ANGELES LINK PHASE 1
WORKFORCE PLANNING & TRAINING EVALUATION
FINAL REPORT - DECEMBER 2024

SoCalGas commissioned this Workforce Planning & Training Evaluation study from Burns & McDonnell. The analysis was conducted, and this report was prepared, collaboratively.

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation	Term/Phrase/Name
AI	Artificial Intelligence
CBOSG	Community Based Organization Stakeholder Group
CCM	Control Center Modernization
CFR	Code of Federal Regulations
CPUC	California Public Utilities Commission
CIS	Close Interval Survey
CP	Cathodic Protection
DBE	Disadvantaged Business Enterprise
DOT	Department of Transportation
ESCMP	Environmental and Safety Compliance Management Program
GIS	Geographic Information Systems
H2EDGE	Hydrogen Education for a Decarbonized Global Economy
HCA	High Consequence Area
I&C	Instrument and Control
ILI	In-line Inspection
ISN	ISNetworld
MAOP	Maximum Allowable Operating Pressure
MCAs	Moderate Consequence Areas
MEA	MEA Energy Association
MFL	Magnetic Flux Leakage

Abbreviation	Term/Phrase/Name
NCCER	National Center for Construction Education and Research
NFPA	National Fire Protection Association
O&M	Operations and Maintenance
OQ	Operator Qualification
PAG	Planning Advisory Group
PIR	Potential Impact Radius
PHMSA	Pipeline and Hazardous Materials Safety Administration
SAP	Systems Analysis Programming
SCADA	Supervisory Control and Data Acquisition Systems
SoCalGas	Southern California Gas Company
SSP	Standards, Specifications, and Procedures
TSA	Transportation Security Administration
TVC	Traceable, Verifiable, and Complete

EXECUTIVE SUMMARY

Southern California Gas Company (SoCalGas) is proposing to develop a clean renewable hydrogen pipeline system to facilitate transportation of clean renewable hydrogen from multiple regional third-party production sources and storage sites to various delivery points and end users in Central and Southern California, including in the Los Angeles Basin. The California Public Utilities Commission's (CPUC) Phase 1 Decision, approving the Memorandum Account for SoCalGas's proposed Angeles Link requires SoCalGas to evaluate workforce planning and training. SoCalGas has the ability to leverage its experience building and managing gas infrastructure for the planning and training of its workforce, with an emphasis on safety as a core value. As such, this study will evaluate applicable construction practices as it pertains to planning, designing, and constructing hydrogen infrastructure. Additionally, routine operations and maintenance protocols that will be executed by SoCalGas employees will drive the skills and training that may apply to operating and maintaining clean renewable hydrogen infrastructure. Furthermore, the development of hydrogen infrastructure could potentially impact the economies of Central and Southern California and would create incremental jobs within the regions. This evaluation was completed through literature review, employment impact analysis, and data from other Phase 1 Studies, including the *Pipeline Sizing and Design Criteria Study* (Design Study).

The intention of this *Workforce Planning & Training Evaluation* Study (Workforce Study) is to provide recommendations for the creation of a workforce that is trained and qualified with appropriate skills to design, construct, operate, and safely maintain hydrogen infrastructure. This study looks at the following steps to transition the workforce for a hydrogen economy, with safety principles for the public, employees, contractors, and infrastructure as the foundation:

1) Identify and review federal and state design, construction, maintenance, inspection, and operational requirements for a clean renewable hydrogen system. This study looks at the skillsets, education, and training that will be necessary to comply with those regulations (as well as any emerging regulations) and provide a basis for establishing training programs and workforce planning. As part of this review, the number of workers required both for the construction of Angeles Link and to support routine operation and maintenance activities will be estimated and will inform the appropriate time needed to structure applicable training and accommodate the growing demand for hydrogen jobs.
2) Compare skillsets of the existing SoCalGas workforce to properly plan to address any potential changes and/or enhancements needed to support the safe construction, operation, inspection, and ongoing maintenance of Angeles Link. Identifying workforce tools for hydrogen assets, as well as compliance with regulatory requirements, such as Title 49 Code of Federal Regulations (49 CFR) Part 192: Transportation of Natural and Other Gas by Pipeline, and best practices that drive the pipeline operator qualifications are also significant

considerations which will result in designing the necessary training for operations personnel.

Key Findings

- **Existing Framework Can Inform Workforce Planning and Training.** Workforce planning and training for Angeles Link infrastructure can utilize SoCalGas's existing workforce planning programs, models, and philosophies in place for the natural gas infrastructure as a baseline for development. SoCalGas's existing workforce planning programs align with the vision of a successful workforce transition in support of the hydrogen economy as stated in the *Workforce Required to Advance Canada's Hydrogen Economy*, which noted that "the technical skills and knowledge required by the hydrogen economy can be found within the existing labor market. There are enough similarities to enable workers to acquire hydrogen skills and knowledge through accelerated training programs such as micro-credential programming, bootcamps, and work-integrated learning."[1]

- **Safety Experience Can Be Leveraged in Planning for Angeles Link.** SoCalGas's longstanding experience in operating and maintaining a safe and reliable natural gas pipeline system can be leveraged to optimize both planning considerations and implementation of appropriate mitigations. This study evaluates potential concerns and identifies mitigations, in Table 1 of Section 3.0: Planning Considerations below, associated with workforce planning for the construction and O&M of new infrastructure like Angeles Link.

- **Positive Employment Impacts.** An Employment Impact Analysis – included in Appendix A – was conducted to estimate the number of jobs that could be potentially created for Angeles Link.

  <u>Construction Job Findings</u>

  - In total, there could be almost 53,000 direct construction-related jobs generated by Angeles Link.
  - The total employment impact could increase to almost 75,000 jobs when indirect and induced impacts are included.

  <u>Operations & Maintenance Job Findings</u>

  - In total, there could be approximately 100 direct annual operations-related jobs. Based on the current percentage of union represented employees at

[1] Hufnagel-Smith, Pat. (2022). Assessing the Workforce Required to Advance Canada's Hydrogen Economy. Transition Accelerator Reports Vol. 4, Issue 4, Pg. 1-45. ISSN 2562-6264.

SoCalGas having a role in operating and maintaining similar infrastructure, there may be a significant increase in union-represented roles as Angeles Link develops.
    - The total employment impact could increase to almost 400 annual jobs when indirect and induced impacts are included.

- **Construction Resources Are Likely Available and Accessible.** Based on past experience, many of the field personnel with these transferrable skill sets could be from labor unions. Multiple trade unions, including pipe trades representatives, carpenters, operating engineers, laborers, and electrical workers that could support construction of the pipeline and/or compressor stations, will be essential to the contracted workforce needed for Angeles Link.

- **Operations & Maintenance Resources Are Likely Available and Accessible.** The workforce for Angeles Link includes field personnel that are union represented SoCalGas employees responsible for operating and maintaining hydrogen infrastructure along with engineering, technical, and operations and maintenance management personnel. Job classifications for these personnel are expected to be similar to SoCalGas's current workforce as supported in the published *European Hydrogen Skills Strategy* that states, "workers from declining or transitioning sectors, especially from the oil and gas industry, have been identified as a key target group due to their highly convertible skills to working hydrogen."[2] Furthermore, the workforce for operations and maintenance (O&M) includes field personnel who will comply with federal and state standards, specifications, and procedures, such as 49 CFR Part §192.605 and contained in an O&M Manual.

- **Existing Workforce Can Be Leveraged for Operation & Maintenance Activities.** The existing SoCalGas natural gas workforce is experienced and trained to conduct the required tasks to operate and maintain pipeline infrastructure. These existing SoCalGas personnel can successfully transition to these O&M tasks with additional training to hydrogen specific equipment and procedures. Examples include:

    - SoCalGas's current personnel utilized for leak survey on the natural gas infrastructure are trained per the existing SoCalGas O&M manual and Operator Qualifications requirements and have the required skillsets necessary to conduct leak surveys and operate leak detection equipment. This allows for a streamlined transition to hydrogen pipeline leak survey

[2]ERASMUS+ Project, European Hydrogen Skills Strategy, https://greenskillsforhydrogen.eu/public-deliverables/eu-hydrogen-skills-strategy/

tasks and associated training for use of hydrogen leak detection equipment. Leak surveys follow the requirements in 49 CFR Part §192.706.

- SoCalGas has a robust Integrity Management Program (IMP) in place for its natural gas infrastructure, which can be adapted for Angeles Link and incorporate existing and future regulations applicable to Angeles Link. In-line inspection (ILI) tools such as the magnetic flux leakage (MFL) designed for natural gas pipelines are being tested for use with hydrogen pipelines, with modifications made to address the unique characteristics of hydrogen. The Angeles Link infrastructure will include inline inspection (ILI) capabilities, which will allow for periodic assessments of moderate and high consequence areas using smart tools capable of inspecting pipelines transporting hydrogen.

