Northwest **Power** and **Conservation** Council



November 8, 2016

**MEMORANDUM**

**TO:** **Power Committee**

**FROM:** **Tina Jayaweera, Senior Analyst**

**SUBJECT:** **NEEA's role with EVs and DR**

## BACKGROUND:

Summary — Jeff Harris, Chief Transformation Officer at the Northwest Energy Efficiency Alliance (NEEA) will present on what NEEA's engagement in the demand response and electric vehicle markets might look like. He will inform the power committee on recent discussions with NEEA's Strategic Planning Committee on these topics.

Relevance — Demand response and electric vehicles are both critical components in the Seventh Power Plan. NEEA could be instrumental in achieving the Seventh Plan Action Item RES-5 "Support regional market transformation for demand response".

Workplan: A.2. Demand Response and B.3. Forecasting and Economic Analysis

Background: NEEA has a 20-year history in the region of supporting market transformation for energy efficiency.

More Info: See attached memo from Jeff Harris.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

**Steve Crow**
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

# Memorandum

Nov 8, 2016

TO: Northwest Power and Conservation Council, Power Committee

FROM: Jeff Harris, Chief Transformation Officer, NEEA

SUBJECT: NEEA New Opportunities: Electric Vehicles and Demand Response

**Background:** From a global energy perspective, electric vehicles and demand response can be viewed as energy efficiency opportunities and therefore within the mission of NEEA. However, NEEA's current 2015-2019 Strategic and Business Plan explicitly excludes market transformation for these opportunities as a lower priority when compared to other energy efficiency opportunities included in the Business Plan. However, in adopting the 2015-2019 Business Plan, the NEEA Board held open the option to consider new opportunities as markets and technologies change over time.

**Current Context.** Since the 2015-2019 Plans were adopted in July of 2014, much has changed in the markets for both EVs and DR. The 7th Power Plan established a near-term need for DR resources and identified potentially significant growth in loads from electric vehicles over the next 20 years. Oregon passed SB1547 requiring utilities to develop EV infrastructure plans. Washington Utilities and Transportation Commission approved pilot efforts for Avista and PSE to test programs encouraging consumer adoption of electric vehicle charging station infrastructure at homes and businesses.

Given these developments, the NEEA Board of Directors recently directed NEEA staff to look at near term market transformation opportunities in electric vehicles (EVs) and demand response (DR). At the same meeting, the NEEA Board approved an overall framework to guide development of the 2020-2024 Strategic Plan including a longer-term view of opportunities for both EVs and DR.

**Near Term Opportunities for EVs.** NEEA staff has identified a relatively small opportunity to increase efficiency in products and services for EV charging in the residential consumer marketplace. This opportunity aligns with and leverages existing NEEA efforts in consumer markets. It also lays some foundation for a broader, future market transformation effort if warranted under the 2020-2024 Strategic and Business Planning efforts. A more detailed view of preliminary opportunities is attached. Please note that the attached is a draft for discussion only and has not been approved by the NEEA Board.

**Near Term Opportunities for DR.** NEEA Staff has identified several opportunities to engage manufacturers in the consumer products market and lighting controls with solid-state lighting in the Commercial and Industrial Lighting market. This opportunity aligns with and leverages

Northwest Energy Efficiency Alliance
421 SW Sixth Avenue, Suite 600, Portland, OR 97204
503.688.5400 | Fax 503.688.5447
neea.org | info@neea.org

existing NEEA efforts in these two markets. It also lays some foundation for a broader, future market transformation effort if warranted under the 2020-2014 Strategic and Business Planning efforts. A more detailed view of the preliminary opportunities is attached. Note that this opportunity summary is a draft for discussion only.

**Next Steps:** NEEA's Strategic Planning Committee has discussed the near term opportunities at their November 1st meeting recommending a discussion at the December 1, 2016 NEEA Board of Directors meeting. If approved by the Board, staff would pursue engagement with stakeholders to develop a program prospectus in Q1 of 2017 to be considered for Board approval at the Q1 Board meeting. Funding and contracts would follow through the remainder of 2017 with implementation likely starting in late Q4 2017 or Q1 2018. Both EVs and DR have been included in the list of topics to be discussed in the 2020-2024 Strategic Planning Process that will begin in Q1 of 2017.

