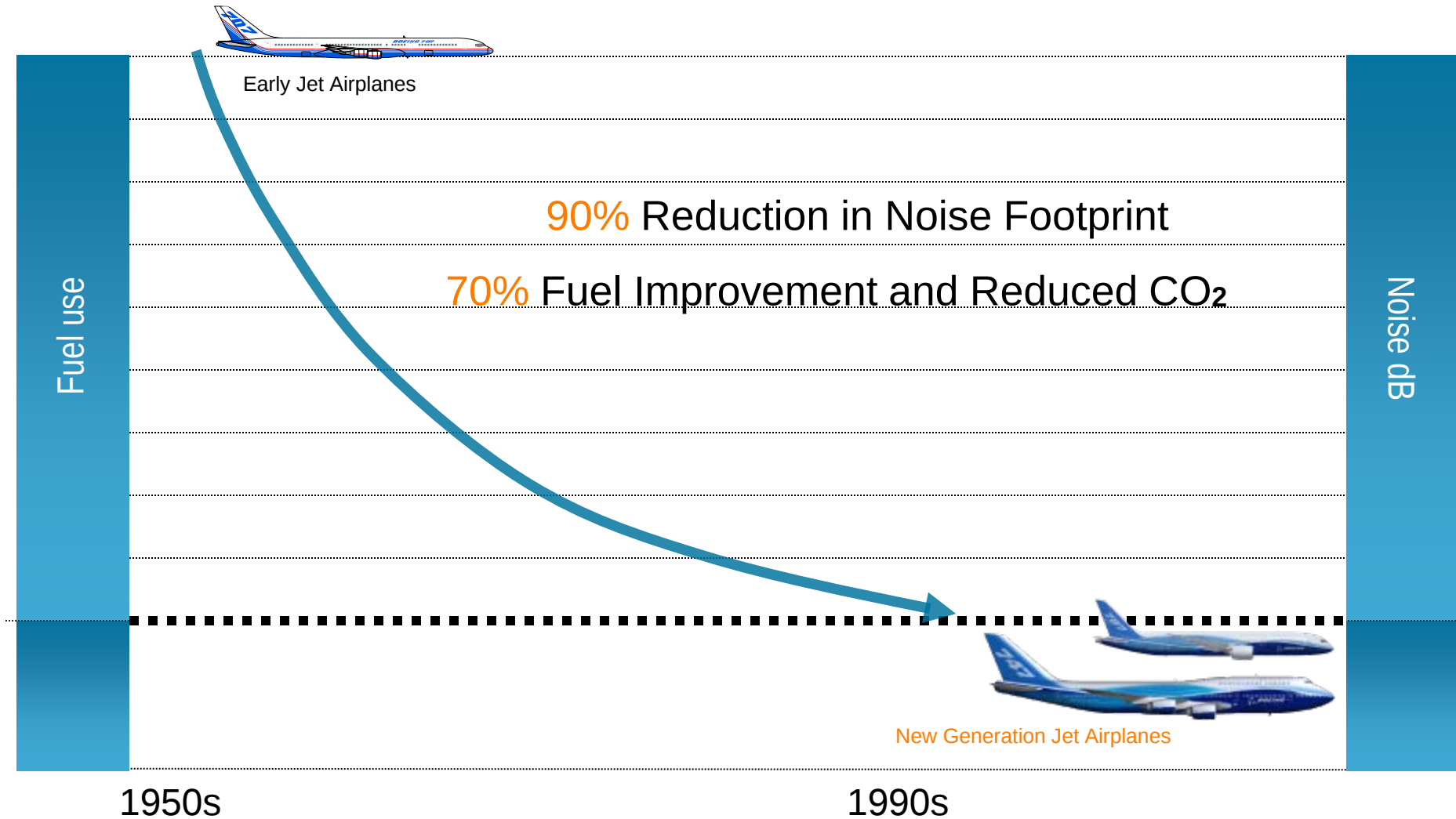




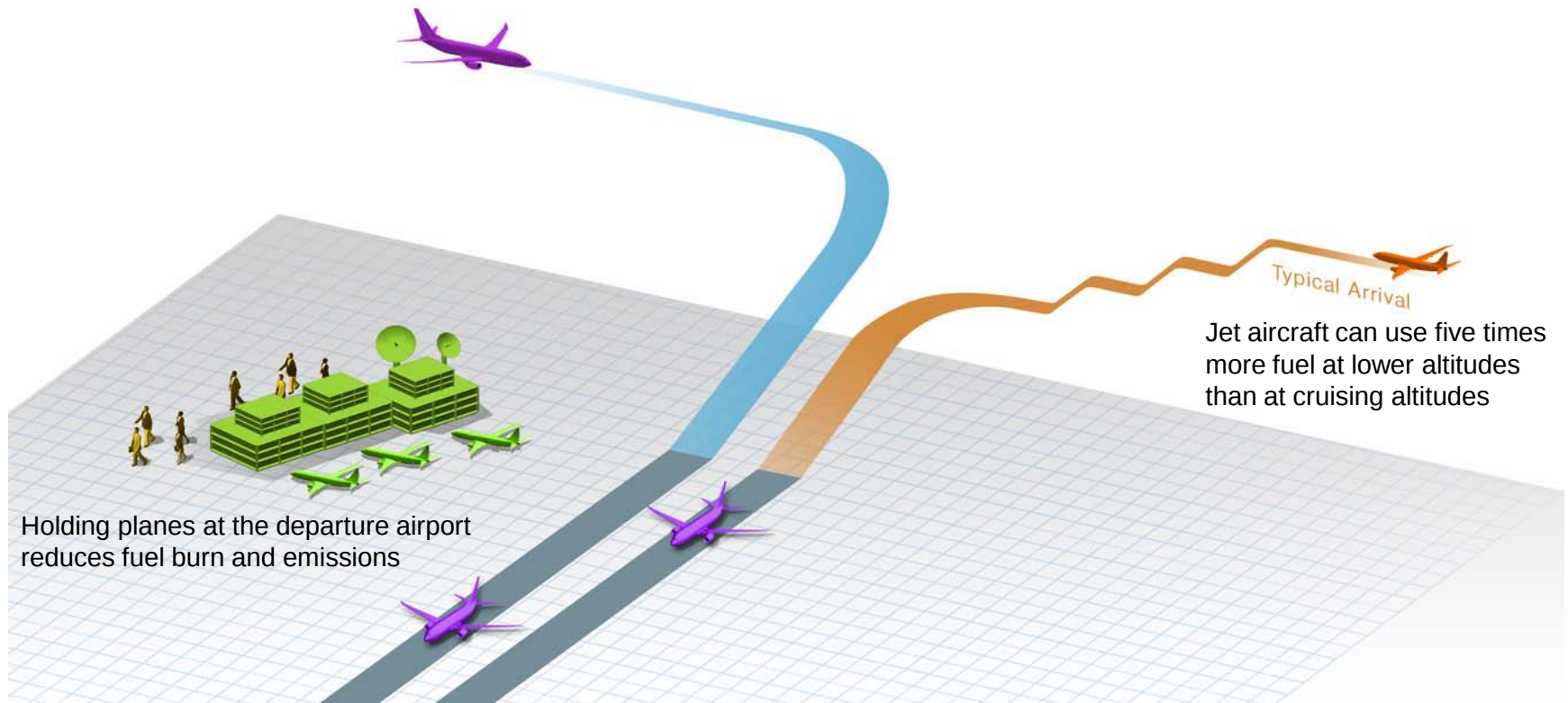
History of Environmental Progress



Noise footprint based on 85 dBA.

