

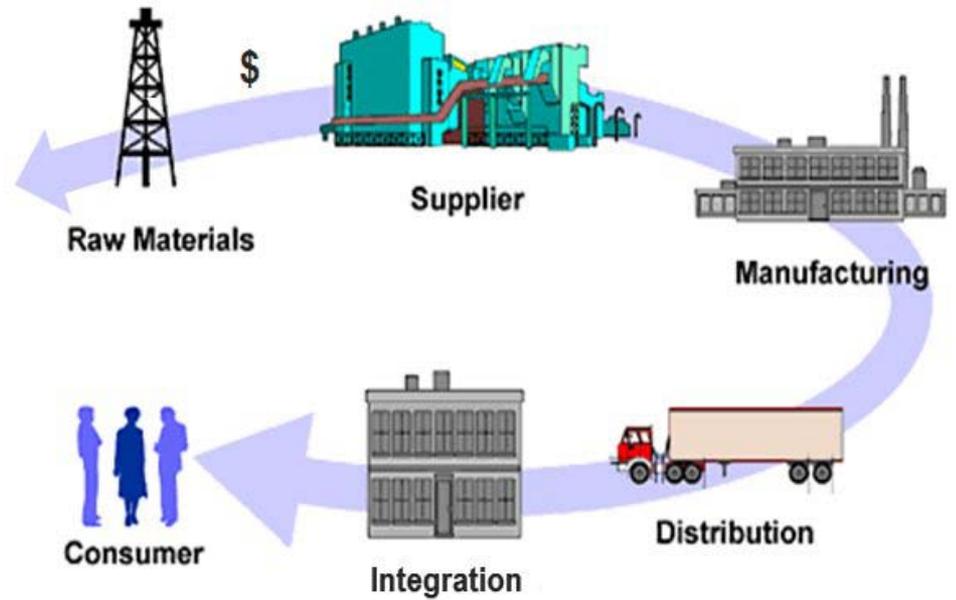
JOB ***FC 1.0*** ***(JOB*** ***s and economic impacts of Fuel Cells)****

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JOBS FC uses input-output approach to model deployment

- JOBS FC is a user-friendly **spreadsheet-based** tool that calculates direct, indirect and induced job creation, wages and sales resulting from FC production, installation, operation and fueling.
- JOBS FC uses Regional Input-Output Modeling System (RIMS II) **multipliers** to capture effect of expenditures on earnings, output and employment
- JOBS FC models **gross and net jobs** created by 3 technologies, 3 applications, multiple FC capacities (defaults shown)



Unit Capacity (kW)	LT PEM	PAFC	MCFC
Class I/II Forklift	10		
Class III Forklift	2		
Cell Tower Backup Power	5		
Prime Power (with CHP)		400	1400

Jobs are created at each stage in FC production, fuel infrastructure, O&M, and fuel supply chains (**direct + indirect jobs**), as well as from re-spending dollars in economy (**induced jobs**)



JOB'S FC models expenditures through the supply chain



King, J. 2011, Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment, DOE Annual Merit Review, 2011.



Courtesy of Ballard Power Systems.