- **Technology Impacts.** Angeles Link may require certain SoCalGas's existing systems to be modified. The necessary technological advances appear to be feasible. However, the changes can also have an impact on the workforce. This study examined potential impacts to Close Interval Survey (CIS), Asset Management and Work Management Information Systems, and Supervisory Control and Data Acquisition (SCADA), and found that these systems and tools may need to be upgraded or modified further. The technological advances for these systems and practices can be a dynamic process as the potential need for monitoring and tracking real-time data for hydrogen pipelines grows. Furthermore, the workforce that manages or conducts the tasks to monitor, collect, and analyze the data may need to be organized and coordinated specifically for hydrogen infrastructure.

- **Existing Procedures & Training Can Be Leveraged for Angeles Link.** SoCalGas's existing procedures and training for natural gas infrastructure can be applied to hydrogen infrastructure, with modifications where necessary to account for differences in properties between the two gases.

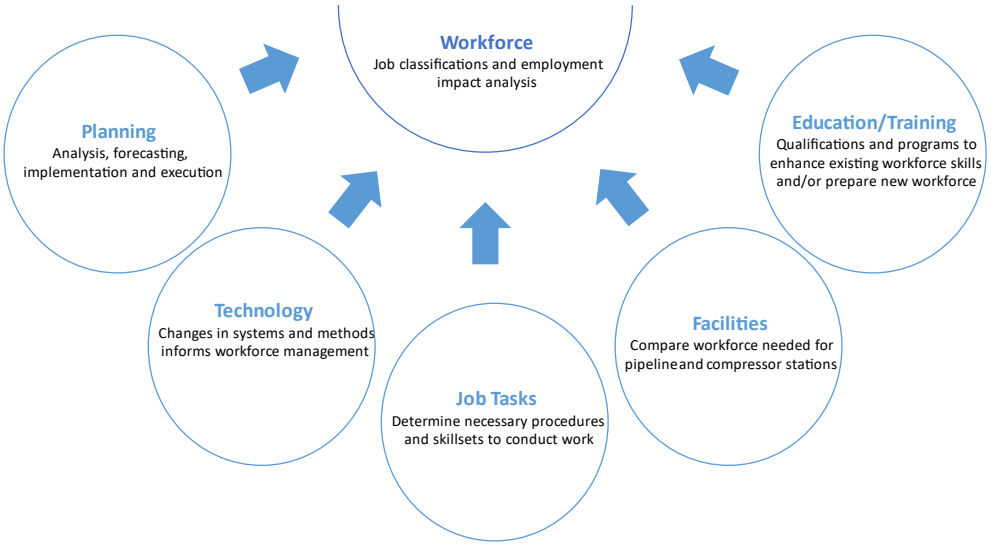
Stakeholder Input Summary

The input and feedback from stakeholders including the Planning Advisory Group (PAG) and Community Based Organization Stakeholder Group (CBOSG) has been informative to the development of this Workforce Study. As further detailed in Section 8.0: Stakeholder Feedback, in response to stakeholder comments received, an employment impact analysis was conducted to estimate the number of potential jobs that could be created during construction and operations. This content is discussed in Section 2.0: Employment Impact Analysis and the complete analysis is provided in Appendix A. The analysis does not specifically identify union jobs, however, approximately 88% of the current SoCalGas - Gas Transmission organization is union represented.

1. INTRODUCTION

The Phase 1 Decision (OP 6 (e)) requires SoCalGas to evaluate workforce planning and training. This study evaluates construction practices and operations and maintenance protocols as it can be applied to a clean renewable hydrogen system that consists primarily of transmission pipeline and compressor stations. As illustrated in Figure 1 below, the Workforce Study evaluates and provides recommendations for the creation of a workforce trained and qualified with appropriate skills to construct, operate, and maintain hydrogen infrastructure. The workforce considerations in planning for an infrastructure project will guide the steps in preparing, implementing, and executing the resources needed to support Angeles Link. These steps include assessing technologies, work activities, and facilities that will inform the capabilities and skillsets necessary to identify appropriate education and training to develop the workforce. Fundamentally, the final steps would consist of workforce resourcing by fulfilling the number of jobs needed to execute the project with a trained and well qualified workforce.

Figure 1: Workforce Approach



The workforce includes, but is not limited to, primarily contracted field workforce that would be responsible for constructing Angeles Link, including contracted personnel responsible for supervising, managing, and administering the construction workforce and the supporting engineering and technical staff. This study also provides insight into the roles and skills that will be applied by SoCalGas union represented employees to

execute critical transmission and compression activities, and operational and maintenance tasks, including leak survey and integrity management practices. Furthermore, including an analysis of the employment and economic impacts of Angeles Link connects the number of potential jobs that will be needed for a workforce specific to Angeles Link. Workforce related to third-party hydrogen producers and end users, third-party storage providers, and SoCalGas distribution and customer service organizations were excluded from this study.

Workforce Planning (WP) is a standard process an organization uses to analyze its workforce and determine the steps it must take to support key business objectives. Defining and optimizing the workforce that can execute a safe clean renewable hydrogen transport system is a continuous process designed to align workforce needs with SoCalGas's long term strategic goals. WP helps SoCalGas plan for the appropriate level and timing of workforce with the necessary skills to design, build, operate and maintain hydrogen infrastructure. There are eight key components to the WP process: Business Strategy Alignment, Workforce Analysis, Demand Forecasting, Supply Analysis, Gap Analysis, Action Planning, Implementation & Execution, and Monitoring and Evaluation.

1) **Business Strategy Alignment:** Aligning workforce planning with the company's strategic goals[3] establishes that the workforce is prepared to meet the future demands of the business. SoCalGas will align its workforce to have the necessary skills to support the company's goal of developing and maintaining hydrogen infrastructure.

2) **Workforce Analysis:** Assessing the current workforce to understand existing skills, capabilities, and performance. SoCalGas needs to identify existing skills that can be leveraged to support the hydrogen infrastructure and determine if there are any skills gaps that need to be addressed. Preliminary assessments addressed in Sections 3.0 through 6.0 identify potential skillsets, safety protocols, and capabilities that can be leveraged from the existing workforce and may apply to construction, operating, and maintaining hydrogen infrastructure.

3) **Demand Forecasting:** SoCalGas will need to forecast the roles and number of workforce needed for Angeles Link, based on the design and requirements of the hydrogen infrastructure. Experiences with natural gas infrastructure can be leveraged to develop a forecast. Preliminary forecasts and modeling were conducted

[3] SoCalGas's mission is to build the cleanest, safest, most innovative energy infrastructure company in America. In alignment with this mission and California's decarbonization goals, SoCalGas aims to achieve net-zero greenhouse gas (GHG) emissions by 2045.

in Section 2.0: Employment Impact Analysis and 5.0: Comparison to Existing SoCalGas Facilities to address the potential need.

4) **Supply Analysis:** Assessing internal talent pipelines and understanding external labor market conditions. SoCalGas must determine if existing workforce can transition into new hydrogen roles, or whether collaboration with external partners is needed to develop a talent pipeline. Analysis will be conducted upon further refinement of project plans in subsequent phases.

5) **Gap Analysis:** Identifying the gaps between the current workforce levels and skills against future needs. Section 3.0: Planning Considerations and Section 5.0: Comparison to Existing SoCalGas Facilities identifies potential gaps between current workforce and future needs.

6) **Action Planning:** Developing strategies to address identified gaps, such as talent acquisition, and training required. New training, safety protocols, and operating procedures may need to be developed specifically for the hydrogen infrastructure as suggested in Section 3.2: Education, Operator Qualifications, and Training.

7) **Implementation and Execution:** Implementation involves detailed planning, assigning responsibilities, and ensuring workforce is allocated appropriately. This can also include integration of any new training, technology, safety protocols and operating procedures. Implementation would be conducted upon further refinement of project plans in subsequent phases.

8) **Monitoring and Evaluation:** The workforce plan should be continuously monitored to assess effectiveness and make necessary adjustments.

As the hydrogen economy continues to expand, the specific skills and necessary education and training for the workforce needs to be assessed. A broad range of job positions will be needed to plan and execute Angeles Link. The Queensland Government states, “Key skills for the hydrogen industry will also include project management, design, and workplace safety…. A strong foundational knowledge of safety requirements will be essential. Workers with existing skills will need to be upskilled to become familiar with the properties of hydrogen.”[4] The regulations and codes/standards establishes the pipeline operator qualifications and the necessary training. See the Evaluation of *Applicable Safety Requirements* (*Safety Study*) for a list of the applicable regulations, codes, standards, and best practices to consider to safely design, construct, operate and maintain Angeles Link. In turn, those job positions that will be required to carry out these tasks, whether in the field or in the office, will need to

[4] Queensland Government “Hydrogen Industry Workforce Development Roadmap 2022-2032”, https://www.publications.qld.gov.au/dataset/hydrogen-industry-workforce-development-roadmap-2022-2032

be quantified to determine workers needed to construct Angeles Link, as well as operate and maintain it.

