

Use of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications

Kevin Kenny

Sprint - Nextel

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H2RA012

Overview

Timeline

- Project start date: 03/18/10
- Project end date: 09/30/13
- Percent complete: 74%

Budget

- Total project funding
 - DOE: \$7,295,000
 - Sprint: \$17,248,482

Barriers

- Barriers and Risks:
 - Siting & Permitting
 - Hydrogen Refueling Infrastructure
 - New Fueling Business Model
 - Runtime

Partners

- A&E -Black & Veatch, Burns & McDonnell, ReliOn
- PEM –Altergy, ReliOn
- Fuel - Air Products and Chemicals, Champion Energy
- Services - Ericsson Services, Inc.

Relevance to ARRA Goals

Project supports job retention and creation in several industries/business:

- HFCs manufactured/assembled by two vendors with direct manufacturing as well as indirect job market impacts to the various material/component suppliers involved in the supply chain
- Fueling partner to develop and provide at least 330 MPHSS cabinets and 5,280 Hydrogen Tanks (11BC615)
- Staffing to support hydrogen production, distribution logistics, and technical field support in multiple geographic regions
- Two A&E firms retained to provide engineering, site acquisition, project management, and construction management
- Local tradesmen (construction, electrical) to complete on-site installation, commissioning, and support services
- Ericsson project management services provided to support lease modification, site acquisition, material procurement, project coordination, and Sprint specific requirements for data basing, implementation, and network integration
- Sprint will provide overall project supervision, financial governance, planning direction, incentive management, and all project performance and operational data reporting per contractual requirements

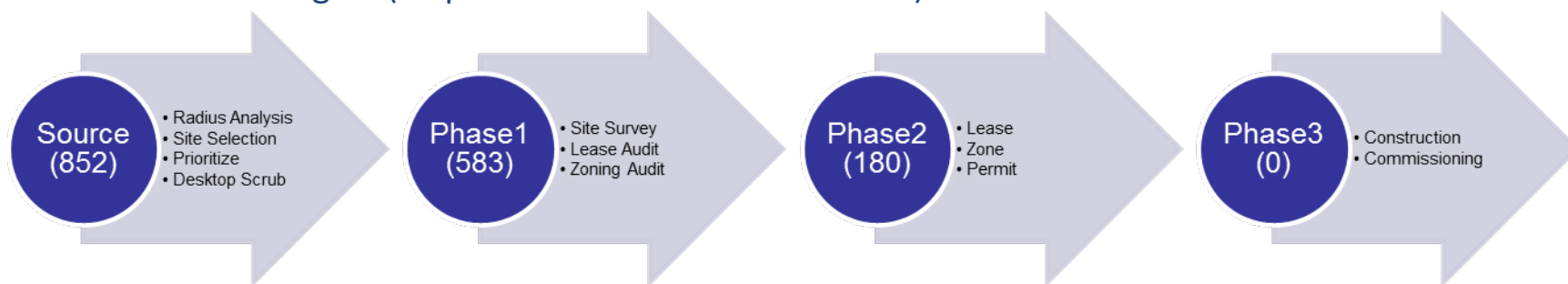
Relevance to DOE Goals

Expands installed Sprint fuel cell base from Southern US to Northeast and west coast regions, thus introducing HFC technology to new areas