Improved Fuel Efficiency Through Air Traffic Management

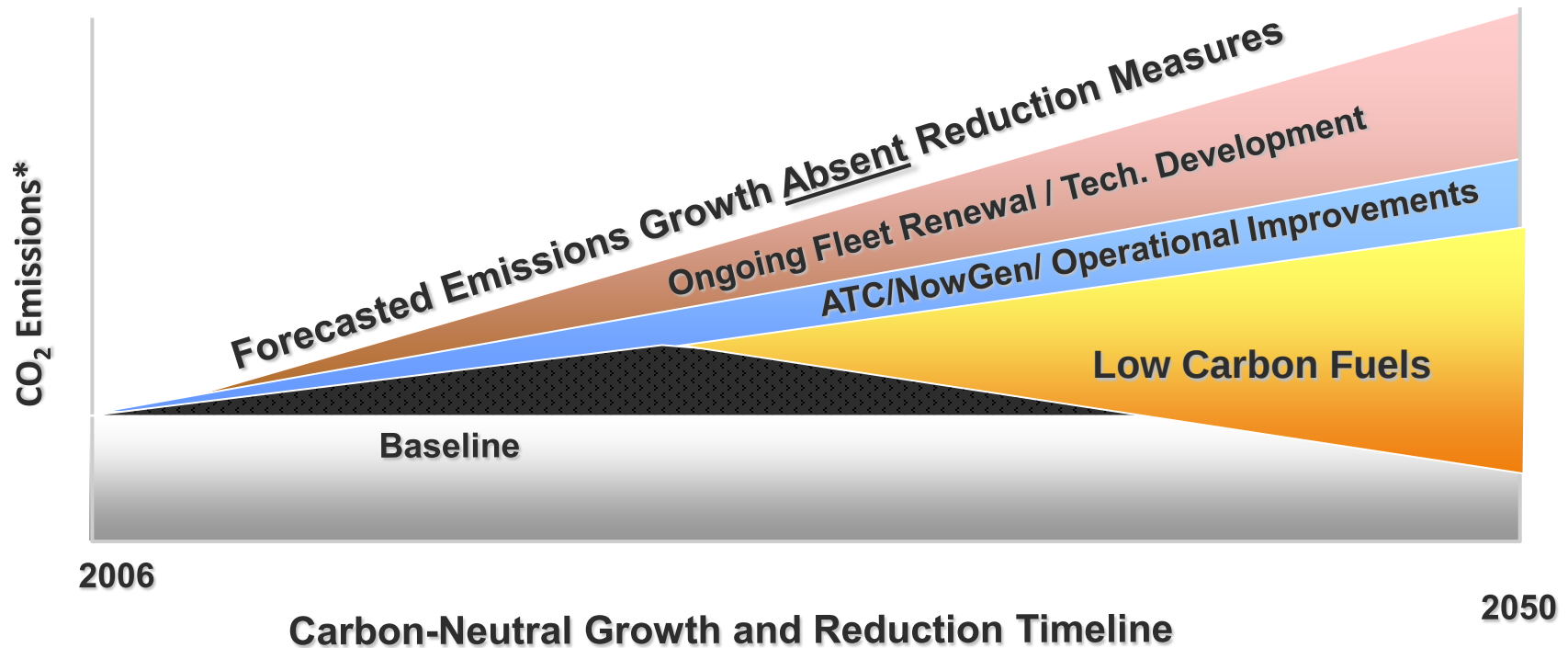
- Optimizing flight paths
- Relieving system congestion
- Integrating ATM and airborne technologies