Reforming
Fueling Equipment
Fuel Storage

FC Fueling

Maintenance
Operating Labor

FC O&M

**Fuel Cell
Application Cost
Breakdown**

FC Manufacturing

FC Shipping

FC Installation



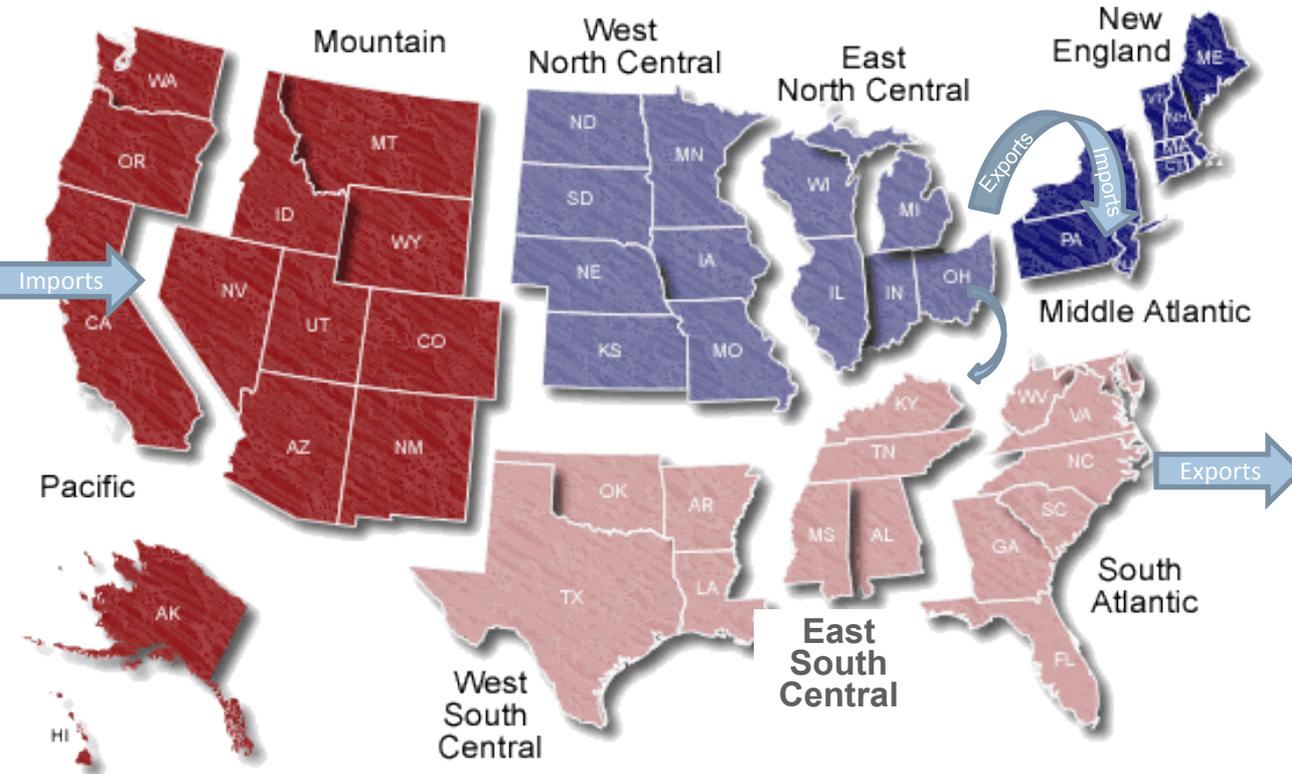
Courtesy of BMW Manufacturing Co., LLC



JOB FC models expenditures for different geographies

Jobs occur where expenditures occur.
Domestic manufacturing, installation and use create the most jobs, but imports and exports also create jobs

- JOBS FC use **RIMS II multipliers** for 60 different geographies to account for geographic variation
- Jobs are created from **imported** FCs installed and operated inside region (no manufacturing facility construction & FC production impacts occur).
- Jobs are created from **exported** FCs installed & operated outside region (no installation, O&M of FCs and fuel infrastructure & fuel purchase impacts occur).
- **Net effects** exclude jobs displaced by FCs (unless FCs displace imports)



Map by the Indiana Business Research Center,
Kelley School of Business, Indiana University

To Use JOBS FC 1.0

- Register and download Excel 2010 file and User's Guide at <http://JOBSFC.es.anl.gov>
- Open model and select application
 - Forklift INPUTS
 - Backup INPUTS
 - Prime INPUTS
 - PEM Facility Construction INPUTS
- Select geography of interest
 - Select net or gross analysis (national analysis only)
- Define scenario of interest
 - Required User Inputs (kW, number of units produced, imported, exported)
 - Optional User Inputs
 - Advanced User Inputs
- View results
 - Charts
 - Tables

JOBS FC 1.0 Demo

Stakeholders have been key collaborators for peer review, data collection/validation & beta testing

Beta tester/Peer reviewer

Public Agencies:

- South Carolina Hydrogen and Fuel Cell Alliance
- California Stationary Fuel Cell Consortium
- Connecticut Center for Advanced Technology
- Ohio Fuel Cell Coalition
- NYSERDA
- Clean Energy States Alliance
- California Fuel Cell Partnership
- Virginia Clean Cities

Customers:

- Sprint-Nextel
- Metro PCS
- Whole Foods
- Sierra Nevada

Researchers:

- ORNL
- NREL
- PNNL
- Battelle

Trade Associations:

- FCHEA
- Fuel Cells 2000

Manufacturers:

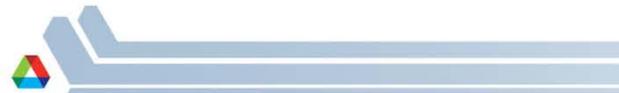
- PlugPower
- ReliOn
- Idatech
- UTC Power
- Fuel Cell Energy
- Ballard



FuelCell Energy



Connecticut Center for Advanced Technology, Inc.



Where do we go from here?

