



Aviation Fuel Supply Chain Stakeholder Perceptions of Sustainable Alternative Jet Fuel

Penn State:

Paul Smith & Wenping Shi

DGSS, WSU:

Michael Gaffney & Season Hoard

CLH Aviation:

Ibon Ibarrola

Metron Aviation:

Bruno Miller

Gevo Inc:

Glenn Johnston

Northwest Advanced Renewables Alliance





• Outline

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- I. Aviation Fuel Demand in the NARA Region
- II. Why SAJF?
- III. Objectives & Research design
- IV. Primary Data Collection – Methods & Preliminary Findings
- V. Future work



Perspective: U.S. Petroleum and Jet Fuel Consumption

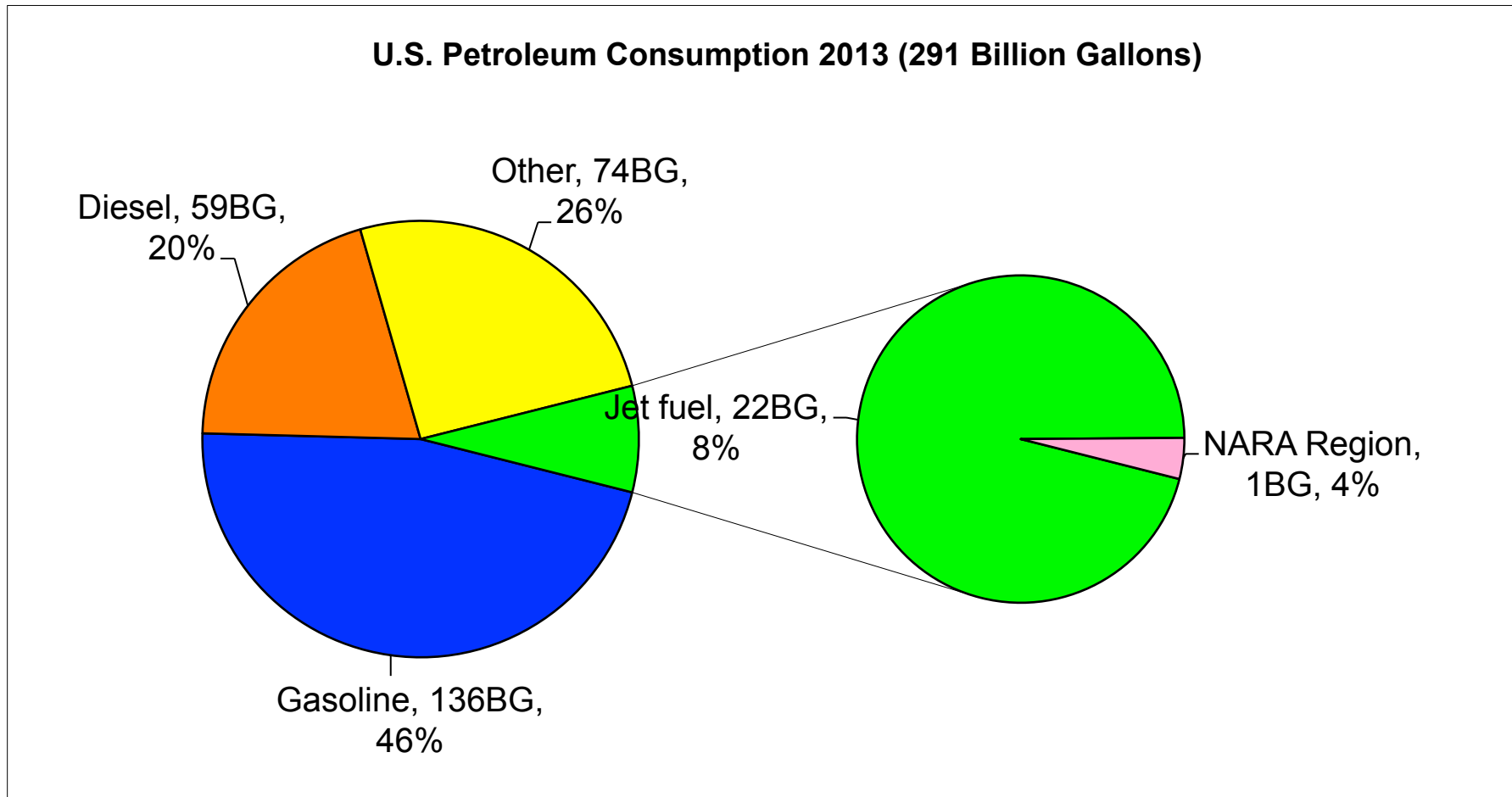
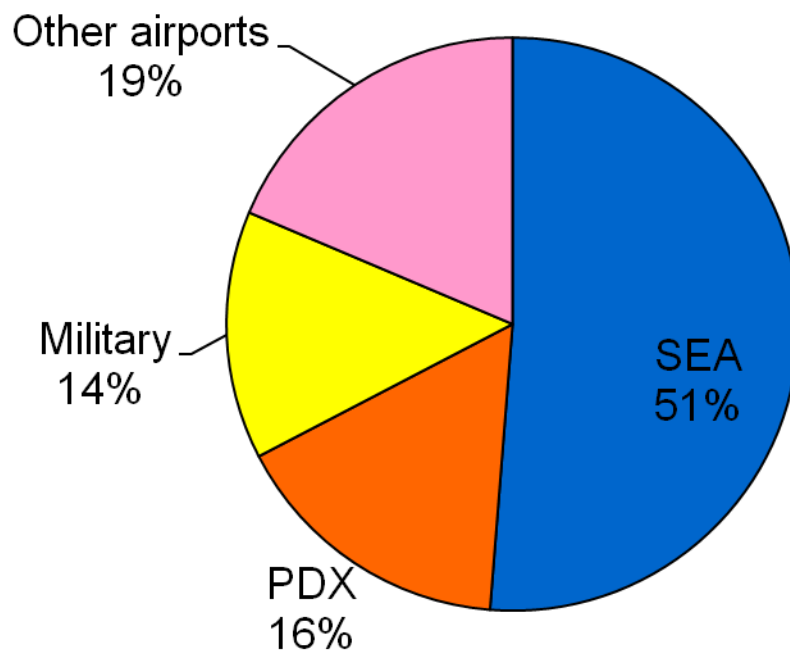