The transmission of clean renewable hydrogen across the value chain must prioritize safety and leverage applicable industry experience, best practices, regulations, codes, and standards. There are a number of rules and regulations for natural gas transportation in pipelines that are applicable or can be used to draw parallels to pipelines for clean renewable hydrogen. Specifically, 49 CFR Part 192, *Code of Federal Regulations: Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards,* Subparts A through P, and the CPUC General Order No. 112-F, *State of California Rules Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems,* provide a foundation for establishing the tasks needed to meet the requirements for pipeline safety and the associated training programs, which can be utilized for workforce planning and the specific skillsets and training required by the workforce. These subparts contain requirements for procedures including materials, design, construction, welding, corrosion, testing, operations and maintenance, qualification of pipeline personnel, and integrity management. Industry best practices for developing procedures to meet the requirements set out by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and the CPUC can include the following items:

1. Code specific language.
2. Discussion of the requirements of the procedures associated with design, construction, testing, operation, and maintenance.
3. Methodology of “How To” execute the procedure.
4. Records required and retention time for those records.

Title 49 CFR Part §192.605 contains the following pipeline operation requirements:

> ***§192.605 Procedural manual for operations, maintenance, and emergencies.***
>
> *(a) General. Each operator shall prepare and follow for each pipeline a manual of written procedures for conducting operations and maintenance activities and for emergency response. For transmission lines, the manual must also include procedures for handling abnormal operations. This manual must be reviewed and updated by the operator at intervals not exceeding 15 months, but at least once each calendar year. This manual must be prepared before operations of a pipeline system commence.*
>
> *(b) Maintenance and normal operations. The manual required by paragraph (a) of this section must include procedures for the following, if applicable, to provide safety during maintenance and operations.*

(c) Abnormal operation. For transmission lines, the manual required by paragraph (a) of this section must include procedures for the following to provide safety when operating design limits have been exceeded.

Workforce training is an integral part of workforce planning. Through review of the current Standards, Specifications, and Procedures (SSPs) per the *Safety Study*, and the current training programs for SoCalGas's natural gas pipeline system, there is already a basis for training that would be applicable to Angeles Link construction and operations. Modifications/revisions and new developments to the SoCalGas SSPs to account for differences between hydrogen and natural gas would enable SoCalGas to further develop additional training for a new workforce as well as enhance existing training for current employees for Angeles Link with safety at the forefront. Furthermore, Deloitte's analysis of hydrogen jobs suggests that the emerging hydrogen economy will likely offer the core natural gas workforce many opportunities to transfer into new roles across decarbonization strategies.[5]

This study focuses on the considerations for what action needs to take place to supply the existing workforce and emerging workforce with the hydrogen skills and training necessary to adapt to the energy transition so that all levels of occupation have an opportunity for a fulfilling career in the hydrogen industry.

2. EMPLOYMENT IMPACT ANALYSIS

Several stakeholders requested that job creation estimates be included within the Workforce Study. Therefore, in response to stakeholder feedback, an analysis was conducted to estimate the potential economic and employment impact of Angeles Link. For the purposes of this analysis, Angeles Link is assumed to be located in Central and Southern California, specifically in Los Angeles[6], Kern, Kings, and Fresno counties and the cost estimate applied in this analysis is based on Scenario 7, as described in the cost estimate section in the Design Study. Increases to route mileage and changes in location may result in an increase to workforce estimates. For purposes of a conservative analysis, the Scenario 7 (the shortest of the Preferred Routes identified in the Routing Study – Preferred Route A) was utilized for the Employment Impact Analysis. Scenario 7 assumes 390 miles of pipeline installed and two compressor stations constructed.

[5] Deloitte, "The natural gas utility workforce in a decarbonizing world", https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-the-natural-gas-utility-workforce-in-a-decarbonizing-world.pdf

[6] Los Angeles County estimation includes pipeline mileage within Orange and Ventura counties.

This analysis identifies the potential direct, indirect, and induced[7] economic and employment impacts for the four-county area in total and disaggregated by county. A *Southern California Gas Company Employment Impact Analysis* report (Employment Impact Analysis) is provided in Appendix A. Results were derived from an economic impact model developed using IMPLAN economic multiplier data and methodology. IMPLAN[8] is a widely-accepted and utilized software input-output modeling program that performs economic impact analysis for planning purposes. IMPLAN models the way a dollar injected into one sector is spent and re-spent in other sectors of the economy, generating waves of economic activity. The model uses national industry data and county-level economic data to generate a series of multipliers, which in turn estimates the total economic implications of economic activity.

The following economic and employment factors were estimated in this analysis:

- Direct output and employment impacts associated with the direct construction, operation, and maintenance of Angeles Link
- Direct, indirect and induced impacts to the regional economic output, regional employment and regional employee compensation
- Disadvantaged Business Enterprise (DBE) participation, based upon SoCalGas's stated policy and experience[9]
- Tax revenues during construction and operation, including:
    - Property taxes
    - Payroll taxes (California only)
    - Sales/Use tax

2.1. Construction Job Findings

- In total there could be almost 53,000 direct construction related jobs generated by Angeles Link.
- The total employment impact could increase to almost 75,000 jobs when indirect and induced impacts are included.

2.2. Operations & Maintenance Job Findings

- In total, there could be approximately 100 direct annual operations-related jobs.

[7] Induced impacts include the value of goods and services purchased throughout the regional economy -- goods and services not directly associated with Angeles Link, but which would otherwise not be purchased without the activity generated by Angeles Link.

[8] Economic input output modeling application; https://implan.com/

[9] Supplier diversity: SoCalGas . https://www.socalgas.com/doing-business-with-us/supplier-diversity

- The total employment impact could increase to almost 400 annual jobs when indirect and induced impacts are included.

3. PLANNING CONSIDERATIONS

Important considerations must be made associated with workforce planning and training applicable to large-scale infrastructure projects such as Angeles Link. The application of technology in order to support safe operations, regulatory requirements, and optimized efficiency drives components of training, staffing, and organizational structure. Similarly, effective training, education, and the integration of technology to support processes is necessary to achieve safe and efficient operations.

As the project proceeds from design to construction to commissioning and operations, effective training would be continuously updated and reviewed. The existing considerations and potential mitigations associated with workforce planning and training applicable to Angeles Link are included in Table 1 below.

Table 1 – Considerations Associated with Workforce Planning and Training and Potential Mitigation

Considerations	Potential Mitigation
Skills Gap	• Identify skill requirements - Identify the specific skills and qualifications required for various roles involved in pipeline construction (such as welders, engineers, project managers, safety personnel, environmental specialists, etc.) and for SoCalGas employees in pipeline operations (pipeline and compressor station). • Safety and regulatory compliance - Provide workforce with adequate training on safety protocols, environmental compliance, and regulatory requirements specific to hydrogen infrastructure. • Skill gap analysis - Conduct a skill gap analysis to identify any shortages in the required skill sets within the existing workforce. Determine whether additional training or recruitment is needed. • Consider operator qualifications for both natural gas and hydrogen systems.

Considerations	Potential Mitigation
Shortage of workers	• Determine workforce size - Estimate the number of workers required at different stages of the project, considering factors like construction phases, locations and routes, pipeline segments, compressor stations, and the complexity of the work. • Continuous monitoring and adaptation - Regularly monitor workforce performance, project progress, and any changes in project requirements. Adapt the workforce plan as needed as the project evolves.
Mechanical issues due to utilizing components familiar to natural gas systems, but not compatible with hydrogen	• Proper training given to the operations workforce to confirm appropriate material and component selection. Operator qualifications would help drive appropriate training and awareness to operations personnel. • Training programs - Develop training programs to enhance the skills of the existing workforce or prepare new hires for specific roles. Training should cover technical skills, safety protocols, and any unique aspects related to hydrogen infrastructure.
Coordination with workforces from 3rd party hydrogen producers and storage facilities	• Establish communication channels with 3rd party hydrogen producers and storage facilities to understand their workforce capabilities and constraints. • Establish receipt points at hydrogen producers and storage facilities to be remotely monitored through SCADA.

Technical competency gained through training and previous work experience would continue to be reviewed as part of the risk and mitigation assessment. The optimal approach is to integrate existing SoCalGas natural gas personnel familiar and experienced with natural gas pipeline construction and operations/maintenance, particularly for high-pressure pipelines, to perform similar activities for new hydrogen infrastructure. As new construction and operations personnel are hired, they can be trained and integrated into either natural gas or hydrogen or rotate between both infrastructure systems.

