

Pipelines 101

Episode 3: Understanding Dekatherms, Construction, and Export

October 29, 2018

Shelley Robbins, Energy and State Policy Director, Upstate Forever



Pipelines 101: Episode 3

Shelley Hudson Robbins

Energy and State Policy Director
Upstate Forever



🌱 Pipeline Construction: Jargon

1. Alignment
2. Pig (smart or dumb?)
3. ECD
4. HCA's (Class 1-4)



OR



Pipeline Construction: Components

1. Right of way (construction vs permanent)
2. Access roads (temporary and permanent)
3. Lay down yards
4. ATWS : additional temporary workspace
5. Compressor stations (every 50-100 miles)
6. Valves/regulators (manual or automated)
7. Pig launchers and receivers
8. City Gate (reduce pressure to .25-200 psi)
9. Pressure: 200-1500 psi



Pipeline Construction: Process order

1. Clearing, grading and trenching
2. Stringing, welding and coating
3. Lowering and backfilling
4. Restoration



❖ Clearing, grading and trenching



Trench depth: 30-36"; 48-60" if warranted by a high consequence area HCA

Stringing, bending, welding and coating



40-80' segments
Fabricated in steel rolling mills



🌱 Lowering and backfilling



❖ **Hydrostatic
Testing,
Restoration, and
Cathodic
Protection**



🌱 Pipeline Construction: Water bodies

1. Open-cut crossing
2. Dry-ditch crossing
 1. Dam and Pump
 2. Flume
 3. HDD



🌱 Open-cut crossing (wet)

No stream diversion

Pipe is installed while stream runs through the site

Substantial sedimentation



❧ Dry-ditch crossing – dam and pump

Stream is dammed and water is moved across the site via a temporary pipe and pump, if needed