Figure 1. U.S. Petroleum Consumption and NARA's share of U.S. Jet Fuel in 2013 (EIA 2015a)



NARA Region Jet Fuel Uptake; Total ~950MG*



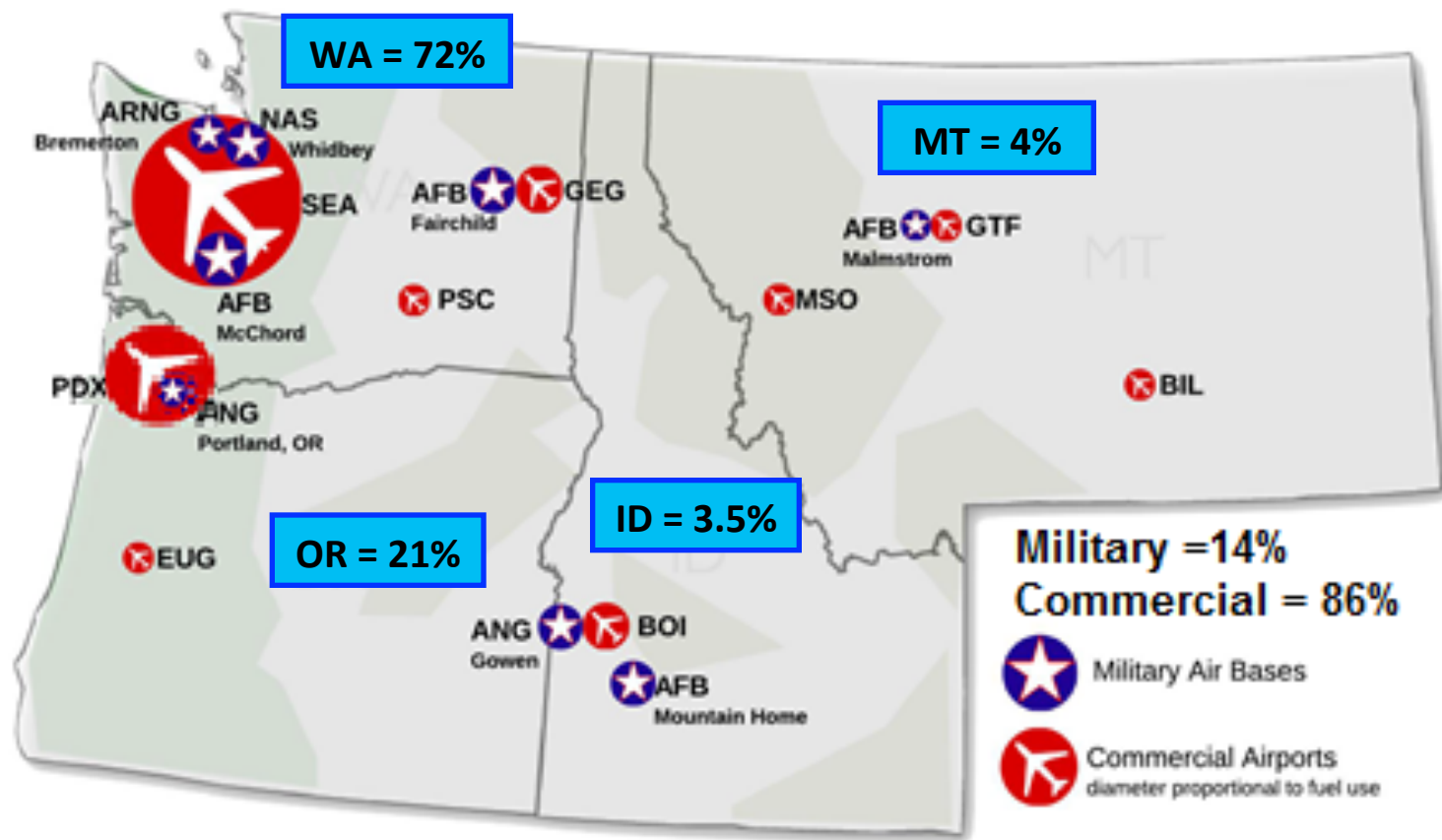
- NARA total and military fuel consumption data is est. from FAA and SAFN; data for SEA & PDX is A4A based



NARA Region Demand by State (2013)

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Civil and Military Jet Fuel Demand Centers in NARA Region



Data source: Military share is derived from SAFN 2011 Report; the state fuel consumption is from FAA



II. Why SAJF?



- Global aviation growth (airline passenger travel is projected to double from 2014 – 2034) (IATA 2015)
- No viable alternatives:
 - High-performance, liquid, and high-density
 - SAFJ must be “drop-in”
 - SAFE: Rigorous ASTM certification (D7566 – SAFJ; D1655 – Jet A1)
- Access to distribution – few “filling stations” (SAFN)
 - US: 376 primary airports vs. 160,000 gas stations
 - Global: 75 airports = 80% of traffic; Top 21 = 50%
- Customer pull
 - Strong military support
 - Airlines/airports - driven to reduce their CO₂ emissions



- Petro-jet fuel price volatility
- Growing global demand for air travel
- Public/political pressure re: carbon emissions
- Energy security
- Rural economic development



III. Research Objectives

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1. ID key aviation fuel supply chain SHs in the NARA region;
2. Assess SH perceptions regarding the drivers/ barriers to economically viable SAJF production in the NARA region;
3. Examine key issues to adding blended SAJF (ASTM D7566) into the ASTM D1655 Jet A fuel supply chain, including molecule tracking and crediting.