3.1. Technology & Implementation

Levering technology and communications tools currently in use by SoCalGas within the existing natural gas pipeline infrastructure may be considered for use within the proposed Angeles Link infrastructure. Potential changes to these tools and methods must be thoroughly studied to develop a strategic approach to skill development and resource allocation. Methods of data collection, application of procedures, technology

integration, the effects of technology on process, and electronic information management inform how a workforce could be organized and managed to maximize operational efficiencies. As technology continues to evolve, including recent developments in artificial intelligence (AI), to support hydrogen and other pipeline systems, systems supporting safety and system reliability will also continue to evolve.

The following examples of existing systems and methods may need to be evaluated for potential impacts to workforce tasks and organization are as follows:

1. Close Internal Survey (CIS)
2. Asset Management and Work Management Information Systems
3. Supervisory Control and Data Acquisition (SCADA) systems

3.1.1. Close Interval Survey (CIS)

Close interval survey (CIS) is an existing method used to assess the adequacy of cathodic protection (CP) or to identify locations where a current may be leaving the pipeline. Examples are Interruptions in the pipeline external coating which may cause corrosion, and for the purpose of quantifying voltage (IR) drops other than those across the structure electrolyte boundary, such as when performed as a current interrupted, depolarized, or native survey.

This method of direct assessment is expected to be utilized for Angeles Link, as external corrosion monitoring and mitigation would be similar for hydrogen pipelines as compared to natural gas pipelines. API 5L, *Specification for Line Pipe*, is expected to incorporate hydrogen pipe specifications, and therefore specific guidance on corrosion monitoring and mitigation will be determined and adjusted as needed.

CIS is used to supplement data obtained from traditional CP surveys where readings are taken at test stations on an annual schedule (not to exceed 15 months) per 49 CFR Part 192.465. CP survey technology is expanding to allow real-time data collection utilizing satellite and other forms of data transmission. The technology has already been proven for rectifier readings to reduce the required bi-monthly field reads (not to exceed 2.5 months between inspections), which can now be collected remotely in real-time for each of the rectifiers. The skills required to perform CIS and CP surveys include knowledge of calibrating and using the appropriate equipment, technical and engineering support to analyze data, and specifying mitigation procedures, including coating repair and possible pipe replacements. These skills are similar to those required for natural gas infrastructure, with the addition of hydrogen-specific safety training to account for any differences in physical and chemical properties.

3.1.2. Asset Management and Work Management Information Systems

Asset Management and Work Management Information Systems include information systems to plan, design, build, maintain, monitor, and decommission energy infrastructure assets. Applications including and not limited to GIS, Engineering design systems (e.g. AutoCAD), System Analysis Programming (SAP) for a variety of enterprise areas, and mobile work execution systems are important components and tools for existing natural gas infrastructure and potential future hydrogen system operations and integrity management. SAP incorporates information functionally through different internal applications such as SAP Plant Maintenance, used for maintenance and inspection, and SAP Construction Planning Design systems which are associated with planning and construction. Key aspects of asset management would include retention of traceable, verifiable, and complete (TVC) records of the new hydrogen system and use of a geospatial database. Digital Construction Management (DCM) tools are now available for use to collect TVC records as required by 49 CFR Part 192. The data collected by DCM tools can be efficiently downloaded to a GIS system along with pipeline routing locations. Personnel capable of managing the required data and the supporting tools will be an important resource in compliance and data management. As data for integrity management is collected in accordance with 49 CFR Part 192 Subpart O, GIS systems would become the primary repository for all hydrogen infrastructure data and material tracking. Technical advancements, such as AI, could be used with GIS to analyze the data for various processes, including maximum allowable operating pressure (MAOP) verification, assessment scheduling, and identifying rupture mitigation valves.

As much of the focus of the PHMSA's Mega Rule relates to TVC data and data integration, having an accurate and robust GIS can be essential to maintaining compliance and pipeline integrity. The existing SoCalGas GIS database is expected to incorporate the Angeles Link infrastructure data, with asset information incorporated in existing database(s) with minimal upgrades or modifications. Any ongoing support to maintain the Angeles Link system and data is expected to be covered through existing databases and processes, and any future modifications will be determined as Angeles Link progresses.

3.1.3. SCADA

SCADA is the primary system to monitor and control a high-pressure pipeline. Inclusion of Angeles Link infrastructure to SoCalGas's existing natural gas infrastructure will add a significant amount of field data points, necessitating a review of the capacity of SoCalGas's existing SCADA system. Angeles Link could result in expanding the system into more remote locations. As a result, communications paths for SCADA would need to be evaluated to support reliable network connections.

Independent of Angeles Link, SoCalGas is in the process of implementing the Control Center Modernization (CCM) program, which will further digitalize the existing natural gas transmission and distribution pipeline system. CCM will implement industry leading technologies in field sensors, advanced analytics, visualization, reporting, and operations technology network communication that will enhance real-time monitoring and control of SoCalGas's pipeline infrastructure, providing a platform for future clean energy projects. These upgrades to SoCalGas's control center operations will be considered in evaluating SCADA system needs for hydrogen-related projects. Natural gas control room personnel possess skills and experience that can be valuable for collaborating with hydrogen gas control personnel, and existing training and processes on the current SCADA system can be leveraged for hydrogen infrastructure (e.g., OQ and control room management procedures). As contemplated, the Angeles Link infrastructure will contain new transmission pipeline, and thus the use of Rupture Mitigation Valves will likely be required. The SCADA system would be appropriately designed to allow for optimized rupture detection, and SCADA specialists will be leveraged to confirm SCADA system requirements can fully support future clean fuels (e.g., Angeles Link) infrastructure.

3.1.4. Future Technology Considerations

Additional considerations that are recommended to be included during the next phase of Angeles Link are:

1. Leveraging existing data management tools such as AVEVA PI. AVEVA PI focuses on data infrastructure for collection, storage, and analysis of data, and turning data into insights with enterprise-wide accessibility and integration.
2. The requirements of the Transportation Security Administration (TSA)/Homeland Security Guidelines for Critical Energy Infrastructure[10], which may impact the design of any needed SCADA system upgrades/replacements as well as physical security requirements. SoCalGas's Corporate Security group has governance responsibility for oversight, conducting and coordinating any organization-wide security and/or investigative risk assessments.
3. The PHMSA Valve Rule[11] requirements that impact all new transmission pipeline infrastructure including hydrogen, necessitating the need for installing rupture mitigation valves.

[10] 49 of the United States Code, Transportation Security Administration, section 114(s); https://www.dhs.gov/publication/2023-biennial-national-strategy-transportation-security

[11] Pipeline Safety: Amendments to Parts 192 and 195 to Require Valve Installation and Minimum Rupture Detection Standards, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202204&RIN=2137-AF06

3.2. Education, Operator Qualifications, and Training

The regulations and codes that will provide a basis for establishing hydrogen training programs and workforce planning should be incorporated into SoCalGas's existing employee development programs and will be key in addressing potential knowledge gaps associated with hydrogen operations. SoCalGas employee development programs employ a variety of learning and development approaches, including classroom, online, and other specific training for necessary job skills. Furthermore, employees receive learning tools and programs for both technical and soft skills, encompassing compliance, job-specific, leadership, and soft-skills training curricula.
Integrating technical expertise with essential soft skills is vital for fostering well-rounded talent. By combining these two facets, employees can thrive in a dynamic work environment, adapt to challenges, and contribute effectively to their teams and organizations. Training topics include the understanding of and compliance with labor and employment laws, business policies, and safety practices and procedures as well as leadership development. Technical training includes coursework designed for all union represented job classifications including for Gas Transmission as well. The learning and development programs support SoCalGas's goals of maintaining high levels of performance in safety, job-specific technical skills, leadership excellence, customer satisfaction, operational excellence, and cost management.

Training and OQ are intricately linked. Training operations personnel is generally unique to a pipeline operator and is focused on how personnel are expected to perform specific operations or maintenance tasks on the pipeline equipment according to a set of written procedures. OQs, however, are specified in 49 CFR Part 192 Subpart N and are required for all covered tasks, which are identified by the operator. SoCalGas will determine if field personnel can carry OQs for both natural gas pipeline O&M and Angeles Link hydrogen pipeline O&M, or if they must be carried by separate personnel.

Angeles Link personnel training can be accomplished by closely following the required O&M Manual, per 49 CFR Part §192.605(a). Some of standard industry procedures contain the following four basic parts:

- Code specific reference.
- Generic description of the work to be performed in compliance with code.
- "How to" section which describes how the work is to be performed, e.g., how to perform valve maintenance.
- Records required and retention time for the records.

49 CFR Part §192.605(a) specifies that the O&M Manual must be reviewed and updated (if required) with effective dates tracked at intervals not exceeding 15 months, but at least once each calendar year. This timeframe will allow for refresher training on

specific training and procedures associated with maintaining hydrogen (e.g. Angeles Link) infrastructure.

OQ is specific to covered tasks on a pipeline system. 49 CFR Part 192 Subpart N contains scope, definitions, qualification program, record keeping, and general sections. As SoCalGas reviews the OQ program to determine covered tasks required for Angeles Link, a third-party contractor specializing in OQ programs may be consulted.