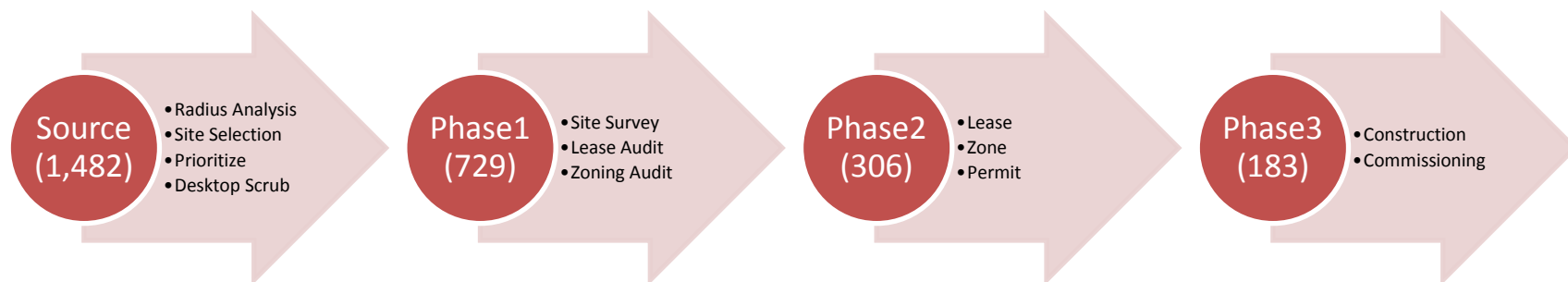
- Project more than doubles the number of HFCs deployed in Sprint's original field trial (237 units)
- Enables AHJ Permitting officials, trained during DOE sponsored, Sprint supported "Hydrogen Siting / Permitting Workshops" (held in both CA and NJ - metro NY) to put their knowledge to work evaluating this new technology in context with Sprint's proposed installations and associated permit applications
- Supports expansion of fueling project partner fleet to support off-road remote refueling applications, opening up a new market to hydrogen fueling previously accessible only to conventional fossil fueling trucks
- Provides a competitive green alternative providing operational parity to diesel generators in providing cell site backup power
- Demonstrates to the telecom industry and other industries/commercial entities the economic and operational viability of PEM Fuel Cells in lieu of incumbent backup power technologies

Approach - Site Lifecycle

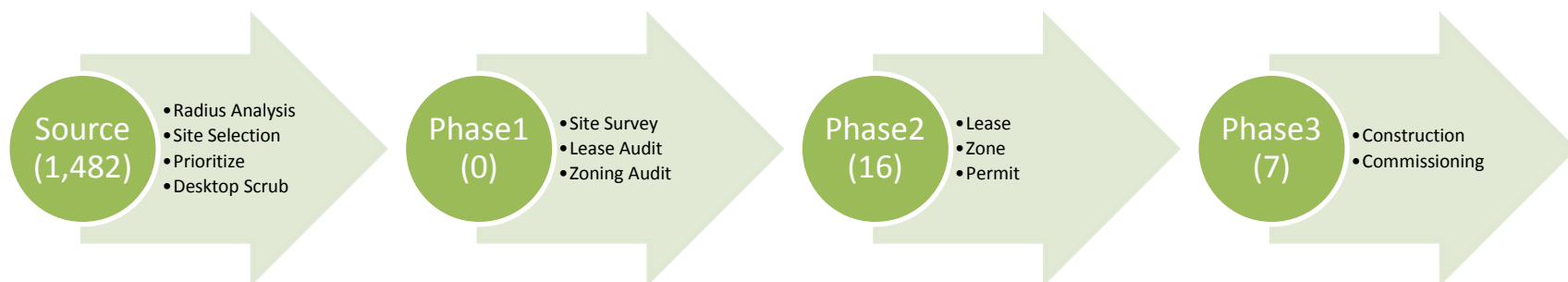
2011 Targets (As presented at 2011 ARRA AMR) – EOY11 Total New Sites = 169



2012 Targets (As presented at 2012 ARRA AMR) – EOY12 Total New Sites = 245



2013 Targets (2013 ARRA AMR) – EOQ12013 Total New Sites = 257. Only 3 to go!



Approach - Source

- Identify initial candidate pool of sites to be considered for HFC deployment which support specific types of “Critical Infrastructure” traffic. (Complete)
- Trim site list to account for the removal of sites with landlords not receptive to HFC installations (seen as a competitive threat to “premium” services offered by the landlord). (Complete)
- Ensure site mix includes both ground based and rooftop deployments – required to support both internal design criteria, as well as demonstrate the ability of the HFC to be utilized in various physical environments. (Largely complete. Rooftops avoided due to installation cost premium ~ \$65k).
- Secure training on HFC operation / installation / commissioning for A&E vendors. (Complete)
- Develop Excel spreadsheet which is to be populated with data collected during the Phase 1 Site Survey. (Complete)
- Define HFC operational data collection arrangement to be used to gather and report HFC system performance information. (Complete)
- Establish Master Construction Services Agreement with potential installation partners to support Phases 2 and 3 of deployment effort (Complete)
- Ensure Hydrogen Storage Solution (HSS) selected can support 72 hour runtime requirement for site specific power load; can be refilled on-site while HFC is either in operation or in standby; and can be fit out with a standardized, vendor specific, External Fuel Control Module. (Complete)

