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ISSUES AFFECTING CO-LOCATION OF ENERGY INFRASTRUCTURE

REPORT

Prepared by:

Governor's Office of Energy
Independence and Security

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Governor's Office of Energy
Independence and Security
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Erika Lloyd, Project Manager at Woodard & Curran, served as the primary author of this report and coordinated and communicated with the stakeholder group.

Jennifer Puser, former Deputy Director, Governor's Office of Energy Independence and Security, is responsible for managing and editing the report.

Ross Elliot, Woodard & Curran, designed the report cover.

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Kenneth C. Fletcher
Director
Governor's Office of Energy Independence and Security

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EXECUTIVE SUMMARY

The State of Maine Comprehensive Energy Plan provides a long-term framework to promote energy efficiency, the development of renewable energy, and upgrading energy infrastructure in the State. Currently, State efforts are underway to establish energy infrastructure corridors to provide for efficient energy transport. Energy infrastructure corridors would provide the conduit for the siting of oil, natural gas, and hydrogen pipelines and electric transmission and distribution to meet the energy transport needs of the State. These energy infrastructure corridors would provide greater certainty in energy infrastructure planning, siting and permitting, thus fostering new economic development opportunities for Maine's renewable resources.

LD 1786 An Act Regarding Energy Infrastructure Development, enacted as Public Law 2010, Chapter 655, sets up a process under which companies/developers can apply to the State to build pipelines, transmission lines or other energy infrastructure along Interstate 95 and two other statutory corridors owned by the state. In return, the State would receive lease payments for reinvestment in energy efficiency, development of renewable energy and efficiency in the transportation sector. The purpose is to increase Maine's development, supply and transport of reliable, clean and secure energy, create new economic development opportunities, and attract investment. This will allow Maine to have a cleaner and more energy independent future and will help transform Maine's energy economy.

However, co-location of energy transmission systems within designated energy corridors may result in interference or other hazards that exist due to the physical proximity of these energy infrastructure. Careful consideration should be given to the issues affecting co-location of energy-infrastructure. The following are the issues laid out in this report:

- Coincident Construction
- Risk of Natural Hazards and Human Threats
- Fire Hazards
- Electrical Interference
- High Voltage Direct Current (HVDC) Lines
- Utility Accommodation Rule

Regardless of the type of infrastructure, there is always concern over natural and/or man-made hazards. These hazards potentially could cause harm to pipeline components, such as pump stations, pipeline segments, and storage tanks, and other energy infrastructure located in the designated right of way (ROW).

The Governor's Office of Energy Independence and Security (OEIS) recommends consideration of the following policies, initiatives and action items:

- Developers should consult with the Maine Emergency Management Agency with their development plans prior to submission for approval by the Interagency Review Panel to ensure safety concerns are addressed.
- Adequate separation of lines and facilities, adequate insulation and fire protection should be required at sites where pipelines exit the ground.
- All applicable codes and standards should be followed for the design, construction, operation and maintenance of collocated energy infrastructure in the State.

- Developers should adhere to all Federal policies regarding co-location of energy infrastructure in the State.
- Guidelines should be developed for maintenance procedures of co-located energy infrastructure in the State.
- The Interagency Review Panel should communicate with the Federal government to determine all Federal policies on co-location of energy infrastructure development prior to soliciting proposals for energy infrastructure.

1. INTRODUCTION

1.0 INTRODUCTION

LD 1786 An Act Regarding Energy Infrastructure Development, enacted as Public Law 2010, Chapter 655, sets up a process under which companies/developers can apply to the State to build pipelines, transmission lines or other energy infrastructure along Interstate 95 and two other statutory corridors owned by the state. In return, the State would receive lease payments for reinvestment in energy efficiency, development of renewable energy and efficiency in the transportation sector. This will allow Maine to have a cleaner and more energy independent future and will help transform Maine's energy economy.

LD 1786 included a provision for the Governor's Office of Energy Independence and Security (OEIS) to report "on issues affecting the co-location of electric transmission and distribution facilities, natural gas transmission lines, carbon dioxide pipelines and other energy infrastructure".

1.1 PURPOSE OF REPORT

The purpose of this report is to provide information and recommendations pursuant to LD 1786.

This report will:

- Clearly define issues affecting the co-location of electric transmission and distribution facilities, natural gas transmission lines, carbon dioxide pipelines and other energy infrastructure;
- Provide analysis of safety, health, engineering, environmental, geotechnical, land use and other factors that restrict or otherwise affect co-location of such facilities, and how it applies to energy infrastructure corridors;
- Present findings with respect to practices in other jurisdictions as well as any industry or governmental recommendations regarding co-location of such facilities, and how it applies to energy infrastructure corridors.

Finally this report will make recommendations pursuant to the OEIS's directive.

1.2 STAKEHOLDERS

Pursuant to its directive, the OEIS conferred with and obtained input from representatives of various stakeholders, including but not limited to the Department of Environmental Protection, the Public Utilities Commission, the Department of Transportation, Department of Defense, Veterans and Emergency Management, and Maine Emergency Management.