**NEEA NEW OPPORTUNITY ASSESMENT: Electric Vehicles.**

**DRAFT – For Discussion Only**

**Nov 1, 2016**

## 1. Opportunity Description, Timing and Resource Requirements:

- ***Description****:*
  - ***Market:*** The market for EVs includes the supply chain that delivers the EVs (parts suppliers, manufacturers, auto dealers) as well as demand side (end-customers) and infrastructure (charging station components, charging businesses, utilities).
  - ***Sales and Power System Forecasts***: The 7th Power Plan estimated that EVs could add between 160 to 650 aMW over the next 20 years. This is significant growth over the current 8 aMW of load associated with 22,000 EVs in the Northwest in 2015. 2016 sales of EVs nationally seem to indicate that the higher growth forecast may be warranted. Sales for the first three quarters of 2016 have increased 33% over the same period in 2015, potentially adding another 7,500 EVs to the NW fleet and 3 aMW of load[1].
  - **Efficiency Opportunities**.
    - **EV Efficiency**: 2016 Electric vehicles range in their end-use efficiency from 85 MPGe to 137 MPGe[2] a difference between worst to best of over 50%. While this is a significant range, as in all light-duty vehicles, the MPGe does not fully describe the amenity delivered by the EV. However, the size of the range certainly indicates that there are possibilities within the EV market for improvement in efficiency.
    - **Charging Infrastructure Efficiency**. Charging efficiency is a function of both the grid-connected charging station as well as the in-vehicle battery charging system. It is currently difficult to ascertain the actual charging efficiency from grid to miles traveled. However, the charging station efficiency can be measured and there are varying levels of efficiency within charging stations.

      Current charging stations are classified according to three "levels"[3]:
      - Level 1 AC Charging: 120 volt household appliance – 2 to 5 miles per hour of charging
      - Level 2 AC Charging: 208-240 volt household or commercial charging station – 10 to 20 miles per hour of charging

[1] Source: Inside EVs website: http://insideevs.com/monthly-plug-in-sales-scorecard/ Accessed on 10/20/2016.
[2] US DOE Energy Efficiency and Renewable Energy Alternative Fuels Data Center. http://www.afdc.energy.gov/vehicles/search/results/?vehicle_type=light&category_id=27&fuel_id=41, Accessed on 10/20/2016.
[3] Ibid.

- Level 3 Fast DC Charging: (variety of voltages/configurations) – some residential products, mostly commercial charging stations 50 to 70 miles per 20 minutes

Most of the current charging station options are "wired" and connect to the vehicle through a specific corded connector. However, there are currently wireless options for level 1 and level 2 charging with development of a level 3 wireless charger in progress[4].

A 2013 study found efficiency improvements from moving from level 1 to level 2 charging. The efficiency improvements from this study appear to be in the small single digits (2 to 3%) although for short, "top-off" charges the difference in efficiency exceeded 10%[5].

Energy Star has developed a draft test procedure and specification for residential scale level 1 and 2 charging stations[6].

- **Energy Savings:** Assuming an average annual consumption for EVs in the Northwest of approximately 3,000 kWh / year, a 2% efficiency improvement in charging would represent an annual savings of 60 kWhs. However, technology improvements in charging systems could increase this efficiency improvement into the low-to mid 90% range perhaps doubling the efficiency potential to over 100 kWh per charging station. Like many consumer products, the efficiency of the charging station has much to do with the standby power consumption and feature sets that consumer power whether the unit is charging a vehicle or not such as network connectivity.