3.2.1. Personnel Training

The continued safe construction, maintenance, integrity management, and replacement of SoCalGas's pipeline system is executed by operations employees who receive training from the Gas Operations Training and Development department. Gas Operations Training and Development provides Field Technical Skills Training. The Operations Field Technical Skills Training team provides Gas Transmission, Gas Distribution, and Storage with the training and services described below. These trainings and services are necessary to enable SoCalGas to follow applicable laws, regulations, and standards, as well as to help maintain the safety of the workforce and the public.

- Centralized and /or decentralized technical skills training is provided to employees who are new to their jobs, require refresher training, have been promoted to positions requiring additional technical skills, receive new equipment or technology, or are being introduced to changes in regulations.
- Compliance-driven qualifications and certifications are conducted for employees who perform such activities as operating cranes, welding on steel pipes, or conducting plastic fusion joints.
- Instructional design services include updating existing training modules and developing new modules, as needed, in response to changes in gas standards, regulations, technology, or equipment. The Field Technical Skills Training team also explores new innovations for training, such as online training and multi-media training aids.
- Field Training Instructors conduct on-the-job training as an integral part of an employee's training experience.

Operations personnel for Angeles Link would benefit from the Gas Operations Training and Development department by receiving the required training to perform the tasks they are assigned and the advanced skills necessary to operate and maintain hydrogen infrastructure. Personnel, such as compressor station operators, would need to complete training on the hydrogen compressor equipment start-up, shutdown, and maintenance. Similarly pipeline operators would need to complete training on valve maintenance, pipeline patrolling, and other tasks. The need to maintain a trained and well qualified workforce is essential to support the safety and reliability of pipeline infrastructure.

3.2.2. Operator Qualifications

An integral component of overall workforce proficiency is the OQ program, which is essentially the management and process for the qualification of pipeline personnel as mandated by Title 49 of the CFR Section 192, Subpart N and G.O. 112-F. For new hydrogen infrastructure, SoCalGas would be required to follow 49 CFR Part 192 Subpart N, *Qualification of Pipeline Personnel*, which includes defining an abnormal operating condition. Qualification of pipeline personnel would apply to all operating infrastructure including Control Room Management and Emergency Response.

Evaluation of operator personnel includes written examination, oral examination, work performance history review, and observation during performance on the job, on the job training, and/or simulations. Once personnel have been evaluated, the trained (qualified) personnel have the skills necessary to perform the assigned covered tasks and recognize and react to potential abnormal operating conditions.

There are potential benefits regarding OQs for hydrogen infrastructure that may include a single qualification for some OQ tasks. Operator qualifications for both natural gas infrastructure and hydrogen infrastructure may provide efficiency between the two types in areas like corrosion control and pipeline patrolling where natural gas and hydrogen infrastructure are located in close proximity.

3.2.3. Accredited Training and OQ Companies

The following accredited training and OQ third party companies could potentially assist SoCalGas with enhancing the effectiveness of workforce training. These vendors provide support to pipeline operators in developing and maintaining an OQ plan and provide OQ training per the requirements of 49 CFR Part 192 Subpart N:

- National Center for Construction Education and Research (NCCER) (NCCER, n.d.)
  NCCER is a non-profit education foundation established in 1996 that provides various credential and certification training. After the Operator Qualification rule was adopted into Subpart N of 49 CFR Part 192, NCCER developed a pipeline training program as part of operators' OQ programs to help meet Pipeline and Hazardous Materials Safety Administration (PHMSA)'s standards. The OQ program incorporates self-paced, online covered task training and real-time, digital submission of performance evaluations conducted in the field. As an example, NCCER offers 154 covered task trainings and estimates more than 190 covered task training offerings as of the end of 2023.
- MEA Energy Association (MEA Energy Association, n.d.)
  The MEA Energy Association (MEA) is a trade association founded over 115 years ago that provides online technical courses, safety assessments, evaluator training, and operator qualification compliance tools for field personnel in the

energy distribution industry. Specifically, MEA's "EnergyU" system provides OQ training, testing, badges, and evaluations and they also offer information management services through ISNetworld (ISN).

- Veriforce (Veriforce, n.d.)

  Veriforce was founded in 1993, and provides supply chain risk management solutions, including operator qualification platforms (e.g. software, documentation and reporting, audit support, evaluator authorization, and training content). Veriforce supports operators in identifying specific covered tasks, customizing OQ programs, and managing drug & alcohol compliance.

- Energy Worldnet (Energy Worldnet, n.d.)

  Energy Worldnet was founded in 1994 with a focus on providing operational and safety training, including solutions and tools to manage and train various workforces. These include online training associated with OQ (e.g. DOT, ASME), safety (OSHA), pipeline inspection, etc., as well as solutions associated with pipeline safety management systems and contractor management.

3.2.4. Environmental and Safety Compliance Management Program

The SoCalGas operations standard for the Environmental and Safety Compliance Management Program (ESCMP) applies to all employees and provides the training and compliance framework that is fundamental to the employee's roles and responsibilities at SoCalGas. ESCMP would require revisions to include the requirements for transporting pure hydrogen gas as it would pertain to compliance, training, environmental & safety goals, and assessments of compliance. Environmental and safety compliance will require SoCalGas to identify all applicable laws, rules, and regulations, as well any other potential requirements. The specific requirements for hydrogen infrastructure would be incorporated into ESCMP in order for employees to receive the necessary training and implement the appropriate compliance measures.

Compliance with all applicable laws, rules, and regulations, as well as the requirements of the internal policies, practices, and procedures (as published in the SoCalGas Environmental and Safety Standards) is the responsibility of all SoCalGas employees. SoCalGas leadership will regularly identify environmental and safety laws and regulations applicable to SoCalGas and, as needed, establish internal policies, practices, procedures, and guidance to foster ongoing training and compliance. Consistency with the appropriate environmental and safety standards is the responsibility of the owners of business unit operating standards.

Developing, identifying, scheduling, and reviewing the employee's respective environmental and safety training responsibilities are reviewed and confirmed by the directors, managers, and supervisors of each business unit. These individuals must

confirm that the appropriate environmental and safety training complies with applicable regulations and internal procedures and are identified and completed as required, including documentation confirming completion of applicable training. The processes and programs are reviewed annually for appropriateness and compliance.

Self-assessments are performed to assess compliance at a facility or locale with the applicable regulatory environmental and safety requirements and internal company policies, identifying any inconsistencies and the appropriate corrective action(s). The ESCMP management review process includes distributing ESCMP communications, conducting annual ESCMP management reviews, compiling the findings, and developing recommendations and goals with executives, as well as verifying and certifying that compliance processes and activities reasonably promote compliance with safety and environmental laws and regulations and company policies and procedures.

SoCalGas's current Gas Safety Plan provides references to the existing safety programs, plans, and procedures in place for specified infrastructure or areas of company activity. Revisions to the Safety Plan Matrix for the natural gas infrastructure to include the Angeles Link hydrogen infrastructure would align with the results of the evaluation of SoCalGas's specifications, standards, and procedures (SSPs) from the Phase 1 Plan for Applicable Safety Requirements. This evaluation identified the current SoCalGas natural gas operations SSPs that should be considered for modification or new development for implementing hydrogen transmission and distribution infrastructure. As those SSPs are modified/developed, the Safety Plan Matrix would need to incorporate those as appropriate. Ultimately, identifying, assessing, and implementing changes will be a continuous improvement process for ESCMP in order to fulfill the training and compliance needs of Angeles Link.

4. KEY IMPACTED OPERATOR TASKS

4.1 Leak Survey, Detection, Mitigation and Repair

Leak management is a critical component of system operations and maintenance for several reasons, including safety, environmental protection, resource conservation, and infrastructure integrity. Title 49 CFR Part 192 and GO 112-F contain requirements for the transportation via pipeline of natural gas and other gases, such as hydrogen. However, it is not currently known if or how these requirements may change in the future as hydrogen pipeline infrastructure may expand. Leak survey and leak detection methods may be modified by PHMSA and/or the CPUC as the pipeline industry gains more experience and collects operating data from hydrogen pipeline systems.

SoCalGas's existing processes, technology, reporting, compliance, and safety notifications related to leak survey and leak detection would require certain modification

for hydrogen leak consequences, but the framework from the natural gas system can be used as a starting point. The areas that will be focused on are as follows:

1. Leak survey and identifying “Abnormal Operating Conditions” for hydrogen.
2. Leak detection – using the appropriate equipment for detection, including confirmation of equipment calibration.
3. Leak mitigation and repair – requiring engineering and technical support.