The following is a list of individuals contacted:

Representative Herb Adams
Jonathon Arey, Maine Turnpike Authority
David Allen, Central Maine Power
Mark Belserene, Maine Emergency Management Agency
James Brooks, Department of Environmental Protection
Jonathan Burbank, Maine Emergency Management Agency
Brian Burne, Department of Transportation
Senator Barry Hobbins
Dwane Hubert, Maine Emergency Management Agency
Eric Kennedy, Department of Environmental Protection
Jeffrey Jones, Bangor Hydro
Rob McAleer, Maine Emergency Management Agency
Lynette Miller, Maine Emergency Management Agency
Marylee Hanley, Maritimes & Northeast Pipeline
Mitchell Tannenbaum, Public Utilities Commission
Conrad Welzel, Maine Turnpike Authority

OEIS prepared this report with guidance and information provided by the stakeholders and pursuant to LD 1786 represents factual information and some recommendations. However, some content and opinions expressed in the report may not reflect the position of every stakeholder.

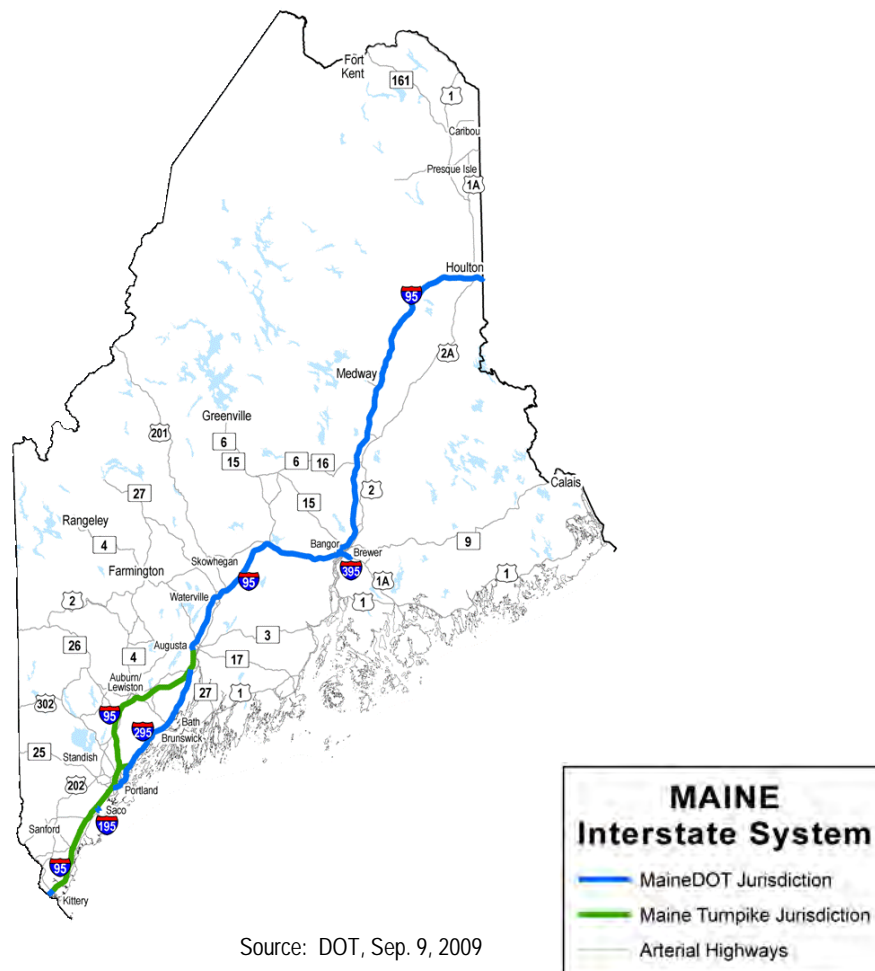
2. LD 1786 – AN ACT REGARDING ENERGY INFRASTRUCTURE

2.0 DEFINITIONS

On May 11, 2010, Governor John Baldacci signed LD 1786, An Act Regarding Energy Infrastructure Development into law. The bill, sponsored by Senator Barry Hobbins, established a mechanism for developers to propose energy infrastructure projects in the three designated “statutory corridors”, and amended the process for establishing “petitioned corridors”.

“Statutory corridors” include the I-95 corridor (including the Maine Turnpike), the I-295 corridor and the Searsport-Loring corridor (a corridor from Searsport to the former Loring Air Force Base in Limestone). “Petitioned corridors” include corridors designated by the Public Utilities Commission (PUC) only after it has been shown that the statutory corridors and possibly others, cannot meet the needs of the proposed energy infrastructure project.

The following map shows the jurisdiction of the Maine Interstate System:



Source: DOT, Sep. 9, 2009

Energy infrastructure is defined as the following: "electric transmission and distribution facilities, natural gas transmission lines, carbon dioxide pipelines and other energy transport pipelines or conduits."

Energy infrastructure corridors may accommodate multiple pipelines (such as for oil, natural gas, or hydrogen), electricity transmission lines, and related infrastructure, such as access and maintenance roads, compressors, pumping stations, and other structures (<http://corridoreis.anl.gov>). Co-location of electric transmission lines and pipelines are encouraged for efficiency and to minimize land use and environmental impact. It is anticipated that the process established in LD 1786 will streamline and expedite the processing of energy-related permits and projects. The Interagency Review Panel, mentioned below, will ensure inter-agency coordination as part of the application process.