Passengers Spend Less Time in the Air



Aviation Actions to Reduce CO₂



Farm to Fly

John Gardner
Washington State University

gardnerj@wsu.edu

Aviation

Fuel

Price

Volatility

Availability

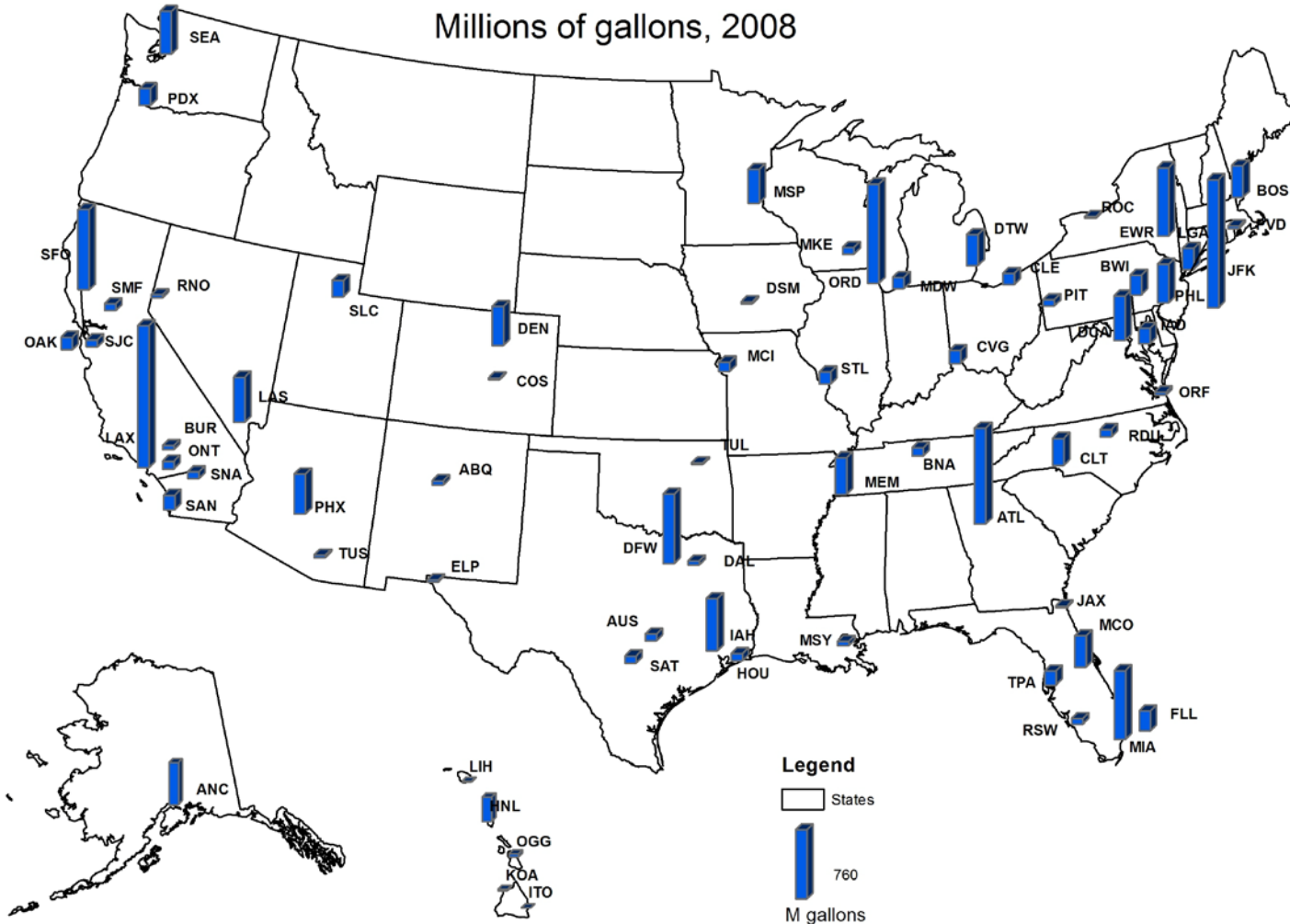
Environmental Impact



Aviation

U.S. Airport Fuel Consumption

Millions of gallons, 2008



Agriculture

Biofuel

Aviation

Oxygenate

Distillate

Market
