIG | 2015 | G27E102N2 | 4 | CNG | ISL G 8.9 L | 0.2 | 0.80 | 3.5 | 2630 | 324 | 1,298 |
| 1500-1510 | GILLIG | 2015 | G27D102N4 | 11 | CNG | ISL G 8.9 L | 0.2 | 2.20 | 3.5 | 2630 | 324 | 3,568 |
| 1560 -1566 | NEW FLYER | 2015 | XN60 | 7 | CNG | ISL G 8.9 L | 0.2 | 1.40 | 3.5 | 2630 | 324 | 2,271 |
| 1300 - 1357 | GILLIG | 2013 | G27D102N4 | 58 | CNG | ISL G 8.9 L | 0.2 | 11.60 | 3.5 | 2630 | 324 | 18,816 |
| 5300 - 5320 | NABI | 2011 | 60BRT-14.02 | 21 | CNG | ISL G 8.9 L | 0.02 | 0.42 | 3.5 | 2630 | 32 | 681 |
| 3868 - 3876 | NABI | 2011 | 40LFW-14.01 | 9 | CNG | ISL G 8.9 L | 0.02 | 0.18 | 3.5 | 2630 | 32 | 292 |
| 2905 - 2914 | EL DORADO | 2011 | EZR II- BRT 32' | 10 | CNG | ISL G 8.9 L | 0.2 | 2.00 | 3.5 | 2630 | 324 | 3,244 |
| 2900 - 2902 | EL DORADO | 2010 | EZR II- BRT 32' | 3 | CNG | ISL G 8.9 L | 0.2 | 0.60 | 3.5 | 2630 | 324 | 973 |
| 2903 - 2904 | EL DORADO | 2010 | EZR II- BRT 32' | 2 | CNG | ISL G 8.9 L | 0.2 | 0.40 | 3.5 | 2630 | 216 | 648 |
| 4090 - 4099 | NEW FLYER | 2006 | L40LF | 10 | LNG | C-Gas Plus | 2.2 | 22.00 | 1.5 | 2630 | 3,568 | 35,685 |
| 4038 - 4089 | NEW FLYER | 2004 | L40LF | 40 | LNG | C-Gas Plus | 2.2 | 88.00 | 1.5 | 2630 | 3,568 | 142,738 |
| Total Fleet | | | | 200 | | | | Total lbs NOx per year | | | | 211,025 |

* Retrofit approximately 06/30/2017 – 06/30/2018

**Retiring fifty 2004 - 2006 New Flyer buses with
C Gas Plus engines that emit 2.2 NOx hp/hr
and
replacing with fifty buses powered by ISL-G
Near Zero Engines that emit 0.02 NOx hp/hr**