2.1 INTERAGENCY REVIEW PANEL

LD 1786 also established an "Interagency Review Panel" whose role is to "establish and implement a regular process for soliciting, accepting and evaluating energy infrastructure proposals for use of a statutory corridor". The panel is made up of the following individuals (Sec. A-2. 35-A MRSA § 122 1-B):

1. The Director of the Governor's Office of Energy Independence and Security within the Executive Department or the director's designee;
2. The commissioner of Administrative and Financial Services or the commissioner's designee;
3. The commissioner of each department or the director of any other state agency or authority that owns or controls land or assets within the statutory corridor under consideration or that commissioner's or director's designee;
4. Four members of the public appointed by the Governor, subject to review by the joint standing committee of the Legislature having jurisdiction over utilities and energy matters and to confirmation by the senate.
 - a) One member with expertise in energy and utilities selected from candidates nominated by the President of the Senate;
 - b) One member with expertise in real estate or finance selected from candidates nominated by the President of the Senate;
 - c) One member representing industrial or commercial energy consumers selected from candidates nominated by the Speaker of the House; and
 - d) One member representing residential energy consumers selected from candidates nominated by the Speaker of the House.

Based on the criteria above, the Interagency Review Panel consists of the following members;

State Agency Members:

1. Kenneth Fletcher, Director, Governor's Office of Energy Independence and Security – Chair
2. Sawin Millet, Commissioner, Maine Department of Administrative and Financial Services

3. David Bernardt, Commissioner, Department of Transportation
Designee: Bruce VanNote, Deputy Commissioner

Public Members:

1. Barbara Alexander (expertise in energy and utility matters, nominated by Senate President)
2. Timothy Agnew (expertise in real estate or finance, nominated by the President of the Senate President)
3. Harrison Horning (representing industrial or commercial energy consumers, nominated by the Speaker of the House)
4. Fenwick Fowler (representing residential energy consumers, nominated by the Speaker of the House)

Public members serve 3-year terms, except that a vacancy must be filled for the unexpired portion of the term. A public member serves until a successor is appointed. A public member may serve a maximum of 2 consecutive terms.

2.2 DECISION CRITERIA FOR APPROVAL OF ENERGY INFRASTRUCTURE PROJECTS

If a developer proposes an energy infrastructure project within a statutory corridor, they must apply for a long-term occupancy agreement from the Interagency Review Panel. In order to receive approval, the proposal must meet several decision criteria (Sec. A-2. 35-A MRSA § 122 1-D):

1. Materially enhances or does not harm transmission opportunities for energy generation with the state;
2. Reduce electricity rates in Maine (or if unable to determine, the owner must agree to pay an annual amount to reduce rates) (Atwood, 2010);
3. Is in the long-term public interest of the state. In order to determine this, at a minimum the following eight factors will be considered:
 - a) Materially enhances or does not harm transmission opportunities for energy generation within the State;
 - b) Is reasonably likely to reduce electric rates or other relevant energy prices or costs for residents and businesses within the State relative to the expected value of those electric rates or other energy prices or costs but for the proposed energy infrastructure development;
 - c) Increases long-term economic benefits for the State, including but not limited to direct financial benefits, employment opportunities and economic development;
 - d) Ensures efficient use of the statutory corridor through co-location of energy infrastructure, collaboration between energy infrastructure developers and the preservation of options for future uses;

- e) Minimizes conflict with the public purposes for which the state-owned land or asset is owned and any management plans for the land or asset within the statutory corridor and, when necessary, mitigates unavoidable impacts;
- f) Limits and mitigates the effects of energy infrastructure on the landscape, including but not limited to using underground installation when economically and technically feasible;
- g) Increases the energy reliability, security and independence of the State; and
- h) Reduces the release greenhouse gases.

If a proposed project meets all of these criteria and the Interagency Review Panel issues an occupancy agreement, the State would receive negotiated lease payments in return. The bill establishes an Energy Infrastructure Benefits Fund, whereby each fiscal year the Treasurer of the State shall transfer 80% of the lease revenues collected to the Efficiency Maine Trust for dispersal according to its Triennial Plan in the form of loans, grants or other incentives largely for energy efficiency, weatherization and fuel conversion projects. The remaining 20% will go into the new Transportation Efficiency Fund for uses related to transportation efficiency.

2.3 THE ROLES OF THE STATE AGENCIES WITH RESPECT TO LD 1786

Several agencies in the State have specific roles with respect to LD 1786. The Maine Public Utilities Commission (PUC) regulates electric transmission, and whether the transmission line is built by a utility or not, the PUC has to approve the construction. The PUC's focus is the impact of the proposed energy infrastructure to the rate payers in the state, the economic aspect, and the reliability and safety of the system (Tannenbaum, 2010). Optimistically, additional energy infrastructure would allow for more energy generation resources and therefore lower the electric rates in Maine; however PUC wants to ensure that any transmission line placed in the designated corridor would benefit the state, and that Maine does not become a "pass through" for electricity (Costigan, 2010).