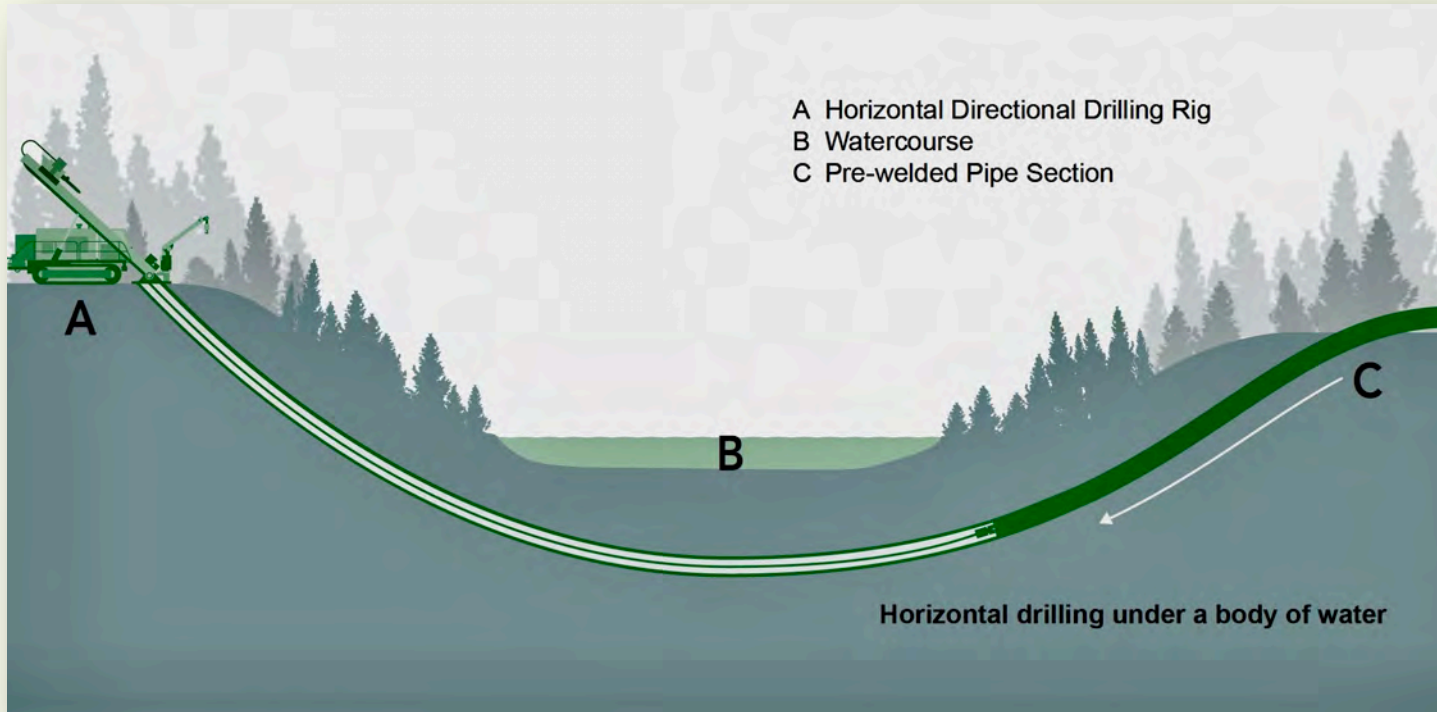


🌿 Dry-ditch crossing – flume crossing

Stream is dammed
and a culvert is
installed



🌱 Dry-ditch crossing – HDD



🌿 HDD – Horizontal Directional Drilling



Problems

1. Falsified x-rays
2. Coating deterioration due to exposure
3. ECD failure
4. Post-construction issues

Coating deterioration



3M Scotchkote Fusion Bonded Epoxy degrades with exposure to sunlight, wind, rain

ECD Failure



Spartanburg County, SC April 2018



Post-construction issues: pop up



1969 Spartanburg County DCGT 8" pipeline



2017

Post-construction issues: erosion

Spartanburg County
DCGT 2018
New pipeline already
experiencing problems



Post-construction Safety

- ❖ PHMSA – Office of Pipeline Safety
(www.phmsa.dot.gov/pipeline)
- ❖ State (SC Office of Regulatory Staff) – can inspect and regulate but not enforce safety issues
(www.regulatorystaff.sc.gov/safety)

Understanding Flow and Use

Cubic feet: volume

Dekatherms: energy

1 Billion cubic feet/day = 1M dekatherms/day

MVP= 2Bcf/d and 2M dkth/d

ACP= 1.5Bcf/d and 1.5M dkth/d

Understanding Flow and Use

500MW power plant requires 84,000 dkth/day at peak

Industrial users range from 50dkth/d to 3,000 dkth/d

1M dkth/d can fuel 5M homes/d



84,000



50-3,000



.2



900,000 dkth/d
But generally uses half
(DCGT Contracted Capacity)