BBB FLEET-INCLUDING 75 GILLIG BUSES & 30 NABI BUSES RETROFITTED WITH CUMMINS NEAR ZERO ENGINES*

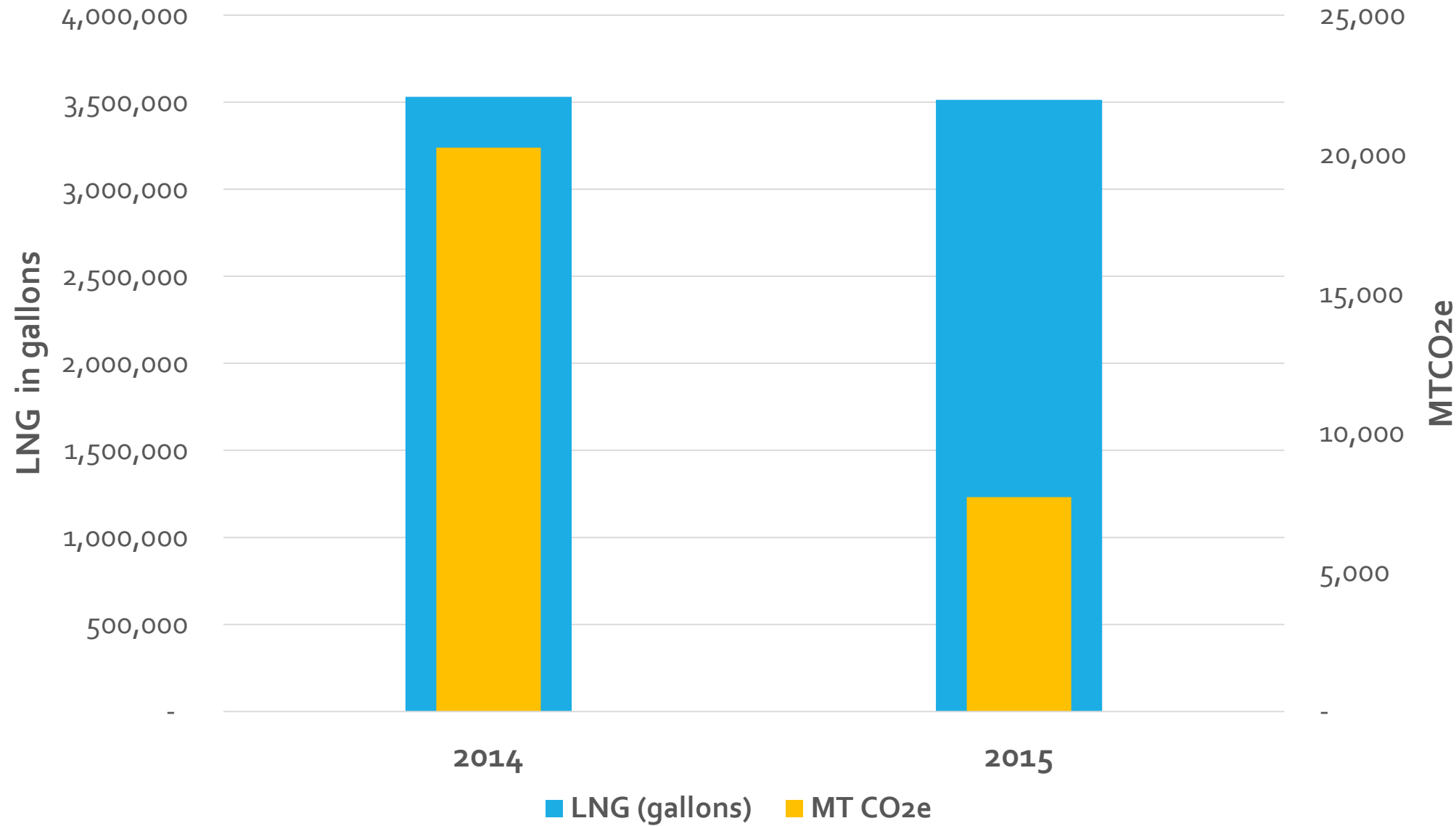
| BUS # SERIES | MAKE | YEAR | MODEL | # OF BUSES IN REVENUE SERVICE | FUEL | Engine Type | NOx | NOx extended | MPG | Ave Annual Hrs | lbs. NOx per year per bus | Total lbs. NOx per year |
|--------------|-----------|---------|-----------------|-------------------------------------|------|--------------------------|------|------------------------|-----|----------------------|---------------------------------|-------------------------------|
| 1800-1849 | GILLIG | 2018-19 | G27D102N4 | 50 | CNG | ISL G 8.9 L Near Zero | 0.02 | 1.00 | 3.5 | 2630 | 32 | 1,622 |
| 1700-1724 | GILLIG | 2017 | G27D102N4 | 25 | CNG | ISL G 8.9 L Near Zero | 0.02 | 0.50 | 3.5 | 2630 | 32 | 811 |
| 1600-1603 | GILLIG | 2015 | G27E102N2 | 4 | CNG | ISL G 8.9 L | 0.2 | 0.80 | 3.5 | 2630 | 324 | 1,298 |
| 1500-1510 | GILLIG | 2015 | G27D102N4 | 11 | CNG | ISL G 8.9 L | 0.2 | 2.20 | 3.5 | 2630 | 324 | 3,568 |
| 1560 -1566 | NEW FLYER | 2015 | XN60 | 7 | CNG | ISL G 8.9 L | 0.2 | 1.40 | 3.5 | 2630 | 324 | 2,271 |
| 1300 - 1357 | GILLIG | 2013 | G27D102N4 | 58 | CNG | ISL G 8.9 L | 0.2 | 11.60 | 3.5 | 2630 | 324 | 18,816 |
| 5300 - 5320 | NABI | 2011 | 60BRT-14.02 | 21 | CNG | ISL G 8.9 L Near Zero | 0.02 | 0.42 | 3.5 | 2630 | 32 | 681 |
| 3868 - 3876 | NABI | 2011 | 40LFW-14.01 | 9 | CNG | ISL G 8.9 L Near Zero | 0.02 | 0.18 | 3.5 | 2630 | 32 | 292 |
| 2905 - 2914 | EL DORADO | 2011 | EZR II- BRT 32' | 10 | CNG | ISL G 8.9 L | 0.2 | 2.00 | 3.5 | 2630 | 324 | 3,244 |
| 2900 - 2902 | EL DORADO | 2010 | EZR II- BRT 32' | 3 | CNG | ISL G 8.9 L | 0.2 | 0.60 | 3.5 | 2630 | 324 | 973 |
| 2903 - 2904 | EL DORADO | 2010 | EZR II- BRT 32' | 2 | CNG | ISL G 8.9 L | 0.2 | 0.40 | 3.5 | 2630 | 216 | 648 |
| Total Fleet | | | | 200 | | | | Total lbs NOx per year | | | | 34,224 |