Under LD 1786, the Maine Department of Transportation (MaineDOT) is the licensing authority with respect to utility permits. They are state corridor experts, stewards of federal and state highways, transportation land owners, and federally designated custodians (Van Note, 2009). MaineDOT's focus is that the proposed energy infrastructure meets the following applicable laws (Van Note, 2009):

- 23 MRSA §52, General Powers and Duties
- 35-A MRSA Chapters 23 & 25, Permit Enabling Statutes
- 17-229 CMR Chapter 210, MaineDOT Utility Accommodation Rule
- 23 USC 116, State DOT Must Maintain Federal-aid System
- 23 CFR 1.23, Non-Highway Use Prohibition/Exception
- 23 CFR 645 & 710, Utility Accommodation

The Utility Accommodation Rule is of particular interest regarding this legislation, and is addressed separately in the next section of the report. Additionally, MaineDOT also identifies if the occupancy agreement requirements, corridor

compatibility, constructability challenges, implications related to Federal Highway Administration, and most importantly the long term implications with respect to future corridor use and maintenance (Van Note, 2009). Once a proposed energy project is approved by the Interagency Review Panel within an interstate corridor, MaineDOT is responsible for overseeing that the infrastructure is constructed and installed properly (Burne, 2010). There may be coincidental benefits that result from additional energy infrastructure in the designated interstate corridor, namely clearing in the interstate Right of Ways (ROWs) that are overgrown. However, MaineDOT recognizes there are several constructability issues (potentially localized) that require careful consideration. MaineDOT's focus is the ability to keep the interstate roads open and to maintain a clear zone for traveler safety (Burne, 2010).

Maine Emergency Management Agency's (MEMA) role is from a homeland security and emergency management perspective. MEMA's concern is that the interstate ROW is easily accessible for both terrorism and emergency response (McAleer, 2010). Unintended economic impacts result from additional energy infrastructure in the designated interstate corridor, because additional emergency planning and on-going preparedness is necessary, which includes emergency plans, training, training exercises, etc. (McAleer, 2010).

The role of the Department of Environmental Protection (DEP) is environmental considerations and the permitting related to the site location of the energy infrastructure. DEP will also include National Environmental Policy Act (NEPA) considerations. NEPA establishes national environmental policy and goals for the implementation of environmental protection, enhancement and maintenance (USEPA, nd). The NEPA process involves an evaluation of environmental effects and based on whether or not there could be significant effects on the environment includes three levels of analysis: namely Categorical exclusion determination, preparation of an environmental assessment/finding of significant impact (EA/FONSI), and preparation of an environmental impact statement (EIS) (USEPA, nd).

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3. ISSUES AFFECTING CO-LOCATION OF ENERGY INFRASTRUCTURE

The purpose of this legislation is to increase Maine's development, supply and transport of reliable, clean and secure energy, create new economic development opportunities, and attract investment. However, there are some issues related to co-location of energy infrastructure that need to be considered. Co-location of energy transmission systems within designated energy corridors may result in some interference between the systems or other hazards that exist due to the physical proximity of multiple transmission systems (Pharris and Kolpa, 2007). The following subsections will present safety, health, engineering, environmental, geotechnical, land use and other factors affecting co-location of such facilities in Maine's energy infrastructure corridors.

3.0 COINCIDENT CONSTRUCTION

There are potential safety issues that may arise with concurrent construction of two separate energy transmission systems within a designated energy infrastructure corridor. Workers on one construction project may be exposed to the hazards of the other due to the close proximity of the two construction activities (Pharris and Kolpa, 2007). Additionally, coordination is needed when workers and equipment on both construction projects use the same equipment lay down areas, access roads, and transportation services during their construction activities. Coincident construction may lessen the overall environmental impact, however it may also present some additional safety hazards that require planned coordination.

3.1 RISK OF NATURAL HAZARDS AND HUMAN THREATS

Regardless of the type of infrastructure, there is always concern over natural and/or man-made hazards. Natural hazards include earthquakes and flooding, while chemical, biological and/or nuclear attacks are examples of man-made hazards that can potentially cause harm to pipeline components, such as pump stations, pipeline segments, and storage tanks, and other energy infrastructure located in the designated ROW (Pharris and Kolpa, 2007). As mentioned above, MEMA's focus related to LD 1786 is the homeland security and emergency management aspect. The table below provides a summary of the degree of vulnerability specific to each type of pipeline component that may be damaged or disrupted by these natural or man-made disasters (Pharris and Kolpa, 2007). Co-locating energy infrastructure in the interstate corridor would only compound the effects of these hazards and MEMA is concerned about the potential ripple effect of such hazards (McAleer, 2010).

Degree of Component Vulnerability to Damage or Disruption from Natural Hazards and Human Threats

(Prepared for liquid petroleum pipelines, but generally applicable to any underground pipelines.)