Approach - Phase 1

- This project has been organized into a three (3) phase approach: Site Survey, Pre-Construction (through Notice to Proceed), and Installation/Commissioning/Project Closure.
 - Phase 1: Site Survey. 100% Complete
 - Each candidate location shall be visited by the assigned A&E to document the site as detailed in the Site Survey Package (xls format).
 - Prioritized candidate list for each impacted market will be evaluated until the market deployment target is reached.
 - GO / NO-GO criteria for each site includes:
 - » Site accessible by hydrogen refueling vehicle.
 - » Space available within the existing compound to support equipment placement and code required setbacks.
 - » Estimated Phase 2 / 3 costs are within budgeted amount.
 - » Lease cost increase, if required, is within Sprint pre-determined OPEX cap.
 - The Final Site List will be assembled based upon information collected and sketches provided in the Phase 1 Site Survey Packages.

Approach - Phase 2

Phase 2: Pre-Construction (through Notice to Proceed). 100% (N) / 100% of pool (R)

Complete

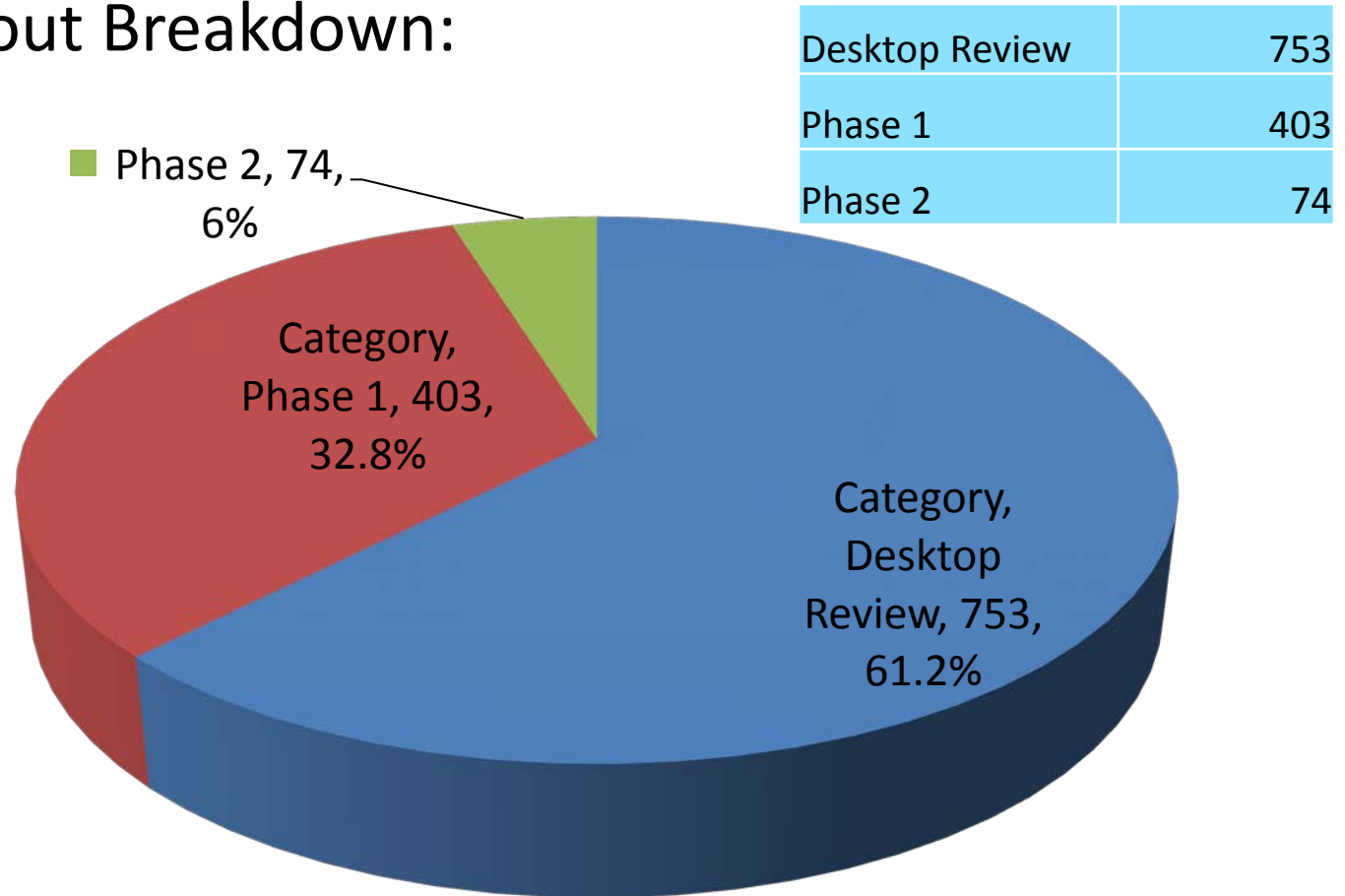
- Site acquisition – fully executed lease amendment, if required.
- Secure all required permits (building, electrical, mechanical, or others required by AHJ).
- Zoning approval.
- NEPA approval (Secured NEPA Categorical Exclusion on 05/19/2011).
- Complete all required engineering drawings.
- Order major material (HFC and MPHSS).
- GO / NO-GO criteria for each site includes:
 - » Lease amendment is fully executed or permission to proceed is provided by landlord.
 - » All necessary permits have been secured..
 - » Zoning approved.
 - » NEPA approved.
 - » All major material has been received at staging facility, or firm scheduled delivery date has been secured from the vendor.
 - » NTP has been loaded in Sprint system.