Exports, International Market Growth and Price



Elba Island - Georgia

Liquefying NG for export

-260 degrees + purification

600cf reduced to 1cf

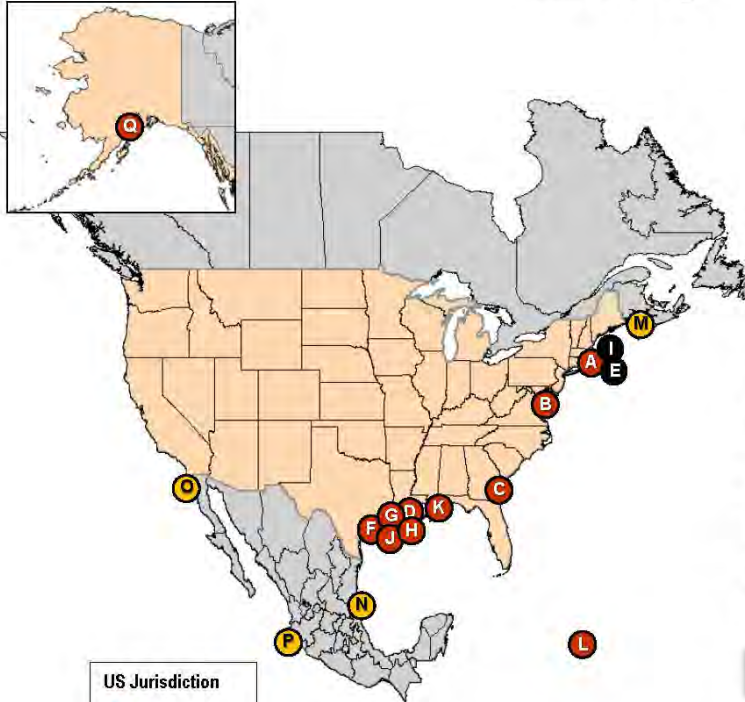
Tanker holds 3Bcf

North American LNG Import/Export Terminals

Existing



Export Terminals



US Jurisdiction
 ● FERC
 ● MARAD/USCG

As of July 2, 2018

★ Authorized to re-export delivered LNG

Import Terminals

- U.S.**
- A. Everett, MA: 1.035 Bcfd (GDF SUEZ - DOMAC)
 - B. Cove Point, MD: 1.8 Bcfd (Dominion - Cove Point LNG)
 - C. Elba Island, GA: 1.6 Bcfd (El Paso - Southern LNG)
 - D. Lake Charles, LA: 2.1 Bcfd (Southern Union - Trunkline LNG) ★
 - E. Offshore Boston: 0.8 Bcfd (Excelerate Energy - Northeast Gateway)
 - F. Freeport, TX: 1.5 Bcfd (Cheniere/Freeport LNG Dev.) ★
 - G. Sabine, LA: 4.0 Bcfd (Cheniere/Sabine Pass LNG) ★
 - H. Hackberry, LA: 1.8 Bcfd (Sempra - Cameron LNG)
 - I. Offshore Boston, MA: 0.4 Bcfd (GDF SUEZ - Neptune LNG)
 - J. Sabine Pass, TX: 2.0 Bcfd (ExxonMobil - Golden Pass) (Phase I & II)
 - K. Pascagoula, MS: 1.5 Bcfd (El Paso/Crest/Sonangol - Gulf LNG Energy LLC)
 - L. Peñuelas, PR: 0.3 Bcfd (EcoElectrica)

Canada

- M. Saint John, NB: 1.0 Bcfd (Repsol/Fort Reliance - Canaport LNG)

Mexico

- N. Altamira, Tamulipas: 0.7 Bcfd (Shell/Total/Mitsui - Altamira LNG)
- O. Baja California, MX: 1.0 Bcfd (Sempra - Energia Costa Azul)
- P. Manzanillo, MX: 0.5 Bcfd (KMS GNL de Manzanillo)

Export Terminals

- U.S.**
- B. Cove Point, MD: 0.82 Bcfd (Dominion-Cove Point LNG) (CP13-113)
 - G. Sabine, LA: 2.8 Bcfd (Cheniere/Sabine Pass LNG - Trains 1, 2, 3 & 4)
 - Q. Kenai, AK: 0.2 Bcfd (ConocoPhillips)

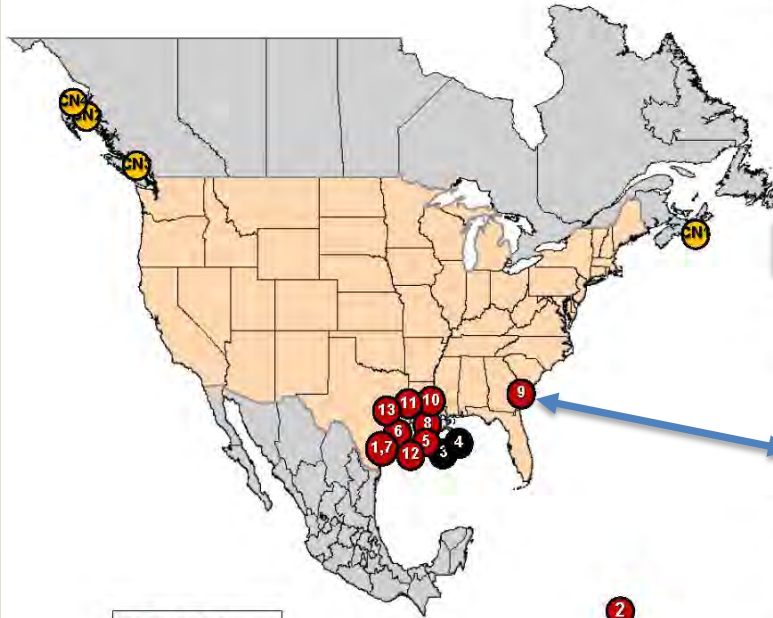


North American LNG Import/Export Terminals

Approved



Export Terminals



US Jurisdiction

- FERC
- MARAD/USCG

As of July 2, 2018

Import Terminals

U.S.