Hazards	Degree of Vulnerability										
	Transmission Pipelines	Pump Stations	Compressor Stations	Processing Facilities	Storage Tanks	Control Systems	Operations Buildings and Equipment	Pressure Regulating/Metering Stations	Distribution Pipelines	Service Lines or Connectors	Maintenance and
Earthquake shaking	L	M	M	M	H	M	H	L	L	L	M
Earthquake permanent ground deformation (fault rupture, liquefaction, landslide and settlement)	H	---	---	---	L	---	---	L	H (Buried)	M	M
Ground movements (landslide, frost heave, settlement)	H	---	---	---	L	---	---	L	H (Buried)	M	M
Flooding (riverine, storm surge, tsunami and seiche)	L	H	H	H	M	H	H	H	L	M	M
Wind (hurricane, tornado) L (Aerial)	L (Aerial)	---	---	---	---	L	L	---	---	---	---
Icing	L	---	---	---	---	---	---	---	L	---	---
Collateral hazard: blast or fire	M	H	H	H	H	M	L	L	L	M	M
Collateral hazard: dam inundation	L	H	H	H	M	H	H	H	L	M	M
Collateral hazard: nearby collapse	---	L	L	L	---	L	L	L	M	L	L
Physical attack (biological, chemical, radiological and blast)	M	M	M	M	---	M	M	---	M	---	---
Cyber attack	---	L	L	L	---	H	L	---	L	---	---

Note: Degrees of Vulnerability: H-High, M-Moderate, L-Low, and - (dash) for not applicable. Comments such as (Buried) or (Aerial) apply to location of the component listed as the column heading.

Source: (Pharris and Kolpa, 2007)

3.2 FIRE HAZARDS

There is potential for a fire in one of the transmission systems causing heating, stress and/or rupture in another due to the close proximity of pipelines carrying volatile materials (Pharris and Kolpa, 2007). Most likely significant underground heat transfer is prevented because of the distance between buried pipelines. Nonetheless, adequate separation of lines and facilities or additional insulation and fire protection should be considered at locations where the pipelines exit the ground, such as compressor and pump station and/or road/river crossings. Overhead electric transmission lines could be damaged in an event of a pipeline fire.

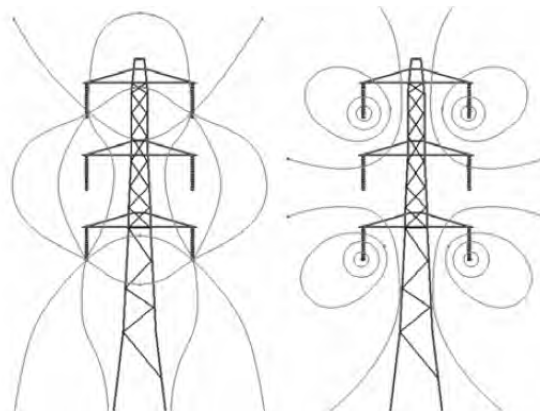
3.3 ELECTRICAL INTERFERENCE

The issue of electromagnetic field interference on buried pipelines has been known for over 30 years (Shwehdi and Johar, 2003). When a pipeline runs parallel to a transmission or electric distribution line, the pipeline becomes part of the electrical circuit by electromagnetic and electrostatic coupling (Nelson, 1986). The impact of co-locating metallic pipelines usually buried in the earth directly underneath high-voltage transmission lines can cause electromagnetic interference, which can be grouped into three broad categories:

1. Influence, which is the sum total of the magnetic induction and ground-return currents;
2. Coupling, which is the "distance" between the source of the magnetic induction (power line) and the objects being affected (pipeline); and
3. Susceptibility, which relates to the vulnerability of the induction element (i.e. the metallic pipeline) to induced and ground-return current (Pharris and Kolpa, 2007).

For every situation, each of the three categories is highly variable and each co-location project must be evaluated separately. The systems' materials, construction method and design are all factors and can help to minimize overall susceptibility of pipeline systems to magnetic induction and damage due to electrolysis and lightning (Pharris and Kolpa, 2007).

The figure below shows the typical electromagnetic field of a high voltage (HV) transmission line, source of induced voltages. The left shows the electric field and the right shows the magnetic field produced by a HV overhead AC power line.



Source: (Purcar and Munteanu, 2009)

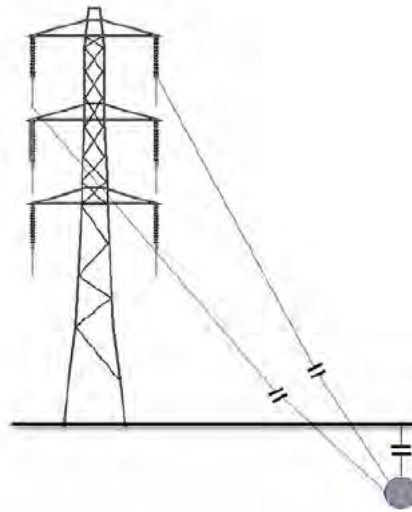
The magnetic and electric fields created by a transmission line induce currents and charges in neighboring metallic objects (Purcar and Munteanu, 2009).