- **Demand Response:** A number of charging station manufacturers offer features that allow the vehicle to interact with the electric grid for purposes of demand response. At the moment, most of the DR logic is around scheduling for charging, allowing the timing of vehicle charging to be curtailed or shifted to match grid operator needs. Future capability would allow EVs to put energy back into the grid and is the topic of much conversation and interest in the smart grid world. There are currently no commercialized products that interact with the vehicles in a way that allows the vehicles to "charge into the grid" without violating vehicle warranty. If vehicle manufacturers and charging station operators could agree on standards for vehicle-to-grid operational parameters, EVs could become highly valuable assets to grid operators for short term (voltage, frequency stabilization), mid-term (hourly capacity support) and potentially

[4] Oak Ridge National Laboratory: https://www.ornl.gov/news/ornl-surges-forward-20-kilowatt-wireless-charging-vehicles Accessed 10/20/2016; https://www.cnet.com/roadshow/news/wirelessly-charge-your-tesla-model-s-with-new-plugless-power-system/ Accessed 10/20/2016; http://arstechnica.com/cars/2016/10/mercedes-benz-debuts-qualcomms-wireless-charging-for-the-hybrid-s-class/ Accessed 10/20/2016

[5] "An Assessment of Level 1 and Level 2 Electric Vehicle Charging Efficiency, Vermont Energy Investment Corporation, Transportation Group, March 20, 2013 (Revised).

[6] Electric Vehicle Supply Equipment Specification Version 1.0, Draft 2, 8/26/2016 US EPA Energy Star Program.

long-term (daily energy delivery) operations. For example, an EV with a 90 kWh battery could power a typical home for 24 hours and still have almost 60% of its capacity still available for transportation use. If there were a way to connect all of the capability to the grid, a Tesla Model X90D could deliver one half of a *megawatt* of power to the grid for a short period of time. If enabled at scale, grid-connected EVs offer the potential to eliminate the need for significant generating resources necessary to support grid capacity needs.

- **Charging Station Market Structure:** Level 1 and Level 2 charging stations are available for purchase by both individual consumers and electrical contractors. Distribution channels include both traditional big-box home improvement stores (Home Depot, Lowes) and online retailers (Amazon). With the exception of some Level 1 products, most charging stations require installation by a licensed electrician. Prices for the stations range significantly from under $500 to over $1,000. Installation costs can push the total to over $2,000. DIY options are available from big-box home improvement stores for Level 1 and Level 2 that can significantly reduce total cost.

- **Proposed Near-Term Market Transformation Opportunity** – NEEA staff propose that a near term intervention strategy be developed with the following parameters:
  - Target market: Level 1 and Level 2 charging equipment targeted at residential consumers.
  - Market Transformation Opportunity: Work with retailers and manufactures to increase sales of efficient models which influences ENERGY STAR leading to adoption of manufacturing standards at the state or federal level.
  - Intervention strategies: Include the product in the Retail Products Portfolio; work with retailers and manufactures to increase market share of Level 2 DIY installations at lower cost; collaborate with existing ENERGY STAR partners; engage in State and Federal standards process; work to include requirements in new construction energy efficiency programs (e.g. next step homes). Create opportunities to partner with local utility programs that incentivize consumer charging infrastructure in coordination with “upstream” retailer and manufacturer programs.
  - Rationale: NEEA currently works with retailers both big-box and online that are engaged in selling this equipment and inclusion of this equipment would benefit substantially from the economies of scale represented in the platform created by RPP. Given that the efficiency savings from chargers is small, full-scale rebate programs based on efficiency alone do not make sense. But an upstream, RPP approach can follow the model of TVs to use the Regional EE$ to highly leveraged effect.