APPROVED - UNDER CONSTRUCTION - FERC

1. Corpus Christi, TX: 0.4 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)

APPROVED – NOT UNDER CONSTRUCTION - FERC

2. Salinas, PR: 0.6 Bcfd (Aguirre Offshore GasPort, LLC) (CP13-193)

APPROVED - NOT UNDER CONSTRUCTION - MARAD/Coast Guard

3. Gulf of Mexico: 1.0 Bcfd (Main Pass McMoRan Exp.)
4. Gulf of Mexico: 1.4 Bcfd (TORP Technology-Bienville LNG)

Export Terminals

U.S.

APPROVED - UNDER CONSTRUCTION - FERC

5. Hackberry, LA: 2.1 Bcfd (Sempra–Cameron LNG) (CP13-25)
6. Freeport, TX: 2.14 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction) (CP12-509) (CP15-518)
7. Corpus Christi, TX: 2.14 Bcfd (Cheniere – Corpus Christi LNG) (CP12-507)
8. Sabine Pass, LA: 1.40 Bcfd (Sabine Pass Liquefaction) (CP13-552)
9. Elba Island, GA: 0.35 Bcfd (Southern LNG Company) (CP14-103) ★

APPROVED – NOT UNDER CONSTRUCTION - FERC

10. Lake Charles, LA: 2.2 Bcfd (Southern Union – Lake Charles LNG) (CP14-120)
11. Lake Charles, LA: 1.08 Bcfd (Magnolia LNG) (CP14-347)
12. Hackberry, LA: 1.41 Bcfd (Sempra - Cameron LNG) (CP15-560)
13. Sabine Pass, TX: 2.1 Bcfd (ExxonMobil – Golden Pass) (CP14-517)

Canada

APPROVED – NOT UNDER CONSTRUCTION

- CN1. Port Hawkesbury, NS: 0.5 Bcfd (Bear Head LNG)
- CN2. Kitimat, BC: 3.23 Bcfd (LNG Canada)
- CN3. Squamish, BC: 0.29 Bcfd (Woodfibre LNG Ltd)
- CN4. Prince Rupert Island, BC: 2.74 Bcfd (Pacific Northwest LNG)

★ Trains 5 & 6 with Train 5 under construction

Figure 1: U.S. Natural Gas – EIA AEO 2018 Base Case (Billion Cubic Feet/Day)

Year	U.S. Consumption	Net LNG Exports**	Net Exports to Mexico	Net Exports to Canada	Lease Fuel	Pipeline & Plant Distribution Use	Total Consumption
2015	74.6	-0.2	2.9	-5.3	4.3	1.9	78.2
2016	75.3	0.3	3.8	-5.9	4.4	1.9	79.8
2017	73.1	1.6	4.3	-5.7	4.4	1.7	79.4
2018	77.2	2.8	4.7	-5.5	4.7	1.8	85.7
2019	79.5	5.1	5.5	-4.8	5.0	1.8	92.1
2020	79.5	8.1	5.9	-4.3	5.1	1.8	96.1
2021	79.9	8.4	6.0	-3.9	5.2	1.8	97.4
2022	80.7	9.0	6.5	-3.7	5.3	1.8	99.6
2023	81.5	10.1	6.7	-3.7	5.3	1.8	101.7
2024	81.2	11.4	6.9	-3.4	5.4	1.8	103.3
2025	81.6	12.5	7.0	-3.3	5.5	1.9	105.2
2026	81.8	13.2	7.0	-3.1	5.5	1.8	106.2
2027	82.5	13.9	7.0	-2.9	5.6	1.9	108.0
2028	83.4	14.3	7.1	-2.7	5.6	1.9	109.6
2029	83.9	14.5	7.0	-2.5	5.6	1.9	110.4
2030	84.2	14.5	7.0	-2.3	5.6	1.9	110.9
2031	84.6	14.5	7.0	-2.2	5.7	1.9	111.5
2032	84.8	14.5	6.9	-2.1	5.7	1.9	111.7
2033	85.1	14.5	6.8	-2.0	5.7	1.9	112.0
2034	85.7	14.5	6.8	-1.7	5.7	1.9	112.9
2035	86.1	14.5	6.8	-1.6	5.7	1.9	113.4
2036	86.6	14.5	6.8	-1.3	5.8	1.9	114.3
2037	87.3	14.5	6.7	-0.9	5.8	1.9	115.3
2038	87.8	14.5	6.7	-0.8	5.8	1.9	115.9
2039	88.2	14.5	6.6	-0.5	5.9	1.9	116.6
2040	89.0	14.5	6.6	-0.3	5.9	1.9	117.6
2041	89.6	14.5	6.5	-0.2	5.9	1.9	118.2
2042	90.3	14.5	6.5	0.03	6.0	1.9	119.2
2043	90.8	14.5	6.4	0.2	6.0	1.9	119.8
2044	91.1	14.5	6.4	0.8	6.0	1.9	120.7
2045	91.5	14.5	6.3	1.0	6.0	1.9	121.2
2046	92.0	14.5	6.3	1.3	6.0	1.9	122.0
2047	92.6	14.5	6.2	1.7	6.1	1.9	123.0
2048	93.2	14.5	6.2	2.0	6.1	1.9	123.9
2049	93.6	14.5	6.1	2.2	6.1	2.0	124.5
2050	94.5	14.5	6.0	2.6	6.1	2.0	125.7
Total Consumption	3,064.3	429.5	225.9	-64.77	200.5	67.6	3,923.03