Research Design

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Phase I:

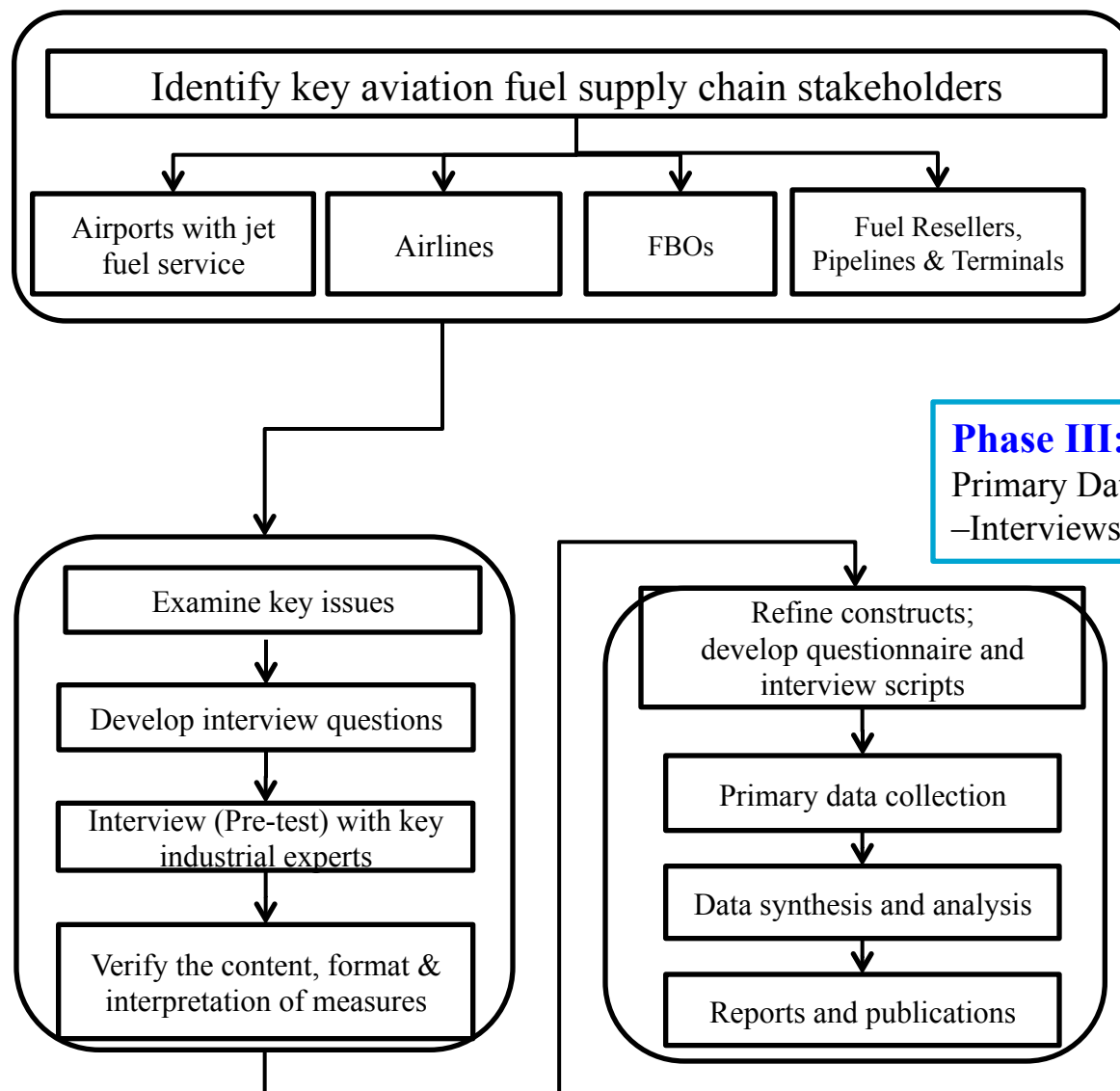
Secondary Data
& Exploratory
interviews –
Population &
issues

Phase II:

Construct
development and
verification

Phase III:

Primary Data Collection
–Interviews & e-Surveys



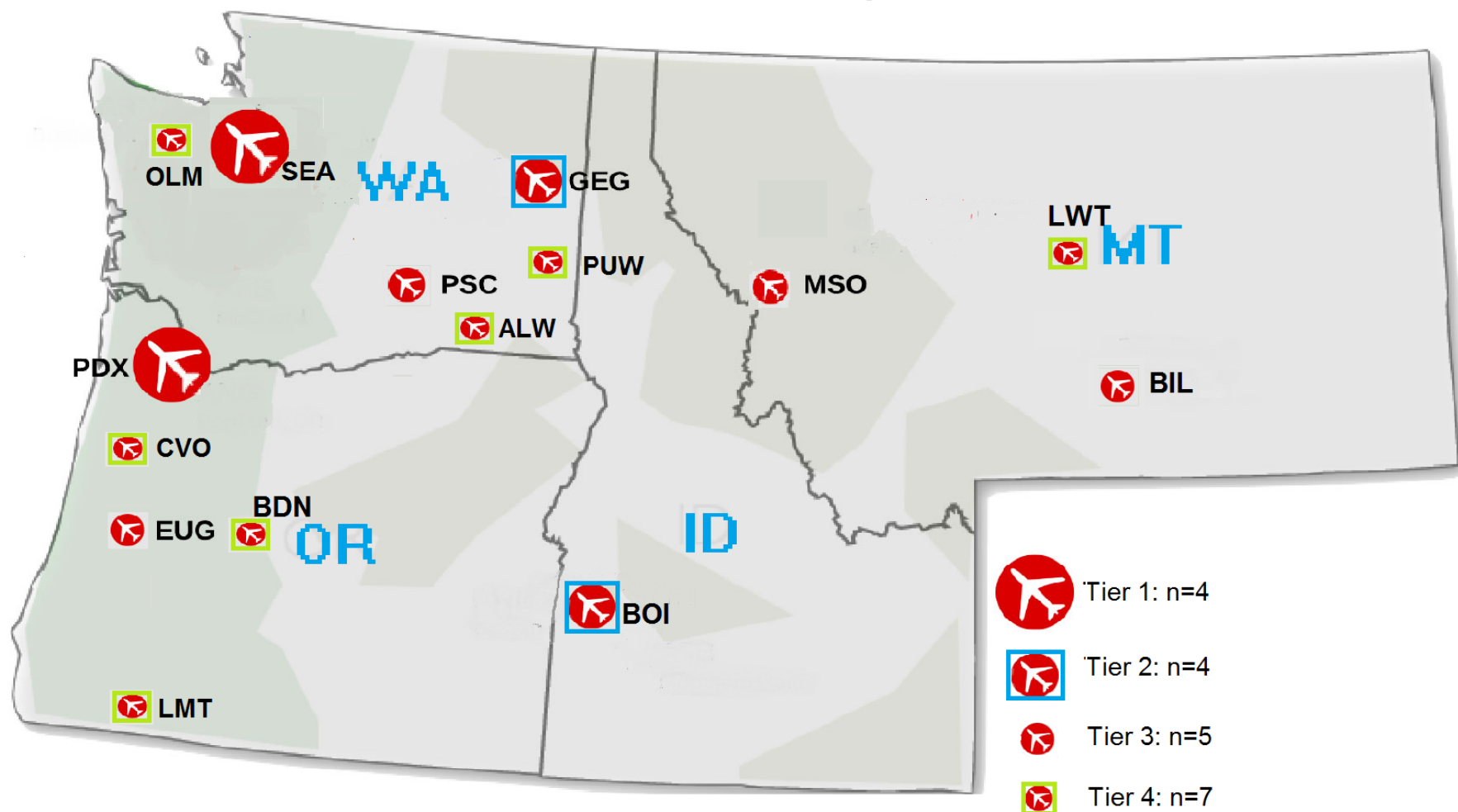


- **e-Surveys – Airport Mgrs.**
 - Pretest, then Round #1 (Spring 2015):
 - 26.5% Response Rate (n=26); mostly small and micro airports
 - Selected 8 for this analysis (size/geog. balance)
 - Sought endorsements to increase RRs
 - Currently being re-administered (Round #2)
- **In-Depth Interviews – 12 Supply Chain SHs**
 - On-Site by Appt; June-Aug.; recorded & transcribed
 - Airports (large & medium)
 - FBOs (fuel facility operators)
 - Airlines



Distribution of Respondents (n=20)

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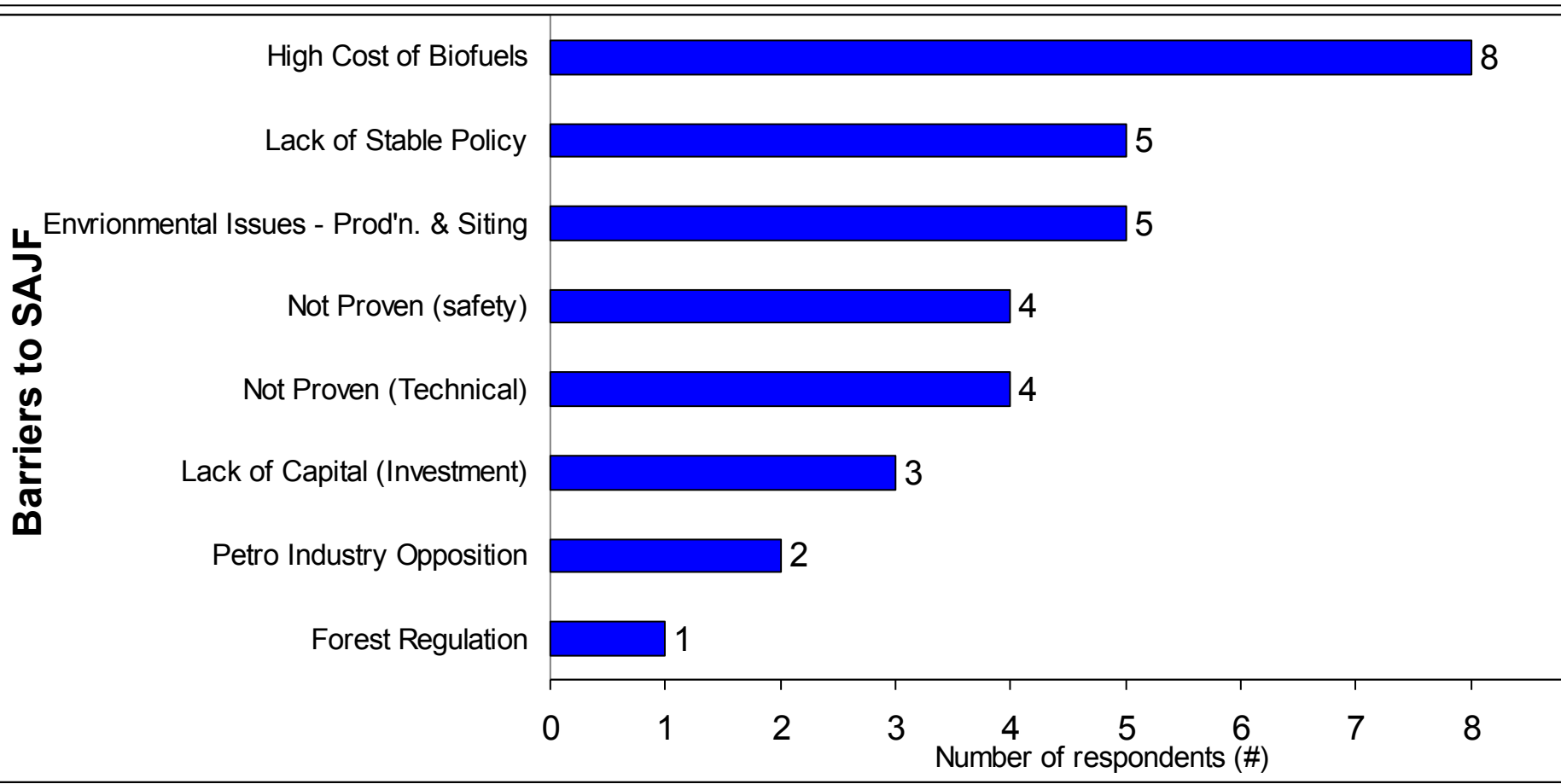