**NEEA NEW OPPORTUNITY ASSESMENT: Demand Response.**

**DRAFT – For Discussion Only**

**Nov 1, 2016**

## 1. Opportunity Description, Timing and Resource Requirements:

- ***Description****:*
  - ***Market:*** The target markets include consumer products and commercial and industrial lighting; both strategic markets currently targeted in the 2015-2019 Business Plan.
  - ***Opportunity****:* The 7th Power Plan identifies the need for up to 600 aMW of new Demand Response resources to be added to the Northwest System over the next five years in anticipation of system capacity needs in the 5 to 10 year time frame.
    - 
  - **Proposed Near-Term Market Transformation Opportunity** – NEEA staff propose that a near term intervention strategy be developed with the following parameters:
    - Target market: Consumer products and C&I technologies that are already in the NEEA portfolio with substantial DR potential benefit. Initial efforts should focus on HPWHs, Dryers, DHPs and luminaire-level lighting systems. Additional targets for future work could include refrigerators and freezers and outdoor lighting. HPWHs offer additional capabilities to store thermal energy from excess renewable power production.
    - Market Transformation Opportunity: Work with manufactures to incorporate specific DR capability within their products. Work with DR enabling standards setting bodies to ensure common command structures and security requirements within consumer products to enable participation in grid DR events. Quantify marginal DR impacts through field studies.
    - Intervention strategies: Work with manufacturers, distributors and retailers to incorporate DR as a standard, embedded feature at minimal incremental cost across targeted product categories. In most cases, focus on operational software changes that allow for DR at virtually no cost. Focus on establishing common protocols (e.g. CTA 2045), that industry can standardize on. Work with existing connectivity platforms (e.g. Amazon Echo, NEST) to ensure DR dispatch capability across the widest possible platform. Conduct metered measurement activities to confirm aggregated DR capacity additions or incremental load as requested by grid operators. Work with Regional and National standards efforts (e.g. Open ADR 2.0, Smartgrid NW) as grid operators move towards a market based DR system that is responsive to energy

imbalance market opportunities.

- Rationale: NEEA currently works with manufacturers and retailers and inclusion of DR capability into existing products would benefit substantially from the economies of scale represented in the platforms (e.g. RPP, RWLR) that are supporting products in these markets. NEEA can represent an aggregated market to manufacturers; something that has been missing so far in their engagement with utilities. NEEA can also reduce risk for both utilities and manufacturers in the development and deployment of these new, DR capable products.

NPCC Power 4 Committee

# *NEEA, DR and Electric Vehicles: What lies ahead?*

Jeff Harris – Chief Transformation Officer, NEEA



# NEEA Background/Context

- 2015-2019 Strategic and Business Plan developed in 2013 and adopted in 2014
- EV's and DRs explicitly considered and excluded from current Business Plan
- Process for new opportunities to come forward
- Strategic Planning for 2020-2024 starting up