Hydrogen leak detection equipment is readily available from a variety of vendors, including detection equipment that can be calibrated to 100% hydrogen. Detection of hydrogen leaks from the hydrogen infrastructure can be accomplished utilizing leak detection equipment that is worn or carried by hydrogen pipeline operating personnel while performing routine operations and maintenance activities, including conducting leak surveys of pipelines with equipment, as well as when responding to identified abnormal operating conditions. In addition, fixed-mounted leak detection equipment located inside compressor station buildings and in areas containing above-ground hydrogen gas facilities can provide effective and continuous leak monitoring for hydrogen. Operators must identify Abnormal Operating Conditions on the hydrogen pipeline that may indicate a component malfunction or deviation from normal operations. Leak detection/gas detection in compressor stations is governed by §192.736, *Compressor stations: Gas detection*. Leak detection equipment vendors can also supply this hydrogen detection equipment for compressor stations. Angeles Link operations and maintenance teams would need specific training on the leak detection equipment selected for detecting hydrogen. Contractors would also need to be trained and supply their own leak detection equipment appropriate for hydrogen detection when working on hydrogen infrastructure. Further information regarding leak surveys, detection and mitigation can be found in the *Safety Study.*

4.2. Integrity Management

It is unlikely that major changes to overall integrity management requirements would be implemented for hydrogen gas infrastructure. The framework already in place for natural gas infrastructure provides a basis for evaluating the integrity of pipeline infrastructure and the associated risks. SoCalGas’s existing integrity management programs have been implemented for over 20 years with oversight from its experienced and trained workforce to maintain safety and regulatory compliance. SoCalGas’s current workforce is equipped to adjust integrity management programs to incorporate the differences in properties of hydrogen and other associated hydrogen infrastructure changes.

Additional considerations that may affect workforce planning and training for the Angeles Link infrastructure are related to integrity assessments (in-line inspection, direct assessment, etc.) for natural gas systems compared to hydrogen systems. There may be differences in conducting integrity assessments such as tool modifications for a hydrogen environment, which in turn lead to safety procedure updates and follow-on

training and/or qualifications. Other considerations may include the parameters associated with risk assessments and data integration aspects of the integrity management program to account for the differences between the types of gases being transported.

4.3. Control Room Management

SoCalGas's control room management procedures may be applicable to hydrogen infrastructure with some modifications. The potential for additional SoCalGas control personnel, specific to the hydrogen system, separate from the existing natural gas system control personnel, is yet to be determined but will include the following control room management tasks.

Hydrogen system control room management:

- 24/7 system operations monitoring
- SCADA monitoring
- Potential rupture mitigation response
- Responding to emergency notifications

SoCalGas is constructing a new control center which may have designated responsibilities for the control of both natural gas and hydrogen systems. OQ for hydrogen gas control personnel may be different due to the physical and chemical properties of hydrogen. Separate control room management plans may be implemented for natural gas and hydrogen. An alternate approach to consider for staffing gas control and emergency response functions would be to rotate gas control personnel and emergency response personnel between natural gas and hydrogen infrastructure, thereby providing cross-training of personnel.

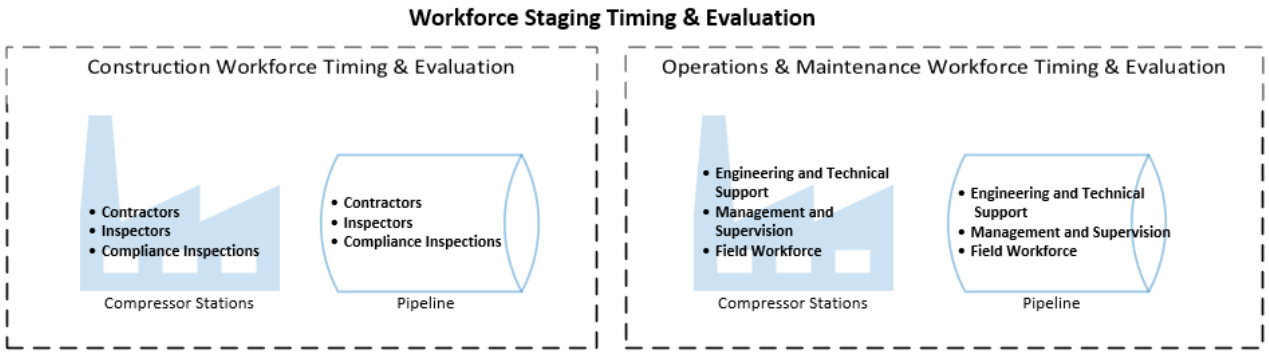
5. COMPARISON TO EXISTING SOCALGAS FACILITIES

The construction of the Angeles Link infrastructure will be similar to construction for natural gas infrastructure. The operations and maintenance of Angeles Link will also be similar to operations and maintenance of natural gas infrastructure. Therefore, when reviewing workforce staging for Angeles Link, there is value in reviewing and comparing the workforce needs and requirements of natural gas assets that are similar in size and scale.

Workforce Staging consists of two major sections: 1) Workforce Staging for Construction and 2) Workforce Staging for Operations & Maintenance (O&M) of Angeles Link. Construction Workforce Staging is further divided into Compressor Station Construction and Pipeline Construction. Compressor station construction is uniquely different from pipeline construction, and each requires different skillsets to be utilized. Figure 2 below, illustrates the workforce staging for pipeline and compressor

stations as it may apply to the construction phase and operations and maintenance. Workforce Staging for O&M of hydrogen infrastructure is similarly divided into Compressor Station O&M and Pipeline O&M. These are the workforce groups to be considered for SoCalGas operations personnel as the Angeles Link construction sites are completed and operating the infrastructure begins. The skillsets for operations and maintenance of the compressor station(s) and pipeline segments are expected to mirror title 49 CFR Part 192 regulatory compliance requirements. The SoCalGas Workforce Planning Subject Matter Experts (SMEs) can provide reviews of Workforce Staging as the Angeles Link project moves from design through construction, commissioning, and operation.

Figure 2 - Workforce Staging Timing & Evaluation



5.1. Construction Workforce

Construction workforce staging would be based on the number of pipeline construction spreads, compressor station construction sites, third-party hydrogen production, and third-party storage facilities and follow contractor-proposed workforce. As explained in Section 2.0: Employment Impact Analysis, one of the possible scenarios selected to conduct the employment impact analysis consisted of 390 miles of pipeline to be installed and two compressor stations to be constructed. The range of jobs required for the construction workforce staging at any point in the construction phase will vary. An example of the job titles/roles that may be required for construction of the Angeles Link infrastructure could include, but is not limited to the following:

Table 2 - Example Job Title/Roles

Job Title/Role
Manager/Superintendent
Safety/Quality Assurance/Inspector
Pipefitter
Carpenter

Welder
Operator/Driver
Mechanic
Electrician
Laborer

Note: The "Job Title/Role" includes senior, supervisor, and manager levels as well as helpers, foreman, etc.

5.2. Operation & Maintenance Workforce

SoCalGas's processes and procedures for its existing natural gas facilities (per 49 CFR Part 192 Subparts A through P) were reviewed, and an analogous comparison was performed, which identified a workable framework or basis for the hydrogen facilities. This review was completed as part of the *Evaluation of Applicable Safety Requirements* study.

For purposes of this study, workforce requirements of an existing SoCalGas natural gas compressor station and pipeline segments will be used for comparison to the potential workforce requirements for Angeles Link. The following provides a comparison of existing natural gas infrastructure and how those may translate to the needs or requirements of hydrogen infrastructure.

5.2.1 SoCalGas Compressor Station Example

Typical compressor station operations positions include compressor operators, compressor maintenance personnel, instrument, and control (I&C) personnel, valve and regulator maintenance personnel, and engineering/technical support personnel. Depending on equipment, location, and setup, these facilities may be staffed continuously or remotely operated. On-site personnel perform different tasks inside the compressor stations and could draw upon skillsets already being utilized for the natural gas system.

Hydrogen compressor station operations are unique to the selected compressor OEM. Staging would be dependent on SoCalGas electing to operate locally/on-site or operate remotely, and thus it has not yet been determined whether hydrogen compression will be centrifugal or reciprocating.

Workforce requirements and sizing of the compressor facilities are assumed to be similar to existing facilities. The following table is a summary of the potential workforce that may be required for operation and maintenance of a compressor station for Angeles Link:

Table 3 - Example Compressor Station Job Title/Roles

Job Title/Role	Estimated Count
Station Technician	4 – 6
Station Maintenance	4 – 6
Station Operations	8 – 10
Instrumentation and Measurement	4 – 6
Technical Services*	1 – 2
Total	**21 – 32**

*Note: The "Job Title/Role" includes senior, supervisor, and manager levels as well as technicians and specialists. *Technical Services are not directly staffed at a station but provide consistent direct support to compressor operations.*

5.2.2. SoCalGas Pipeline Segment Example

Skillsets for hydrogen pipeline operations and maintenance are not expected to differ significantly from natural gas pipeline operations and maintenance as discussed below.