Approach - Phase 3

- Phase 3: Installation/Commissioning/Project Closure. 99% (N) or 100% of pool (R) Complete
 - Place pad, and HFC / MPHSS equipment in leased / landlord approved space per details provided on site engineering drawings.
 - Trench (if required), place, connect and leak test all required pipe / hydrogen fuel lines.
 - Run, terminate, label and secure all required ground, electrical, supervisory, and alarm cabling.
 - Once installation of material is complete, coordinate fuel delivery, NOCC notification / maintenance ticket scheduling, and perform test / acceptance / and commissioning tasks per vendor instructions and Sprint provided MOP.
 - Once device is commissioned, complete system handoff to Operations' personnel
 - Prepare As-Built drawing updates to document equipment installation.
 - Load all necessary information into Sprint systems.
 - Provide ongoing data collection and reporting as contractually committed.

Technical Accomplishments and Progress

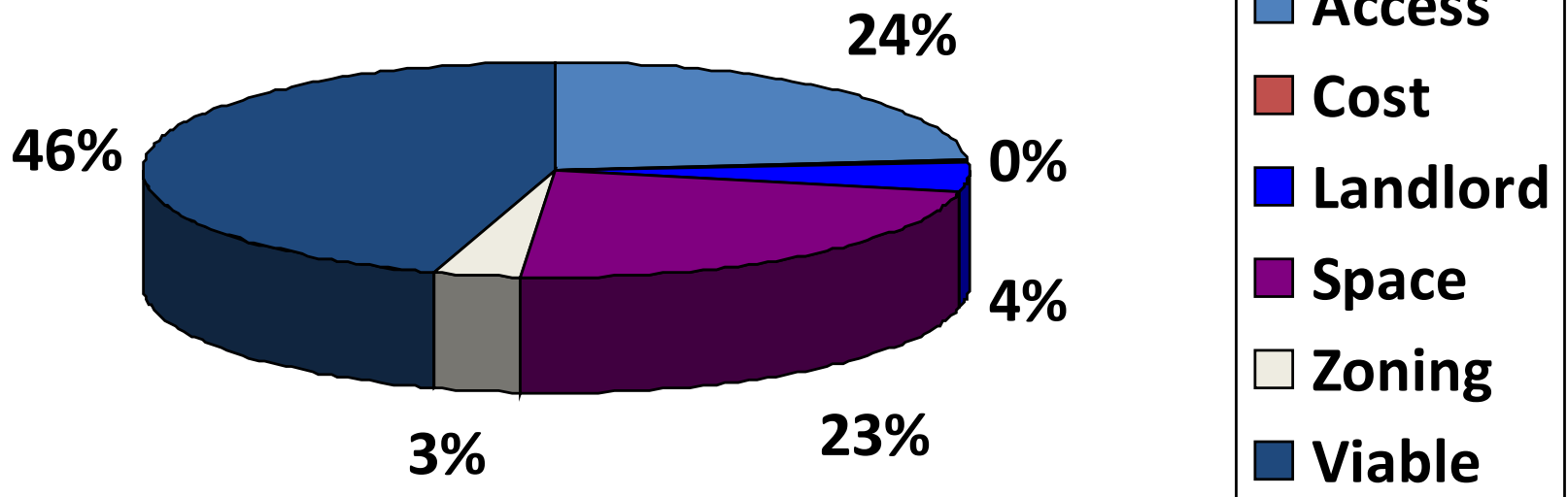
- Site Fallout Breakdown:



Technical Accomplishments and Progress

- Phase 1 to 2 fallout:

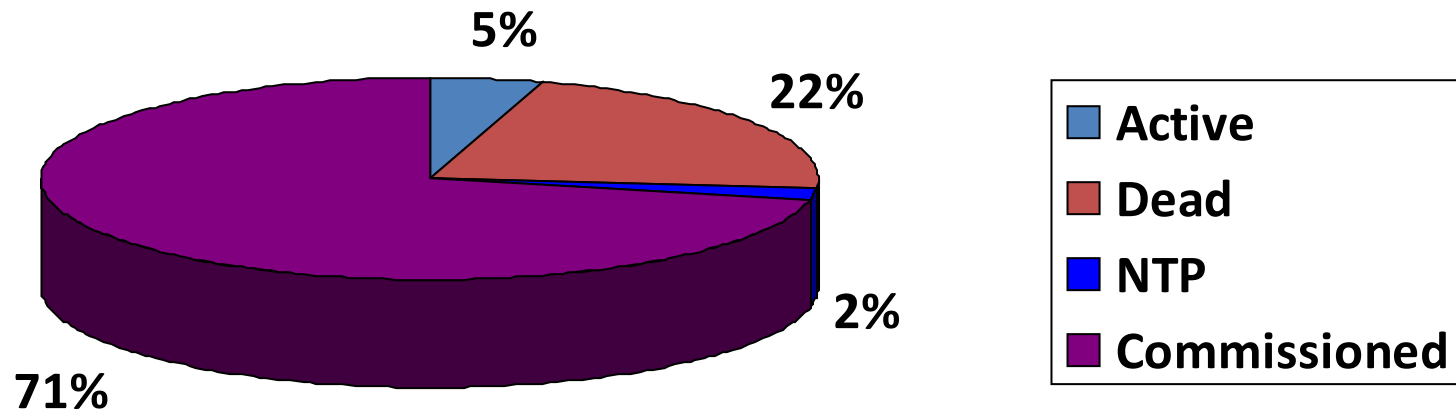
Access	162
Cost	3
Landlord	30
Space	172
Zoning	33
Viable Site	342
In-Review	16



Technical Accomplishments and Progress

- Phase 2 Status:

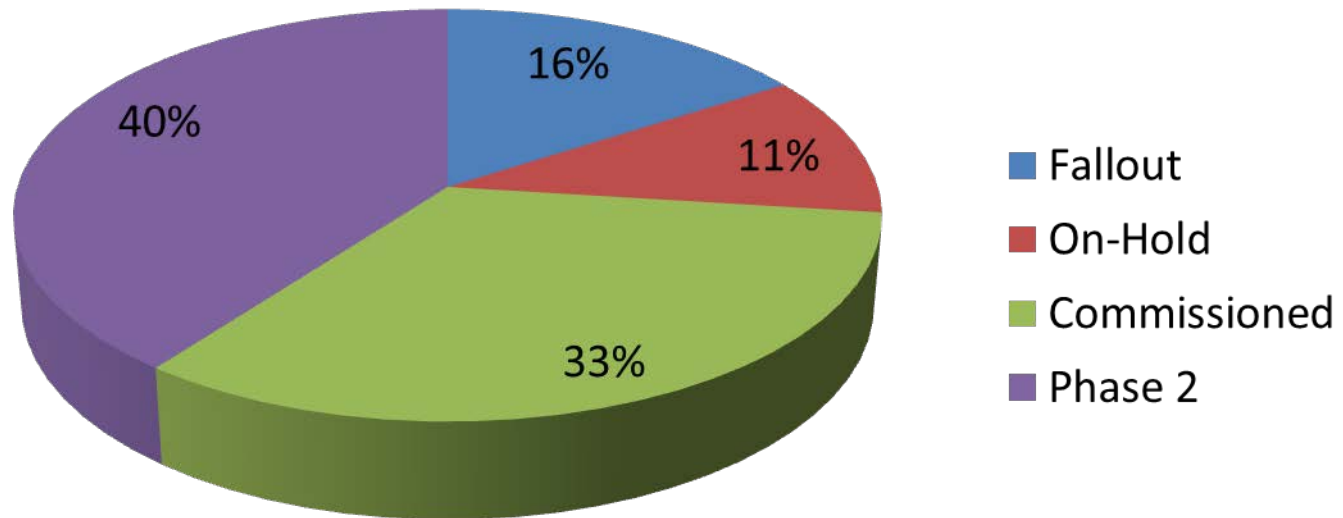
State	Active	Dead	NTP	Commissioned	Grand Total
California	0	23	1	75	99
Connecticut	1	8	0	28	37
New Jersey	1	26	0	38	65
New York	0	14	1	54	69
Louisiana	4	1	0	8	13
Texas	9	2	5	40	56
Mississippi	1	0	0	0	1
North Carolina	0	0	0	2	2
Grand Total	16	74	7	245	342



Technical Accomplishments and Progress

- Retrofit Status:

Fallout	10
On-Hold	7
Commissioned	21
Phase 2	25



Collaborations

- **Project Partners**

- A&E Firms
- Black & Veatch
- Burns & McDonnell



- PEM Fuel Cells
- Alteryg
- ReliOn



- Hydrogen Fuel Storage & Supply
- Air Products and Chemicals, Inc.
- Champion Energy



- Deployment Management
- Ericsson Services, Inc.



- End User
- Sprint - Nextel

Summary

- Relevance
 - Implementation plan establishes HFC presence, on the Sprint Network, in three new states thus introducing the technology to numerous AHJs.
 - To support these deployments, building officials are being educated in the technology to ensure code compliant installations; construction, trade and service personnel are being trained / certified on the equipment to install, commission and service these devices.
 - Jobs are being created, as well as retained, to support this program in the form of direct employment at all project partners, as well as indirect employment at all levels of the supply chain.
- Approach
 - Phased approach facilitates project success (demonstrated positive track record in previous major product rollouts) while minimizing financial impact to the project (GO/No GO decision points help preserve limited capital funds).
- Technical Accomplishments and Progress
 - Our deployment processes are working and obstacles are being overcome as we move the project forward. Of critical importance is ensuring the product pipeline is filled and capable of providing equipment when necessary.
- Collaborations
 - Working with our project partners to investigate potential design changes to permit less costly rooftop installations, as well as integrated on-site hydrogen generation.
- Future Work
 - “Design solutions to cost effectively address rooftop installation requirements.
 - Continue to seek changes to NFPA code regarding Hydrogen Setback Distances.
 - Modify grant contract to reflect reduced retrofit quantities, as well as the In-Direct Rate issue.
 - Continue to investigate modular, scalable reformer based fuel cell technology to satisfy backup power requirements at sites which have fallen out of consideration.

New Installation Summary

State	Original	Revised
California	100	76
Connecticut	30	29
Louisiana		9
Mississippi		2
New Jersey	65	38
New York	65	55
North Carolina		2
Texas		49
Total	260	260