Agonistic

Feedstock
Agonistic

Supply
Push

Market
Pull

Food and Feed
Benchmark

Oil
Benchmark

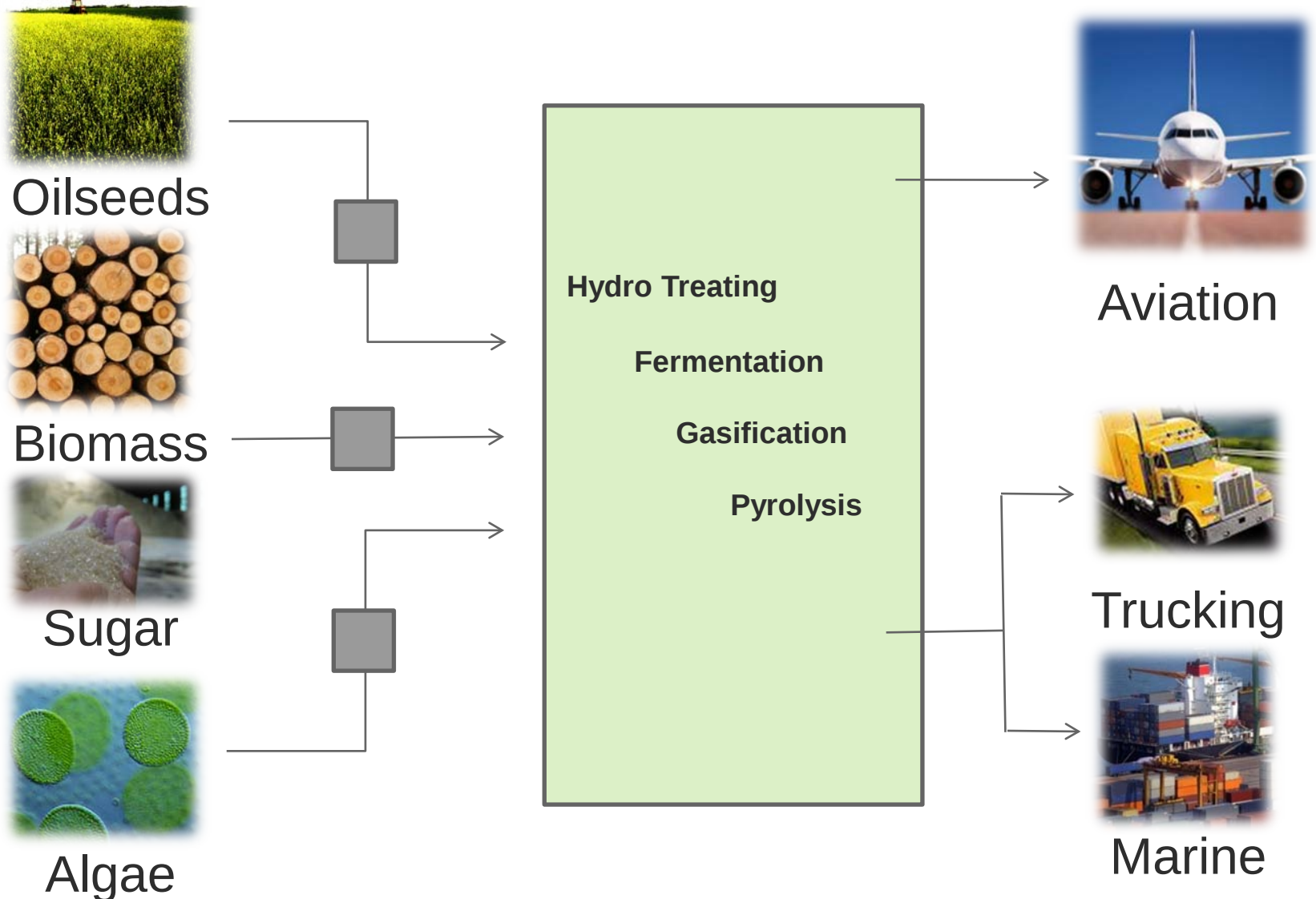
Sustainability
In Context

Sustainability
Unconditional



Advanced Biofuel Production

Feedstocks → Processing → BioRefining → Distribution/Utilization



Sustainable Biofuel Test Flights



Feb 2008

Virgin Atlantic
Coconut and Babassu



Dec 2008

Air New Zealand