Source: Energy Information Administration (EIA), Annual Energy Outlook (AEO) 2018

**The process of producing consumer-grade natural gas. Natural gas withdrawn from reservoirs is reduced by volumes used at the production (lease) site and by processing losses. Volumes used at the production

Where is it going by ship (2018)?

South Korea 18%

China 15%

Japan

Turkey

Spain

Jordan

US Export Capacity

3.6 Bcf/d now

9.6 Bcf/d by 2019

3rd largest exporter by 2020,
behind Australia and Qatar



UPSTATE
FOREVER

What will exports do to price???

Industrial Energy Consumers of America

From July 27, 2018 Comments to US DOE

“When we export natural gas, we are lowering the cost of natural gas to our manufacturing competitors in other countries and increasing our domestic costs – a double negative impact. You are making it harder for us to compete, invest capital, and create high paying middle class jobs.” (emphasis added)

“In 2017, according to the Bureau of Labor Statistics (BLS), the oil and natural gas industry employed 512,100 jobs. The manufacturing sector employs 12,713,000 jobs. Of that total, energy-intensive trade-exposed industries (EITE) (IECA members) that would be most affected by LNG exports employ 5,125,600 employees. The point is –that you could double or triple the number of people employed by the oil and gas industry due to LNG exports and it is still a small job creator. But, if the DOE gets this wrong and approves too many export terminals and natural gas prices rise, DOE puts at risk trillions of dollars of manufacturing assets and over 12.7 million jobs.” (emphasis added)



Navigating the EIA Website

https://www.eia.gov

Independent Statistics & Analysis
U.S. Energy Information Administration

+ Sources & Uses | + Topics | + Geography

Search eia.gov

Electric Power Annual

With data for 2017 >

What's New

- [Monthly Energy Review](#)
Oct 26, 2018
- [Wholesale Electricity and Natural Gas Market Data](#)
Oct 25, 2018
- [Monthly Solar Photovoltaic Module Shipments Report](#)
Oct 24, 2018

[More >](#)

Today in Energy

Posted October 26, 2018

Most utility-scale fixed-tilt solar photovoltaic systems are tilted 20 degrees-30 degrees >

Nearly 40%, or 10.4 gigawatts (GW), of utility-scale solar photovoltaic (PV) systems operating in the United States at the end of 2017 were fixed-tilt PV systems rather than tracking systems. Of the utility-scale fixed-tilt solar PV systems, 76% of the capacity was installed at a fixed angle between 20 degrees and 30 degrees from the horizon. [More >](#)

U.S. utility-scale fixed-tilt solar photovoltaic operating capacity by tilt angle (2017)

gigawatts

Tilt Angle	Capacity (gigawatts)
20-30 degrees	~4.5
Other	~3.5

Data Highlights

- WTI crude oil futures price**
10/25/2018: **\$67.33/barrel**
↓ \$1.32 from week earlier
↑ \$15.15 from year earlier
- Natural gas futures price**
10/25/2018: **\$3.20/MMBtu**
↓ \$0.004 from week earlier
↓ \$0.283 from year earlier
- Weekly coal production**
10/20/2018: **14,494 million tons**
↓ 0.003 million tons from week earlier
↓ 0.573 million tons from year earlier



Navigating the EIA Website

International Statistics & Analysis

Sources & Uses Topics Geography Tools Learn About Energy News

U.S. States
State energy information, including overviews, rankings, data, and analyses.
• [State Energy Data System \(SEDS\)](#) >