Considerations for the hydrogen pipeline segment impacting workforce staging include:

- Requirement for Rupture Mitigation Valves – To be installed on new transmission pipelines 6-inches and greater OD that are located in a High Consequence Areas (HCAs) or Class 3 or Class 4 location, or if located in a Class 1 or Class 2 location and have a potential impact radius (PIR) greater than 150 ft.
    - Operated during normal, abnormal, and emergency operating conditions.
    - Monitored for valves status, upstream pressure, and downstream pressure. Point-to-point verification between SCADA system displays and the installed valves, sensors, and communications equipment must be conducted.
    - Requires valve maintenance at least once each calendar year, not exceeding 15 months.
    - Testing and verifying internal communication plans and testing any backup SCADA will also follow annual intervals, not to exceed 15 months.
- Class Location, HCAs, and Moderate Consequence Areas (MCAs) can impact leak survey, patrolling, and integrity management for pipelines.
    - As class location increases, the number of leakage surveys per year increases.
    - As class location increases, the number of patrols per year increases.
    - If HCAs are identified, integrity management will be required, which is outlined in 49 CFR Part 192 Subpart O and includes assessments, risk and threat analysis, preventative and mitigation measures, etc. Section

4.2: *Integrity Management*, of this study contains potential changes related to hydrogen infrastructure.

The following table is a summary of the workforce that may be required for operation and maintenance of the pipeline infrastructure for Angeles Link using similar applicable natural gas pipeline systems within an area of SoCalGas service territory averaging approximately 250 miles of pipeline:

Table 4 - Example O&M Job Title/Roles

Job Title/Role	Estimated Count
Field Operations/Technicians	8 - 12
Instrument, Measurement and Control	6 – 8
Cathodic Protection/Corrosion	1 – 2
Pipeline Integrity*	1 – 2
Technical Services*	1 – 3
Total	**17 – 27**

*Note: The "Job Title/Role" includes senior, supervisor, and manager levels as well as technicians and specialists. *These groups directly provide consistent support to pipeline operations.*

As discussed in the above examples, employment numbers for work at compressors stations and work for pipeline operations can be considered based on current workforce resourcing for existing SoCalGas assets. Variables such as the number of compressor stations, the mileage of pipeline, and location will ultimately influence estimates of operations-related jobs needed to operate and maintain Angeles Link. The *Employment Impact Report* in Appendix A considers Scenario 7 from the Design Study to arrive at a detailed estimate. This scenario evaluates 390 miles of pipelines and two compressor stations and results in an estimate of approximately 100 direct annual operations-related jobs that could be created to operate and maintain Angeles Link. Future comparisons may provide more information once refined pipeline routes and compressor station details are determined.

Angeles Link and the natural gas infrastructure would both be governed by 49 CFR Part 192 with the same regulatory requirements. Examples of these activities include valve maintenance, leak survey, and corrosion protection. Compressor station operations would include original equipment manufacturer (OEM) recommended O&M tasks and training provided by OEM manufacturers on the principles and operation of hydrogen gas compression. The applicable subparts of the regulatory code were reviewed for corrosion control, and operations and maintenance requirements per the following list in

Table 5 (this is not an exhaustive list) and may be applicable to compressor stations and pipeline segments.

Table 5 - Pipeline and Compressor Station Requirements

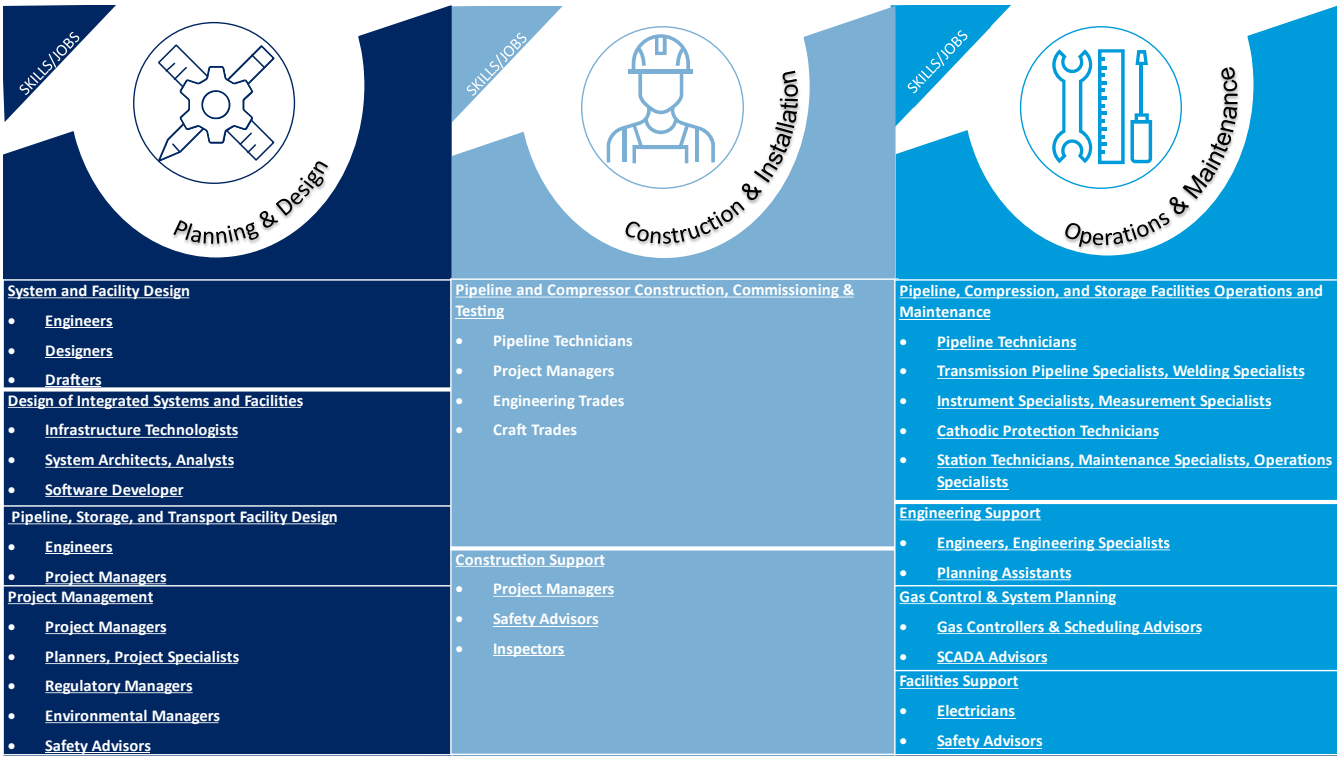
49 CFR Part 192 Code Section	Applicable to Natural Gas Infrastructure	Applicable to Angeles Link Hydrogen Infrastructure
Subpart I – Requirements for Corrosion Control		
§192.455 External corrosion control: Buried or submerged pipelines installed after July 31.1971	Yes	Yes
§192.461 External corrosion control: Protective coating	Yes	Yes
§192.463 External corrosion control: Cathodic protection	Yes	Yes
§192.465 External corrosion control: Monitoring and remediation	Yes	Yes
Corrosion control requirements for natural gas infrastructure and Angeles Link may be similar		
Subpart L – Operations		
§192.605 Procedure manual for operations, maintenance, and emergencies	Yes	Yes
§192.609 Change in class location: Required study	Yes	Yes
§192.613 Continuing surveillance	Yes	Yes
§192.614 Damage prevention program	Yes	Yes
§192.615 Emergency plans	Yes	Yes
§192.616 Public awareness	Yes	Yes
§192.631 Control room management	Yes	Yes
Operating requirements for natural gas infrastructure and Angeles Link may be similar		
Subpart M – Maintenance		
§192.705 Transmission lines: Patrolling	Yes	Yes
§192.706 Transmission lines: Leakage surveys	Yes	Yes
§192.707 Line markers for mains and transmission lines	Yes	Yes
§192.710 Transmission lines: Assessments outside of HCAs	Yes	Yes
§192.711 Transmission lines: General requirements for repair procedures	Yes	Yes
§192.731 Compressor stations: Inspection and testing of relief devices	Yes	Yes

49 CFR Part 192 Code Section	Applicable to Natural Gas Infrastructure	Applicable to Angeles Link Hydrogen Infrastructure
§192.735 Compressor stations: Storage of combustible materials	Yes	Yes
§192.736 Compressor stations: Gas detection	Yes	Yes
Maintenance requirements for natural gas infrastructure and Angeles Link may be similar		