Barriers to Regional SAJF (n=20)

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*Q. What are the **key barriers** to developing an economically viable SAJF production industry in the Pacific Northwest region?*





Barriers to Regional SAJF

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“Cost is the #1 barrier.” “The cost of production and logistics is limiting market entry and scale up.”

“There is not **policy stability** or harmony for (S)AJF. In contrast, on-road fuels have better incentives for renewable fuel than jet fuel.”

“Siting refineries is a contentious issue with environmentalists, particularly new greenfield sites. Brownfield siting or co-siting with existing mfg. may be the answer.”

“Safety is a paramount concern in this industry.”

“Lack of **long-term (fuel) purchasing agreements** to provide a secure return on capital.”

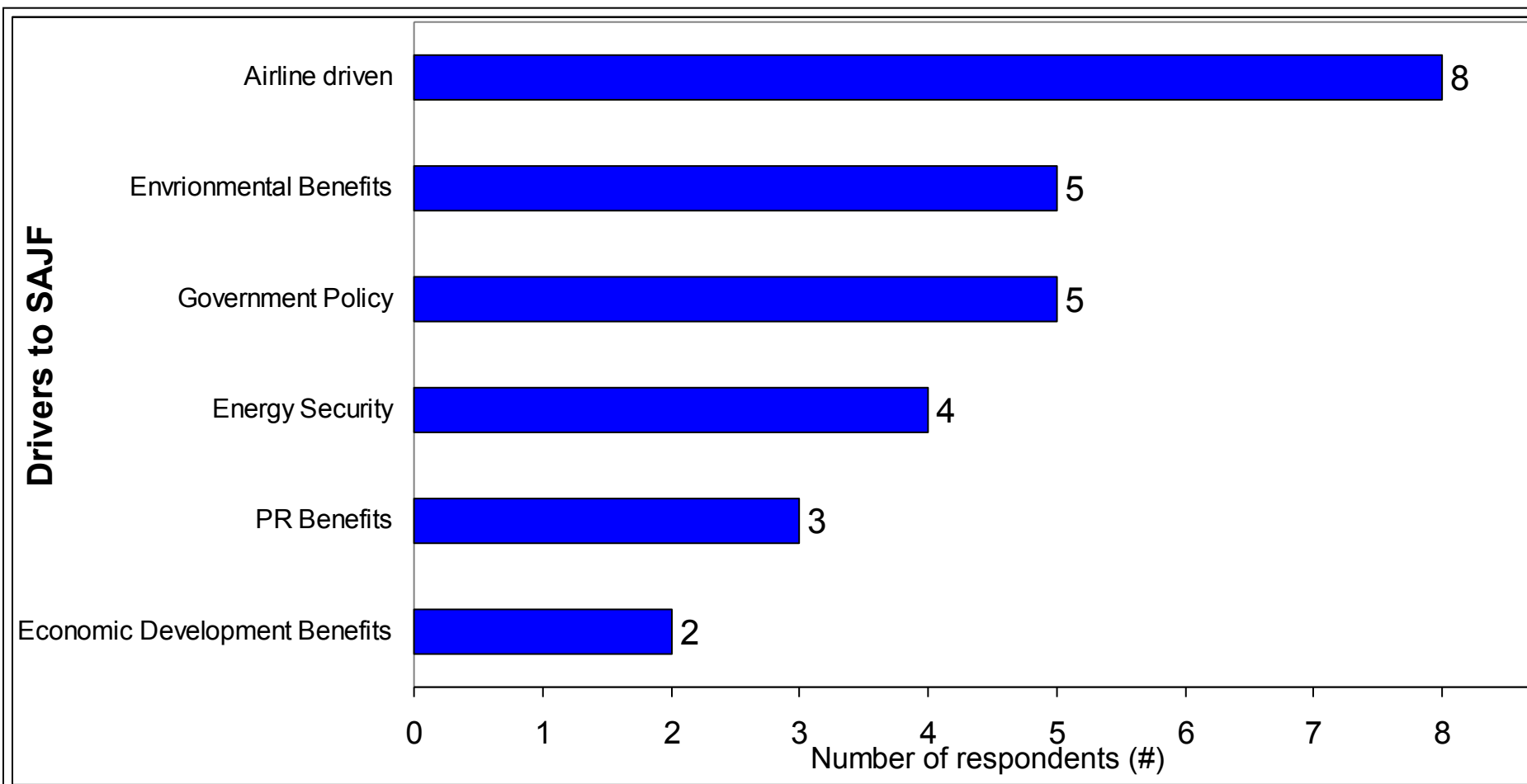
“The **forest is over-regulated**. We can’t sit and watch thousands of acres of natural resources burn. It (SAJF) is a great use of the biomass.”