* Approximately 06/30/2019

| Fleet | NOx | Reduction of NOx | Percentage of NOx Reduction | Projected Completion Date |
|---|---------|------------------|-----------------------------|---------------------------|
| Current fleet NOx | 349,384 | - | - | - |
| | | | | |
| Retire (13) 2002 NABI buses that produced 4.0 of NOx | 219,784 | 129,601 | 36.17% | 1/15/2017 |
| | | | | |
| Repower (30) 2011 NABI buses with 0.2 NOx with Near Zero Engine | 211,025 | 9,376 | 3.97% | 6/30/2017-6/30/2018 |
| | | | | |
| Replace (50) 2004-06 New Flyer buses with 2.2 NOx and purchase (50) buses with Near Zero 0.02 NOx Engines | 34,224 | 176,801 | 82.51% | 6/30/2019 |
| | | | | |
| Total Overall NOx Reduction from Current | | | 315,161 | 90.20% |

**In 2015, Big Blue Bus received
3,513,819 gallons of LNG
produced from landfill methane**

RNG cuts BBB emissions by 62%



RNG vs Fossil Gas

City of Santa Monica LNG Gallon Costs

- FY 14-15, average price per gallon of Fossil LNG:
 $\$.965 \times \text{approx. } 3.5 \text{ million gal} = \$ 3,377,500$
- FY 15-16, average price per gallon of RNG:
 $\$.837 \times 3.5 \text{ million gal} = \$ 2,929,500$
- FY 16-17, fixed price per gallon of RNG with shared LCFS credits:
 $\$.62 \times 3.5 \text{ million gal} = \$ 2,170,000$
- Total anticipated savings in FY 16-17 using RNG with shared LCFS credits \$ 759,500

Core Values

Sustainability

- With 105 Near Zero engines NOx emissions will be reduced by 90%
- With the use of the RNG we will reduce Greenhouse Gases (GHG) by 62%

Core Values

Fiscal Responsibility

- Cost saving of approximately \$759,000 using RNG
- With the use of the Near Zero Engine, costly facility infrastructure improvements are not necessary
- Minimal impact on housing the ISL-G Near Zero Engine replacement parts
- Minimal training of technicians on the ISL-G Near Zero Engine

Core Values

Transit System Reliability

- Using the Near Zero Engine there is no impact to transit services