May-2012

June-2012

July-2012

Aug-2012

Dec-2012

Develop site-specific tool & evaluate ARRA projects

Add prime power manufacturing and H2 production

Complete model update (JOBS FC 1.1) and documentation

User training, data validation and documentation

Potential FY13 model expansion:

- Debt or other financing
- High temperature PEMFC
- Transportation applications
- H2 fueling stations
- Biogas fueled prime power
- SOFC
- CHHP

H2 Production, FC Manufacturing

Supporting Infrastructure

Deployment

Employment

Earnings

Economic output



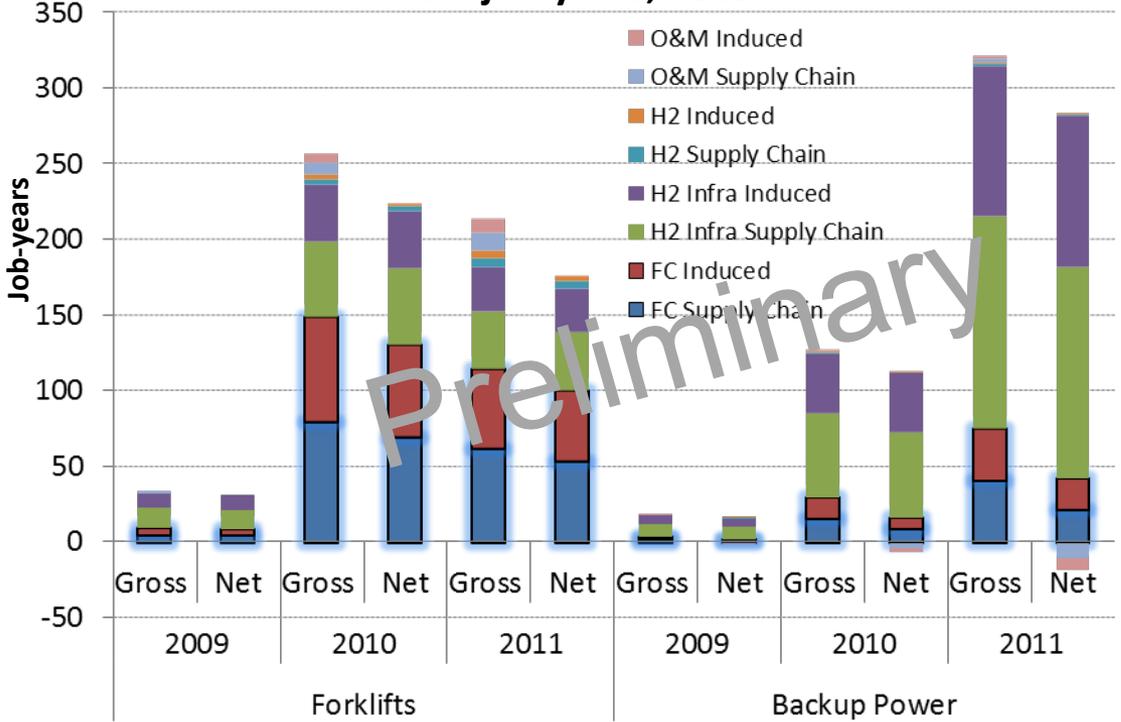
Thank you!

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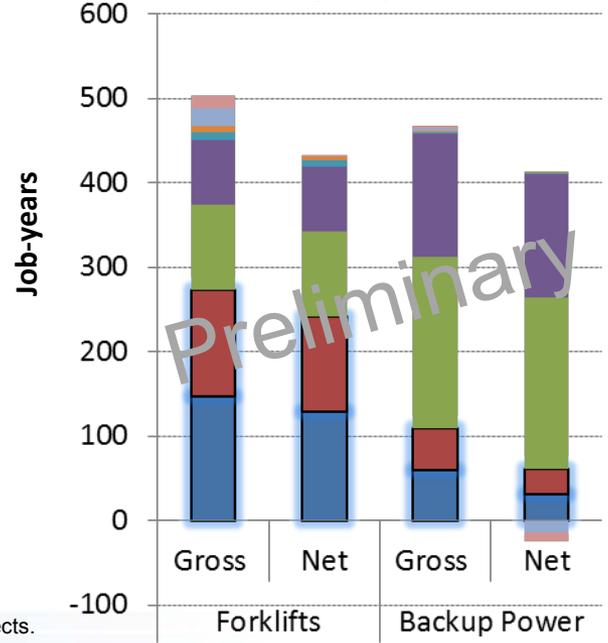
ARRA FC deployments produced 800–950 job-years to date (500–550 excluding FC manufacturing)

Annual job-years, 2009-2011*



ARRA Deployments, 2009-2011	Forklifts		Cell Tower Backup Power
	Class I/II	Class III	
Units: 2009	14	0	24
2010	122	172	166
2011	124	72	417
Total	260	244	607
Ave. capacity (kW)	8	2	2.1
Annual operating hrs.	2500	2500	24
Fuel type	LH2/GH2	LH2/GH2	GH2
Operating hrs./refuel	4	4	72

Cumulative job-years, 2009-2011*



- Initial results: ~800–950 job-years to date
- Excluding jobs from
 - Financing, taxes
 - Remaining forklift and cell tower deployments
 - Backup power in non-cell tower applications
 - Post-2011 fueling, FC & fuel infrastructure O&M, stack replacement

*Results on stacked bar charts appear deceptive. Negative values must be added to positive values to yield total net effects.