Drivers to Regional SAJF (n=20)

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*Q. What is **driving** the development of an economically viable SAJF production industry in the Pacific Northwest region?*





Drivers to Regional SAJF

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*“In terms of biofuel into the aircraft, we really look at it as an **airline prerogative**.... the airlines are interested in it (SAJF). As we work with them on a regular basis, of course we will be interested in it.”*

*“**Sustainability** is one of the big buzz word we hear all the time... the other thing is environmental (benefit).”*

*“**Policy stability** is absolutely critical to economic sustainability and to attract long-term investors.”*

*“**NIMBY-ism** is a key factor. Most like the idea of biofuel, but are not interested in a refinery or large industrial facility in their back yard due to transportation impacts and feedstock attractiveness (food vs fuel).”*

*“We need to plan ahead because, if we don’t, we will get behind the power curve... but **at what scale & at what level?**”*

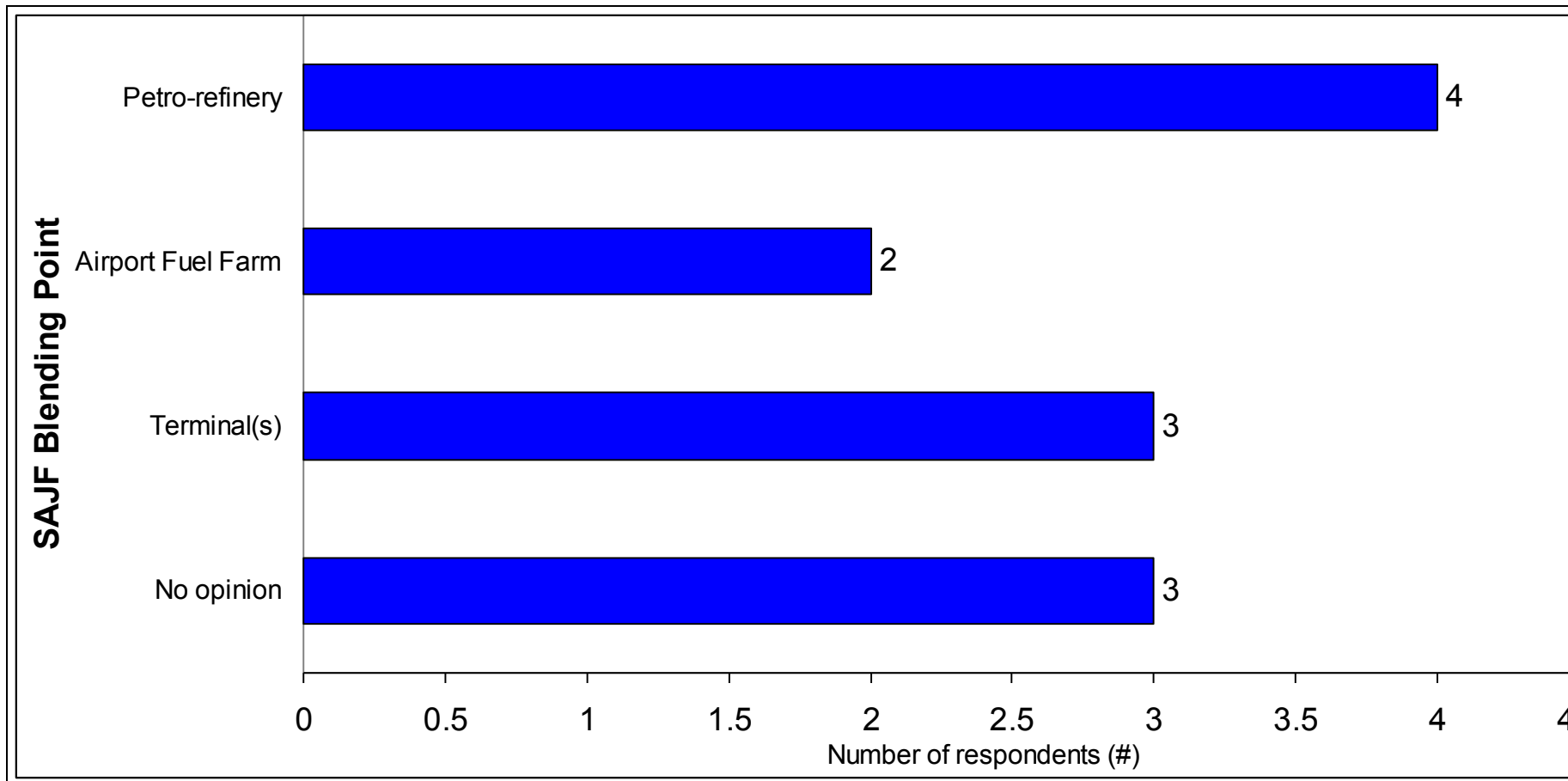


Some support; some oppose:

- (ENGOS) love the product, but are resistant to the regional industrial development necessary for prod'n (siting issues);
- ...distrust the claimed sustainability certification; opposed to environmental impacts; do not think there is real LCA carbon reduction;
- (ENGOS) support/opposition depends on the conversion process and other externalities;
- Local ENGOS could influence local airports;
- (ENGOS) are seeking a credible system, such as ASTM, ISO 4001, etc.