Jatropha



Jan 2009

Continental
Algae and Jatropha



Jan 2009

Japan Airlines
Camelina, Jatropha, Algae



Apr 2010

F/A-18
Camelina



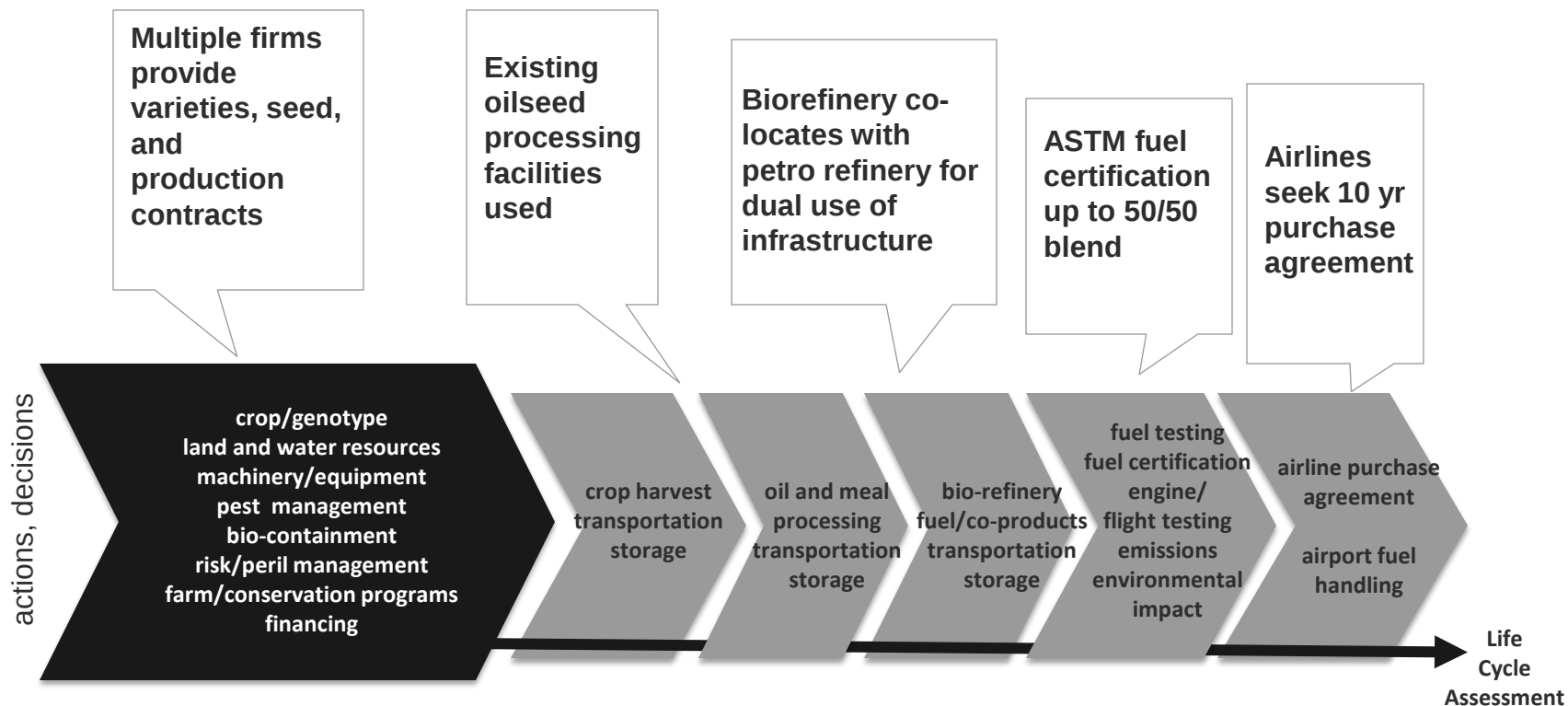
June 2010

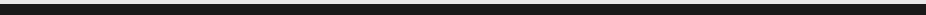
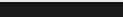
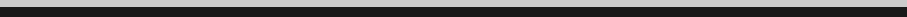
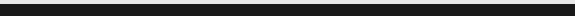
Dutch AH-64 Apache
Algae and Cooking Oil