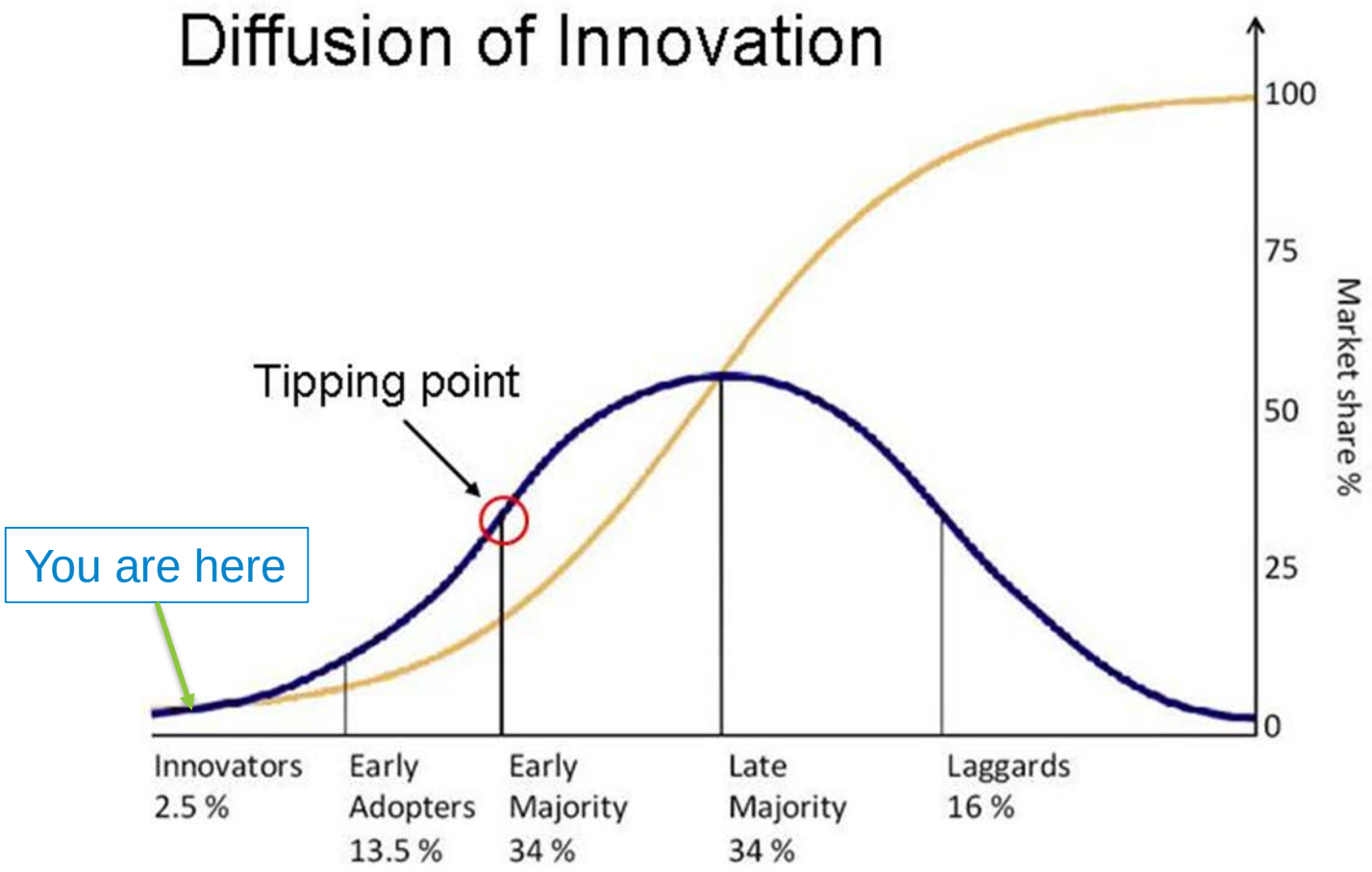
# *A lot can happen in two years…*

- Planning:  7th Plan Adopted:
  - Forecasted new loads from electric vehicles EVs
  - Region short on capacity near-term
  - Demand response key near-term capacity resource
- Policy:
  - Oregon SB 1547: 50% RPS; Requires utilities to submit plans to encourage EV's and DR
  - California: SB 350:  50% RPS
- Technology
  - Internet of things; "connectedness"
  - EV's as high-performance; disruptive force

# *What's this got to do with NEEA?*

- Changing landscape; market transformation opportunities/needs for EVs and DR nearer term
- EV's and DR both can be "efficiency" depending on your perspective
- Both have "market barriers" and "opportunities" similar to energy efficiency
- NEEA has strategic partnerships, tools, and resources that can transform these markets
- Two paths:
  - Do something now….
  - Fold into Strategic Planning for 2020-2029