The potential interference problems, attributable to electricity transmission systems in close proximity to pipelines, have been studied closely by the pipeline industry. There are three mechanisms of electromagnetic interference mechanisms between buried pipelines and nearby power systems (Pharris and Kolpa, 2007):

1. Capacitive coupling;
2. Inductive coupling; and
3. Conductive coupling.

Capacitive Coupling

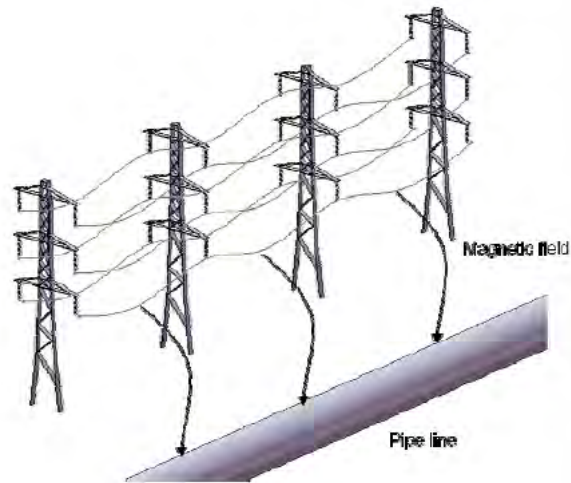
The electric field of the HV transmission line creates capacitive coupling by inducing electric charges in the metallic structure in close proximity. "This represents a form of capacitive coupling operating across the capacitance between the AC transmission lines and the pipeline, in series with the capacitance between the pipeline and the adjacent earth as shown in the figure below (Purcar and Munteanu, 2009).



Source: (Purcar and Munteanu, 2009)

Inductive Coupling

Inductive interference is the most important of the three coupling mechanisms, and results from the magnetic field generated by the power lines (Purcar and Munteanu, 2009), see figure below.

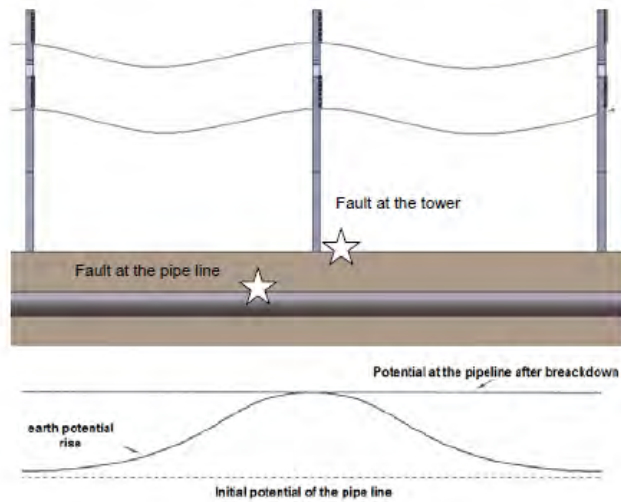


Source: (Purcar and Munteanu, 2009)

The electromagnetic field produced by AC power changes 120 times per second, and metallic structures are subject to the changing electromagnetic field and will exhibit an induced voltage (hence induced AC current) (Rizk and Strike, 2008). The magnitude of such currents depend on many factors such as coating condition, soil composition, power line voltage, and distance, and can cause AC corrosion of the steel and shock hazard to personnel (Rizk and Strike, 2008). Pipelines running parallel to or in close proximity to transmission lines or cables are susceptible to these induced voltages. The inductive influence is the worst in the case of faults, where the induced electromotive forces cause currents circulation on the pipeline and voltages between the surrounding earth, which may result in shock hazards to people or workers touching the pipeline or other metallic structures connected to it (Purcar and Munteanu, 2009).

Conductive Coupling

The current flowing through the grounding electrode produces a potential rise of the electrode and the neighboring soil with related to the remote grounding bed, when a ground fault occurs in an installation (i.e, tower, substation, power plant) (Purcar and Munteanu, 2009). If the pipeline is directly connected to the ground electrode of the transmission system (i.e inside a power station) or if the pipeline enters the "Zone of influence" of electrical installation, conductive coupling occurs between the nearby pipeline and the electrical installation (Purcar and Munteanu, 2009).



Source: (Purcar and Munteanu, 2009)

With the use of computer models, contributions of each type of interference on pipelines have been studied using various scenarios in order to predict the effectiveness of mitigation techniques (Pharris and Kolpa, 2007). It has been determined that “during normal operating conditions of the electricity transmission system, only inductive voltages are imparted to the pipeline as a result of the magnetic field around the electric current conductors” (Pharris and Kolpa, 2007). The greater the physical separation and the angle between the power conductors and the pipeline, the less interferences exist. The greatest interference is observed when the pipeline is parallel to and directly below the electric transmission system (Pharris and Kolpa, 2007). In addition, interference increases with increasing soil resistivity and also with increasing magnitude and frequency of electric power being transmitted (Pharris and Kolpa, 2007). The Ductile Iron Pipeline Research Association has also determined additional factors that can influence the three mechanisms of electromagnetic interference, namely the electrically continuous length of pipeline that is parallel to transmission lines directly above, the nature and strength of the electric power, continuity of the corrosion control coating or other wrapping on the pipe, how well the pipe is electrically insulated from the ground, and construction techniques can also influence the extent of interference (Pharris and Kolpa, 2007).