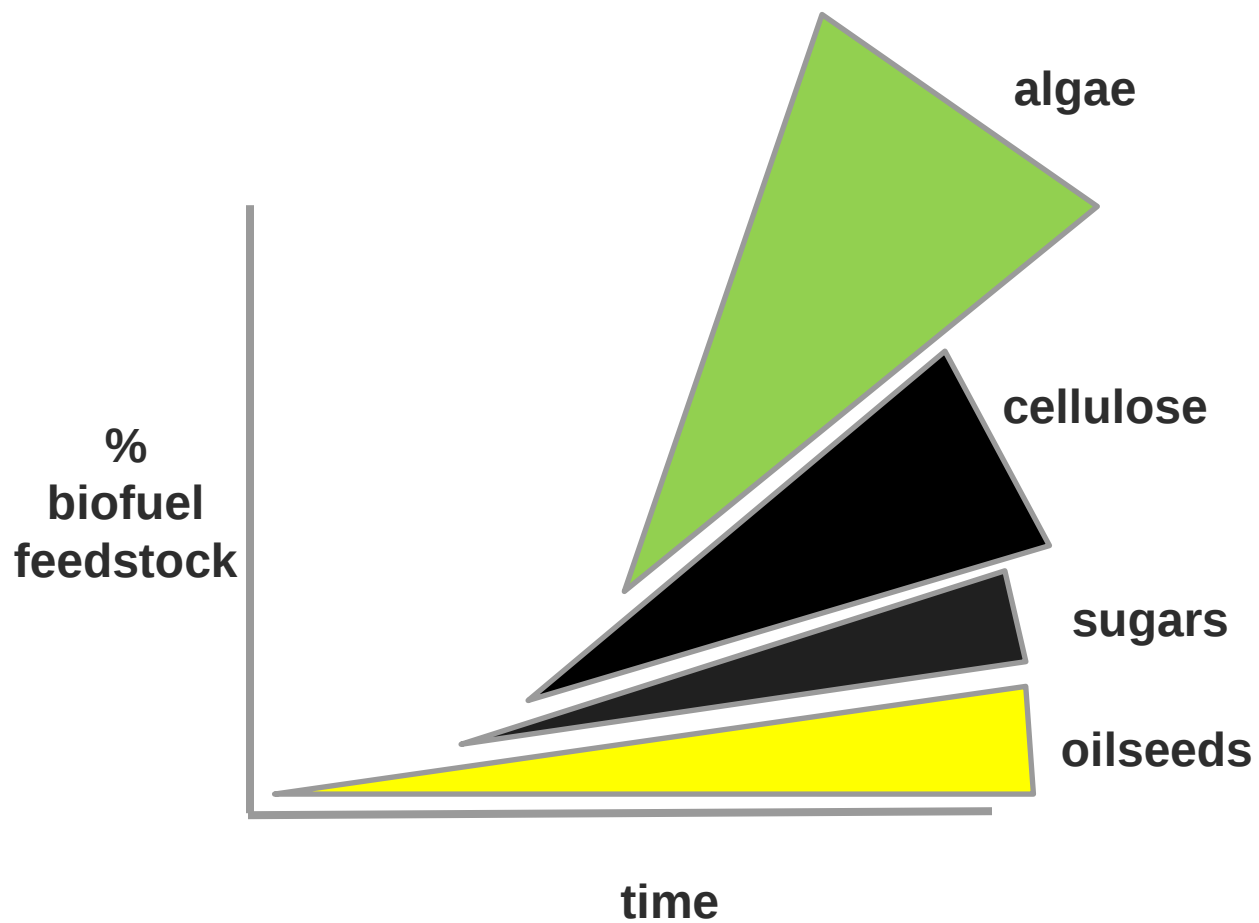
Sustainable Aviation Fuels Northwest



Initial Aviation Biofuel Supply Chain for Pacific Northwest 2010-2013



Federal USDA DOE DoD	    
State grant WSU UW	  
Private Growers Refiner Airlines	  



Sustainable Biofuel Apps.....



Alaska Air



Spokane



Boeing



Port of SEA



Port of PDX



WSU



UW



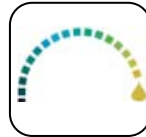
OSU



PNNL



Great Plains



Imperium



Targeted Growth



Alt Air



Catchlight



Stoel Rives



Verno



Harris Group



CAAFA



NREL



Sun Grant



USAF



USDA



US Navy



DLA



DOE



FAA



Amyris



ATA



Weyerhaeuser



Sustainable Oils



Danforth



ADAGE



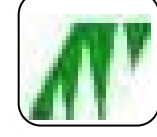
Bioalgene



Biopure Fuels



Conservation NW



Green Diamond



Houghton Cascade



NRDC



Nature Conservancy



NW Biodiesel Network



OR Dept of Agriculture



OR Env. Council



OR Wheat Growers



Parametrix



Roundtable on Sustainable Biofuels



Simpson Investment



Spokane Industries



USDA - RD



USDA - ARS



Honeywell



WA Dept of Comm



WA - DNR



Sapphire



WSGR

Sustainable Aviation Biofuel Projects



SAFUG-Europe
Member Projects



Working Together MOUs
with CAAC, Air China,
PetroChina



Sustainable
Aviation Fuels
Northwest



Project
Flight Path



Aviation Biofuel
Assessment
Project



Life
Cycle
Analysis



Aviation Biofuel
Road Map



Masdar
Research
Project