# *Electric Vehicles – Opportunities and Challenges*



# *Electric Vehicles: Barriers and Opportunities*

**Barriers**

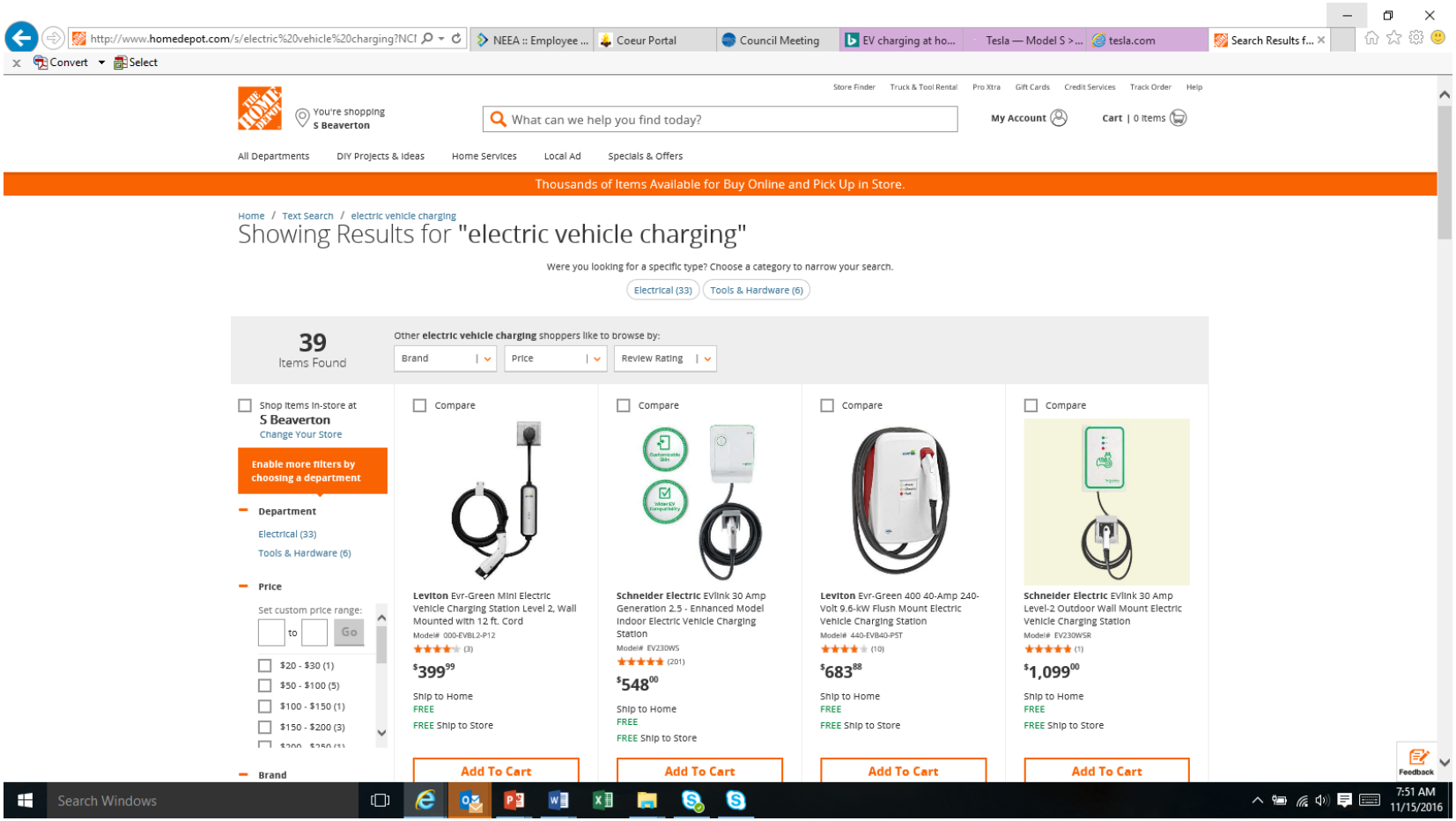
- Awareness
- Availability
- Education
- Infrastructure
- Sales channels
- Range
- Service
- Battery life

**Opportunities**

- Operating cost savings
- Fueling at home
- Vehicle to grid integration
- New revenue for utilities
- Environment
- National security

# *Electric Vehicles – Proposed Near-Term Focus for NEEA*

# Near-Term Focus: Electric Vehicle Service Equipment



# Demand Response: Trends in Consumer Products and Lighting

integration


Granularity


Connectivity

Variable Capacity

# *DR: Proposed Near-term Focus for NEEA*

- Focus on embedded connectivity in consumer and lighting products
- Goal: fully integrate DR capability into products at manufacturer level to be DR capable for whatever grid interactions are requested/available
- Primary targets of manufacturers; distributors, retailers, and standards setting agencies

# Thank You!

Jharris@neea.org

TOGETHER *We Are Transforming the Northwest*