International
International energy information, including overviews, rankings, data, and analyses.
• [International Energy Statistics](#) >

Maps
Maps by energy source and topic, includes forecast maps.
• [U.S. Energy Mapping System](#) > ←
• [Gulf of Mexico](#) >
• [Energy Disruptions](#) >

A-Z Index
[A](#) | [B](#) | [C](#) | [D](#) | [E](#) | [F](#) | [G](#) | [H](#) | [I](#) | [J](#) | [K](#) | [L](#) | [M](#) | [N](#) | [O](#) | [P](#) | [Q](#) | [R](#) | [S](#) | [T](#) | [U](#) | [V](#) | [W](#) | [XYZ](#)

Statements Released: Oct 24, 2018

U.S. utility-scale fixed-tilt solar photovoltaic operating capacity by tilt angle (2017)

50,283 MW total utility

Weekly coal production: 10/20/2018: 14,494 million tons

0.022 million tons from wind energy

0.573 million tons from other sources



Navigating the EIA Website

← → ↻ https://www.eia.gov/state/maps.php ☆ 🔔 🌐

eia Sources & Uses Topics Geography Search eia.gov

U.S. Energy Mapping System

Layers/Legend
Basemaps
Find address
Print

2000km
1000mi

Pacific Ocean Atlantic Ocean



Navigating the EIA Website

← → ↻ https://www.eia.gov/state/maps.php ☆ 🔒 🌐 ⋮

eia Sources & Uses Topics Geography Search eia.gov

U.S. Energy Mapping System

The screenshot displays the U.S. Energy Mapping System interface. The main map shows the United States with various energy infrastructure markers. A legend panel on the right is titled "Layers/Legend" and contains the following sections:

- Views:** Energy Infrastructure
- Map Layers:**
 - State/Territory Boundary
 - County Boundary
 - Congressional District (115th)
 - All Coal Mines
 - Surface Coal Mine
 - Underground Coal Mine
 - All Power Plants
 - Battery Storage Power Plant
 - Biomass Power Plant
 - Coal Power Plant
 - Geothermal Power Plant
 - Hydroelectric Power Plant
 - Natural Gas Power Plant
 - Nuclear Power Plant
 - Other Power Plant
 - Petroleum Power Plant
 - Pumped Storage Power Plant
 - Solar Power Plant
 - Wind Power Plant

Additional features include a scale bar (0 to 2000km/1000mi), a compass, and social media icons for Twitter and Facebook.



Navigating the EIA Website

← → ↻ <https://www.eia.gov/state/maps.php> ☆ U 🌐 ⋮

eia + Sources & Uses + Topics + Geography 🔍 Search eia.gov

U.S. Energy Mapping System

The screenshot displays the U.S. Energy Mapping System interface. The main map shows the Eastern United States, including parts of Virginia, North Carolina, South Carolina, Georgia, Alabama, and Florida. Major cities like Washington, D.C., Richmond, Norfolk, Raleigh, Charlotte, Greenville, Atlanta, and Jacksonville are labeled. The map is overlaid with a dense network of blue lines representing energy infrastructure, such as pipelines and power lines. On the right side of the map, there is a 'Layers/Legend' panel with options for 'Basemaps' and 'Find address', and a 'Print' button. Social media icons for Twitter and Facebook are visible on the right edge of the browser window. A scale bar at the bottom left of the map indicates 200km.



Navigating the EIA Website

The screenshot displays the U.S. Energy Mapping System website. The browser address bar shows the URL <https://www.eia.gov/state/maps.php>. The website header includes the EIA logo, navigation links for Sources & Uses, Topics, and Geography, and a search bar. The main content area features a map of the Eastern United States, densely populated with yellow circular markers representing energy projects. Major cities like Nashville, Knoxville, Atlanta, and Jacksonville are labeled. The map includes a scale bar for 200km and a vertical scale on the left. On the right side of the map, there is a control panel with options for Layers/Legend, Basemaps, Find address, and Print. Social media icons for Twitter and Facebook are visible on the right edge of the page.

Questions?????

❖ www.upstateforever.org

❖ Archive: www.upstateforever.org/pipelines-101

Thank you!

Shelley Robbins
srobbins@upstateforever.org



UPSTATE
FOREVER