There are three Codes and Standards that lay out guidelines and procedures for use during design, construction, operation, and maintenance of metallic structures and corrosion control systems used to mitigate the effect of lightning and overhead alternating current (AC) power transmission systems (Rizk and Strike, 2008):

- Electric Power Research Institute (EPRI)/American Gas Association (AGA) “Mutual Design Considerations for Overhead AC transmission Lines and Gas Pipelines”
- National Association of Corrosion Engineers: “Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems” SP0177-2007 (formerly RP-01-77-95) National Association of Corrosion Engineers
- Canadian Electrical Code C22.3 No. 6-M1987 “Principles and Practices of Electrical Coordination between Pipelines and Electric Supply Lines”

3.4 HIGH VOLTAGE DIRECT CURRENT LINES

There are concerns related to siting long distance High Voltage Direct Current (HVDC) Lines in highway corridors, both above ground and underground. HVDC are power conduits and are seen as the most efficient way to move electricity over long distances without incurring the losses experienced in normal AC power lines. They are also less expensive, and in some cases power will only flow one way (e.g. north to south) (Schneider, 2010). Nevertheless, MaineDOT is concerned about several issues related to HVDC lines and Maine's statutory corridors (MaineDOT, 2010):

- Technology
- Impact from heat
- Electrical auras
- Appurtenances
- Interaction with other utilities, including fiber optics
- Policy
- FHWA concerns
- AASHTO and THWA policy to locate at fenceline
- Maine DOT Utility Accommodation Policy
- Construction
- Required facility clear zone
- Potential Interstate Improvements
- Potential Highway widening
- Restrictions in ROW width
- Potential localized constructability/engineering challenges related to bridge, interchanges, rest areas, railroad, wetlands, ledge, water crossings, etc.
- Adjacent property owner concerns
- Safety
- Malfunction
- Crossing other utilities

- Vandalism
- HVDC utility observation
- Maintenance
- Maine DOT
- HVDC utility, including type and frequency

The ability to continue to maintain the interstate corridor safely and cost effectively over the life of any proposed facility is of particular concern to the MaineDOT, though the focus of LD 1786 must look beyond just the construction phase (Burne, 2010).

3.5 UTILITY ACCOMMODATION RULE

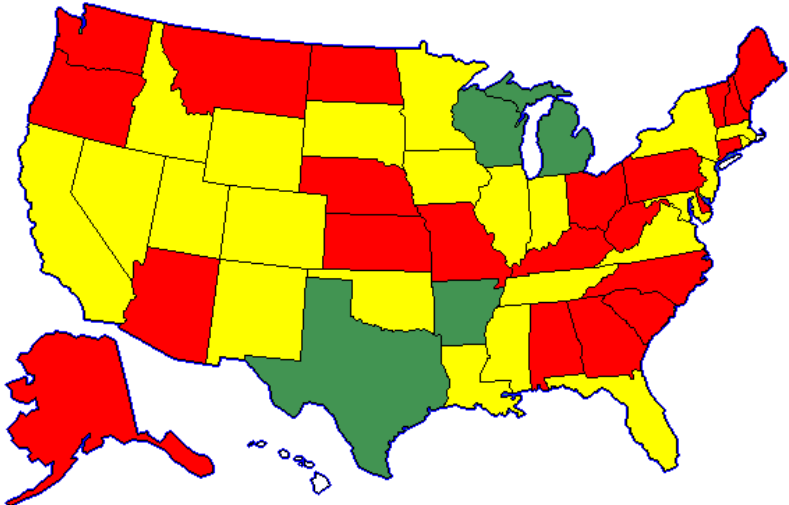
There are additional concerns regarding the Maine DOT Utility Accommodation Rule, 17-229 CMR Chapter 210. According to this law, only underground facilities are conditionally approved by FHWA along interstate systems (Van Note, 2009). Overhead facilities have additional concerns related to safety, corridor maintenance, and aesthetics (Van Note, 2009). Maine DOT has reached out to some other states to gather some additional information regarding the status of utilities in their ROW, see the table below.

State	Status
Connecticut	There were no utilities in interstate ROWs.
Maryland	There are no utilities in the ROWs other than telecommunications fiber optics cables. This is a "resource sharing project" where the state has exclusive use of several strands of the glass conductors.
Mass Turnpike Authority	Three fiber optic cables along the turnpike but no other utilities.
Massachusetts	A small number of natural gas transmission pipes that use the ROW for short distances (a few miles). The only active projects is a fiber optics cable being installed along I-91.
New Hampshire	The only utility in the ROW is a natural gas pipeline along Spaulding Turnpike. It is 8 miles long and serves the University of New Hampshire (UNH) only. UNH pays the Highway Department a yearly fee with a 20 year lease.
New Jersey	There are no utilities in the ROW but fiber optic cable has been allowed since 2009. New Jersey law prohibits utilities in interstate ROWs, but the state is looking into either changing that or making exceptions.
New York	Has utilities in the interstate ROWs. Have a "utilities accommodation plan" to request exemptions from the federal government to allow utilities in interstate and thruway ROWs, but they must meet federal guidelines. There are currently natural gas pipes, electric power underground transmission cables, fiber optics, and cell towers in their corridors, all in the "dirt" along the outer edges of the ROW so as not to interfere with any road expansion. None are the full length of the highway. No permanent leases or easements

	are granted. The permits are granted in 30 day increments and the utility must pay fair market value for use of ROW.
Pennsylvania	No utilities are allowed along the interstates or thruway above or below ground as it is against existing laws.
Texas	Fiber optics, natural gas transmission pipes, electric power overhead and underground, oil lines, etc. exist within interstate ROWs and have for many years. This is made possible by a two lane access road running parallel to all interstates. Both public and private utilities are in the ROW. Public utilities pay for upkeep and installation but are not subject to easement assessment. Private utilities are charged yearly for the easement, usually a lease agreement at fair market cost.
Vermont	There are no utilities in ROW, though the state has received inquiries on placing fiber optics.
Virginia	They are limits to fiber optics only along I-77, about 50 miles long. This is also a shared resource where four strands of the cable are for exclusive use by the state. The only fee is a permitting fee for telecom cables.