Q. Where would be the logical SAJF blending location for your airport? (n=12)





Q. Do you think the SAJF molecules should be tracked? Why? (n=20)

- **Yes (n=13, 65%):**

- *“I think whoever buys the molecule will drive the tracking mechanism to derive value, both the monetary credits and the public perception.”*
- *“Tracking is valuable just from the efficiency stand point to understand what you make actually works.”*

- **No (n=3, 15%):**

- *“It’s probably not important to track biojet since we really deliver the product separately, but the customers are distinct; we deliver one product per customer type.”*
- *“I don’t think there should be any different tracking for biojet vs. our current handling of petro-jet. I don’t see a need to track it.”*

- **No Comment (n=4, 20%)**



Should SAJF purchases have a mechanism for crediting? (n=20)

- **Yes (n=13, 65%):**
 - [SAJF] “... should be credited at point of purchase using the same RSF2 credit pattern .”
 - [Crediting] “... should be for purchases and not (for) use, unless a formula is created to determine who burns the biojet fuel.”
 - “For airlines, it (crediting) is especially important. Saving money on fuel is one of the top initiatives for any airlines because that’s their major cost.”
- **No (n=3, 15%):**
 - [Crediting] “I don’t think so. I don’t believe it is approved (for) every engine.”
- **No Comment (n=4, 20%):**
 - “No opinion, as we are in our infancy on all of this right now.”



How do you think SHs will react to a SAJF crediting system? (n=20)

- **Positively:**

- *“Local ENGOs would love a credible system.”*
- *“...fuel (purchasers) are okay with crediting the fuel.”*

- **Negatively:**

- *“Many stakeholders would have heartburn. Business will generally view it as a tax.”*
- *“If it (crediting system) is required, the petroleum industry will object.”*

- **Unsure:**

- *“There must be incentives to gain support from stakeholders. There will be opposition, but a system like this will be popular for most.”*



- Round #2 – eSurveys
- Additional analysis (in-progress) & write-up
- Expand to other U.S. regions and EU nations



Thank You

Northwest Advanced Renewables Alliance (NARA)

Acknowledgement:

“This work, as part of the Northwest Advanced Renewables Alliance (NARA), was funded by the Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.”



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Extra Slides...

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Growing Global Demand for Air Travel

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- Airline passengers up 5% from 2013-2014 (FAA 2015a)
- 2014 – 2034: Airline passenger travel will double (IATA 2015)
- Military jet fuel consumption is projected to be flat

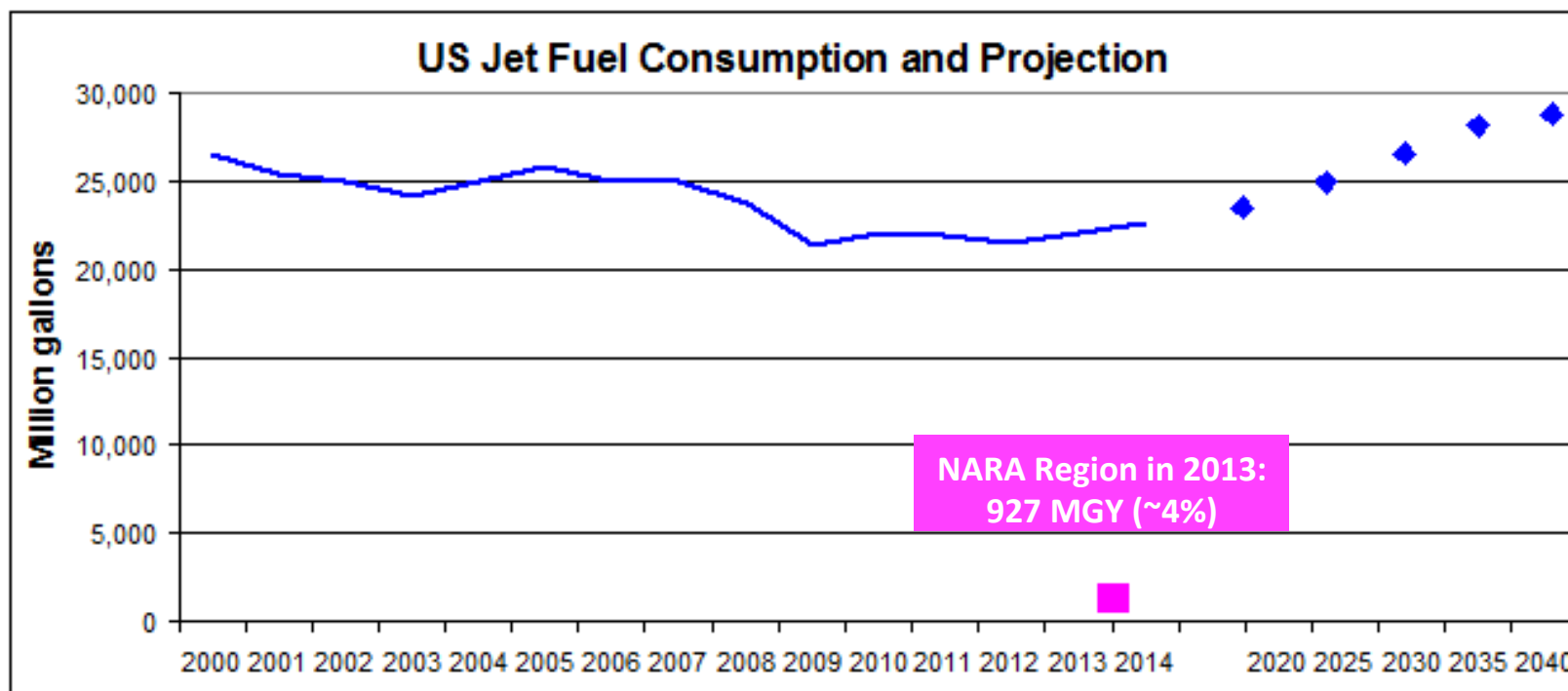


Figure 3. U.S. Jet Fuel Consumption and Projections (EIA 2015a and EIA 2015b)