Source: Maine Department of Transportation

Based on conversations with ROW managers of other states, MaineDOT prepared a map, which is an overview of the interstate utility Accommodation for each state, see below.



Red = These states generally have not allowed longitudinal utility installations along their interstate corridors. Crossings are normally permitted and possibly rare instances of short longitudinal segments where no other feasible alternatives exist. These states may have recently undertaken efforts to open up their interstate corridors to some extent, but currently do not have any significant installations in place.

Yellow = These states generally allow fiber optic installations, either with or without fees and possibly with some degree of resource sharing. Installations are currently in place today. Wireless towers may also be allowed with some

of these states, however pipelines and electric transmission facilities are generally not permitted and currently do not exist today to any significant extent.

Green = These states generally allow several types of utility installations, such as fiber optics, electric transmission, and/or pipelines, and they exist within interstate corridors today. Fees and/or resource sharing will typically apply in most cases, although not necessarily in all.

NOTES: This overview is provided as a visual method to broadly group states into one of the three categories provided above. The actual accommodation and compensation policies of the individual states vary considerably.

This information has been compiled from the results of the following 3 surveys: *FHWA Resource Sharing Survey (2002)*; *CalTrans Telecommunications Survey (2006)*; *Florida DOT Natural Gas and Electric Transmission Survey (2007)*. The information was then circulated through an email network of state DOT Utility Engineers in November 2010 and verification/updates were further provided by the following states: AK, IA, ME, MI, NC, ND, NH, NJ, NY, OH, OK, SC, UT, VT, & WV *AK Footnote:* A significant portion of Alaska's interstate system consists of two-way, two-lane highways that do not have controlled access. These areas have utility accommodation that is similar to other non-interstate arterials (i.e. "green"). AK is shown as "Red" to describe how utilities are currently accommodated on the controlled access, freeway sections of their interstate highways.

Source: Maine Department of Transportation

The Federal Highway Administration has not been addressed in LD 1786, however it would need to be consulted regarding any proposed energy infrastructure project. FHWA is open to states pursuing agreements if it is not going to impact the highway in a negative way and transportation needs are not comprised (Van Note, 2010 and Burne, 2010).

With regard to interstate natural gas pipelines, there are no specific regulations that govern the width of the ROW, because the wide range of diameters and pressure of the pipelines that exist in the interstate pipelines (Hanley, 2010). The diameters of the pipelines range from 4" – 48" and the maximum allowable operating pressures range from 100 - 2,000 pounds per square inch (Hanley, 2010). The final determination of the appropriate location and width of the interstate pipeline is made by the Federal Energy Regulatory Commission (FERC) through its certificate proceedings, however it has been determined that a minimum of 50 feet of permanent ROW is usually necessary for safe operations of interstate pipelines that have a diameter of 18 inches or larger (Hanley, 2010). There are many factors that are considered when determining the appropriate width of the ROW, namely "the size of the equipment necessary to maintain the facility, the distance of the area of control on either side of the pipeline to protect the pipeline from third party damage, and the topography or geology where the pipeline is located so that the preceding items can be safely carried out" (Hanley, 2010). The existing Maritimes & Northeast Pipeline's system in the United States has a 50 feet wide ROW, with the exception of approximately 1.7 miles from the U.S. - Canada border to a compressor station in Baileyville which requires an additional 25 feet of permanent easement (Hanley, 2010). In order to have less overall impact to the environment and landowners, Maritimes & Northeast Pipeline tries to use existing corridors where available, and approximately 80% of Maritimes' ROWs are located along existing corridors. However as mentioned previously, co-location of utility facilities requires careful siting, design and operational considerations which is often associated with increased costs.

4. RECOMMENDATIONS

1. Developers should either consult with a variety of agencies with their development plans prior to submission for approval by the Interagency Review Panel to ensure safety concerns are addressed or that should become part of the Panel's review process. OEIS should help organize consulting with the agencies.
2. Adequate separation of lines and facilities, adequate insulation and fire protection should be required at sites where pipelines exit the ground.
3. All applicable codes and standards should be followed for the design, construction, operation and maintenance of co-located energy infrastructure in the state.
4. Developers should adhere to all Federal policies regarding co-location of energy infrastructure in the state.
5. Guidelines should be developed for maintenance procedures of co-located energy infrastructure in the state.
6. The Interagency Review Panel should communicate with the Federal government to determine all Federal policies on co-location of energy infrastructure development prior to soliciting proposals for energy infrastructure.

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