NARA



Jet Fuel Price Volatility

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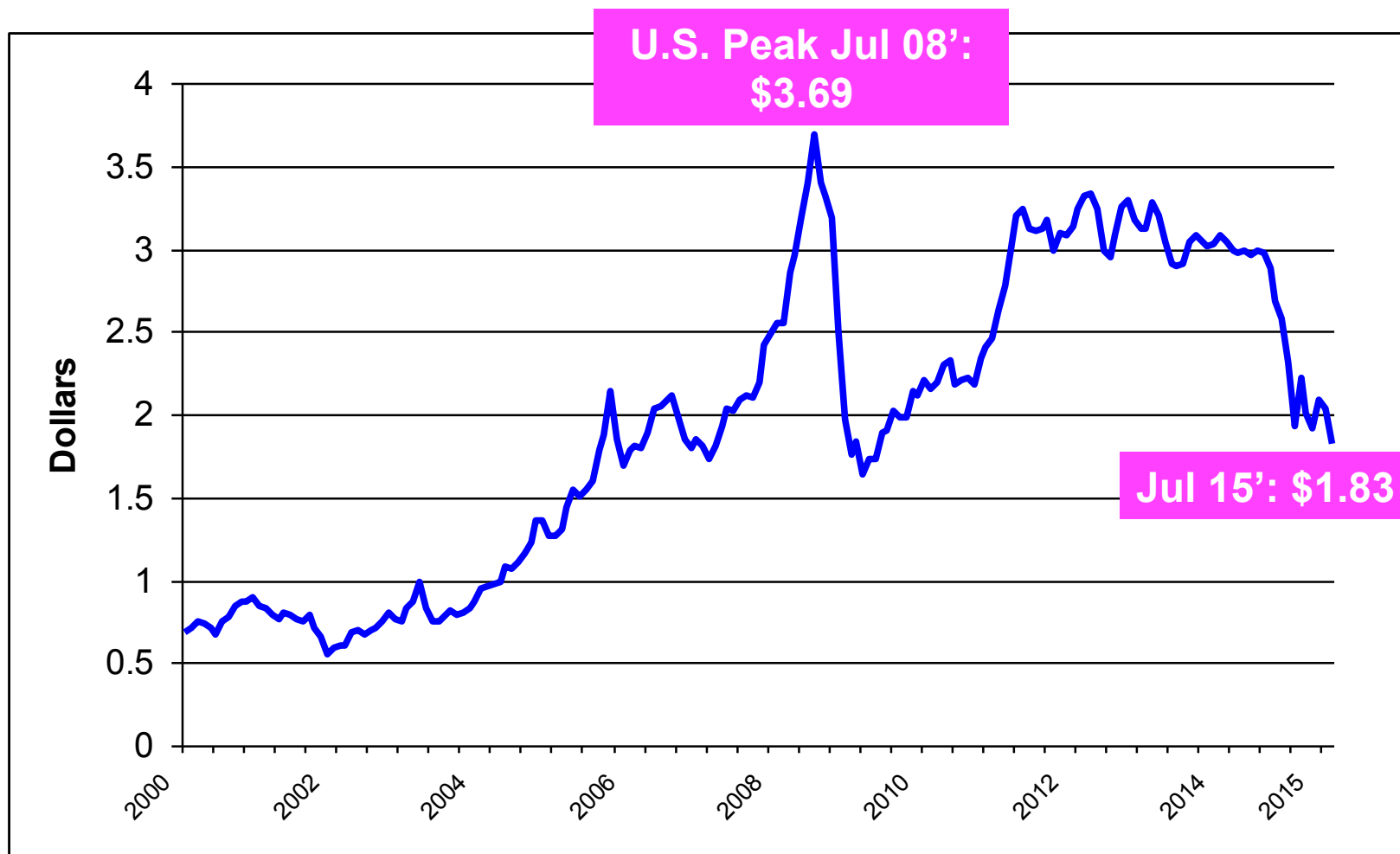


Figure 2. Monthly Airline fuel cost per gallons (US DOT 2015)



- Global Aviation ~12% of all transp. CO2 emissions; ~2% of human CO2 emissions; proj. ~3% by 2050
- Intensified despite 18% reductions (1990-2009)
- Therefore, airlines goals (ATAG 2015):
 - 1.5%/yr. CO2 improvements 2009 – 2020
 - Cap 2020 emissions (carbon-neutral growth)
 - Continue to improve fuel efficiency
 - Deploy more fuel efficient airplanes , engines, parts (e.g., winglets)
 - Reduce distances/flying times, optimize trajectories, improve taxiing



US Military Biofuel Demand

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- 2014 Reauthorization - *Defense Production Act of 1950 (DPA)*
 - Provides an explicit ***“mission to create assured, affordable, and commercially viable production capabilities and capacities for items essential for national defense,” including biofuels***
 - **Navy** - goal of deploying blended AFJ for its “Great Green Fleet” of ships and aircraft by 2016, and to meet ***50% of its total energy consumption using AJF by 2020***
 - **Air Force** is working to acquire ***50% of its domestic aviation fuel from nonpetroleum-based sources by 2016***
 - **Army** has a ***broad aim of increasing renewable energy***, but has not specified alternative fuel goals