6. HUMAN RESOURCES

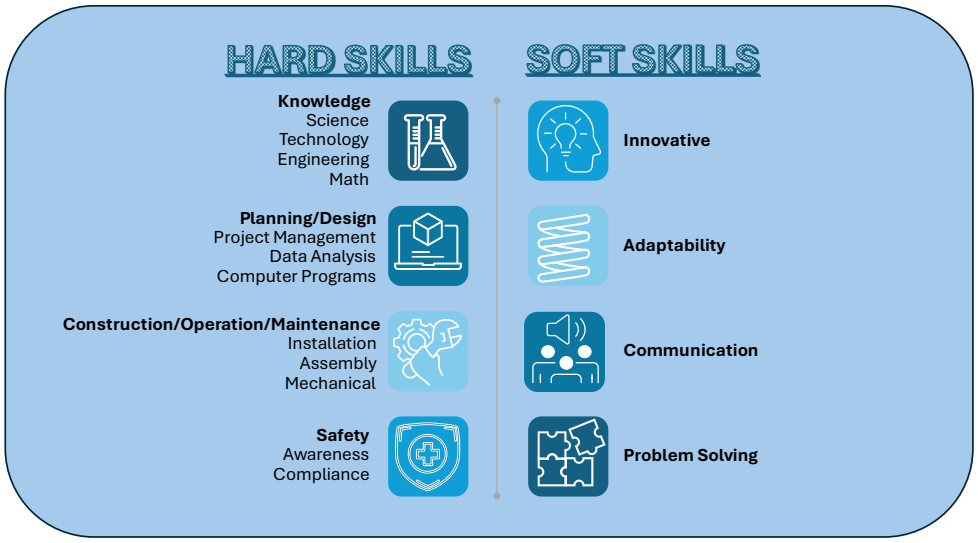
The workforce for Angeles Link infrastructure would include field personnel responsible for operating and maintaining hydrogen infrastructure, engineering and technical support for hydrogen infrastructure, and operations and maintenance management and supervision. SoCalGas's natural gas pipeline systems were reviewed for potential workforce roles and requirements that could apply to Angeles Link. Figure 2 below is a listing that includes but is not limited to the workforce roles that may be required for design, construction, and operation and maintenance of the pipeline infrastructure for Angeles Link.

Figure 2 - Applicable Workforce Roles



Understanding the tasks, responsibilities, and requirements associated with the roles, help in identifying the skills needed to perform the job effectively. There are many hard skills (technical skills) and soft skills (interpersonal and behavioral skills) that will be needed to support roles to construct, operate and maintain pipeline infrastructure. The figure below includes an example of skills that are transitional and beneficial for the workforce to support Angeles Link. Different roles emphasize different skills, and they may vary in the range of competency and ability needed.

Figure 3 - Applicable Workforce Skills



6.1 Job Classifications

SoCalGas develops training plans by job classification that include courses required to perform skilled work, meet company objectives, and satisfy required compliance training. SoCalGas prioritizes a framework to support employees to have skills and abilities to operate and maintain a safe and reliable system. As addressed by the ERASMUS+ Project, including Figure 4:

An analysis of the prevalent themes mentioned by industry experts when describing job roles and skill requirements in the hydrogen sector reveals 11 areas of knowledge. This underscores the diverse skills and knowledge necessary in the hydrogen sector, spanning from production and operation to safety, storage, and legal considerations. The occurrence of these themes in the occupational profiles identified is analyzed. Among the identified themes, “operation,” “maintenance,” and “hazards” can be classified as skills, while the other listed elements would rather belong to the “knowledge” category. This categorization highlights that the “knowledge” items encompass critical areas of understanding, whereas the “skills” items involve the ability

to perform specific tasks effectively. The classification of “hazards” under skills is due to its practical implementation of safety protocols and practices to address risks.12

Figure 4 - ERASMUS+ Project Skills & Knowledge Required

SKILLS & KNOWLEDGE REQUIRED	OCCURRENCE	%
Production	**103**	11 %
Hazards	**87**	10 %
Systems	**61**	7%
Operation	**57**	6%
Maintenance	**57**	6%
Electrolysis	**57**	6%
Storage	**55**	6%
Fuel cell	**55**	6%
Transport	**44**	5%
Refueling	**29**	3%
Refueling	**29**	3%
Legal & permitting	**23**	3%

The themes Hazards, Systems, Operations, and Maintenance are representative of job roles and skill requirements of SoCalGas’s existing natural gas system for transmission and compressor stations as well as potential job roles and skill requirements for Angeles Link. Job classifications are expected to be similar for both the natural gas infrastructure

[12] ERASMUS+ Project, European Hydrogen Skills Strategy, https://greenskillsforhydrogen.eu/public-deliverables/eu-hydrogen-skills-strategy/

and the hydrogen infrastructure, so the effort for SoCalGas to establish job classifications specific to Angeles Link could be based upon the existing job classifications. SoCalGas has the opportunity to separate the job classifications or provide opportunities for cross-training and OQ qualifications for the existing workforce where desired.

1. Potential for separate job classifications for the hydrogen system, such as:
    i. Facility operations
    ii. Facility maintenance
    iii. Leak survey
    iv. Valve maintenance
    v. Emergency response
    vi. Public liaison with emergency response agencies

SoCalGas will be able to leverage its existing operations and maintenance, technical/engineering and management/supervisory workforce to support and develop Angeles Link. Additionally, SoCalGas's well-developed and proven control room management and OQ programs will provide an excellent foundation for corresponding Angeles Link workforce programs.

7. COMMUNITY ENGAGEMENT AND EMPLOYMENT

According to the National Association of State Energy Officials (NASEO), "The anticipated growth of the clean hydrogen industry in the United States provides states with an opportunity to bring good-paying jobs and economic development benefits to their communities, while reducing emissions in hard-to-abate sectors. The expansion of the clean hydrogen economy can also help states support a just transition by offering meaningful career pathways to workers in industries currently tied to fossil fuel production, transport, and use. Clean hydrogen jobs require many of the same skills needed for jobs in the fossil fuel and industrial sectors."[13] To develop clean renewable hydrogen knowledge and skills, the workforce needs access to quality and relevant education and training programs. Building a pipeline of skilled, adaptable workers for the hydrogen industry allows for those opportunities to pursue various job pathways depending on their skills, knowledge, interests, and goals. Knowledge sharing and providing those educational and training solutions in partnership with the communities, government, labor, and organizations is essential. As mentioned above in Section 3.2, Education, Qualifications, and Training, SoCalGas's programmatic workforce training is targeted to create economic prosperity for the individuals and local communities within

[13] NASEO, State Strategies to Develop and Support the Emerging Clean Hydrogen Workforce, https://mojo.naseo.org/data/sites/1/documents/publications/NASEO_Emerging%20Clean%20Hydrogen%20Workforce_FINAL.pdf

its service territory. These programs provide training and soft skills to enable adults, young adults, and veterans the opportunity to obtain meaningful and gainful employment.

SoCalGas's ASPIRE 2045[14] sustainability strategy sets forth SoCalGas's aim to achieve net zero greenhouse gas emissions in the company's operations and delivery of energy by 2045, and includes goals related to safety, diversity equity and inclusion (DE&I), and investment in underserved communities. This sustainability strategy supports SoCalGas's priority for developing the energy workforce of the future to construct, install, and maintain hydrogen infrastructure. As evaluated through SoCalGas's workforce development programs and procedures, SoCalGas's workforce planning includes managing the recruitment and selection of a qualified and diverse workforce, while complying with legal requirements throughout the staffing process. Internal and external recruitment activities are conducted for all positions; SoCalGas partners with colleges, veteran and disability support groups, and local communities to source qualified and diverse candidates to fill job vacancies. Furthermore, these recruitment efforts will be focused on communities along the Angeles Link route. Approximately one-half of the SoCalGas workforce is union represented, with several unions governed by a Joint Steering Committee. SoCalGas continuously supports that union represented positions are appropriately leveled, paid fairly, and includes safeguards for compliance with federal and state labor laws.

This Workforce Study is a proactive evaluation, which allows for a preliminary assessment of existing relative skills through the planning of Angeles Link while allowing the evolution of the hydrogen industry to further refine new skillsets that may be needed. The education and training developed from these outcomes will in turn support preparation for the workforce for SoCalGas and the local communities it serves. SoCalGas has been actively supporting and promoting education and training programs to equip existing and new workers with the necessary skills to fulfill a wide range of jobs in the renewable hydrogen economy. SoCalGas has been collaborating and in some instances initiating the development and progression for education and training programs that will address industry specific needs and be tailored to building job pathways. Additionally, SoCalGas is locally supporting development of hydrogen certificate programs for the local community colleges as well as coordinating learning engagement activities for students, such as STEM events and supporting construction academies.

[14] SoCalGas, ASPIRE 2045 https://www.socalgas.com/sites/default/files/2022-02/SoCalGas_Sustainability_Strategy_final.pdf

Furthermore, SoCalGas's ASPIRE 2045 sustainability strategy includes a goal of achieving 45% spending with diverse businesses by 2025. The recently published SoCalGas Supplier Diversity Annual Report[15] states that in 2023 SoCalGas spent approximately 44% of its total supply management purchases with diverse business enterprise (DBE) vendors, surpassing the CPUC's goal for the 30th consecutive year and nearing SoCalGas's 45% goal. SoCalGas's 2023 Supplier Diversity Highlights are shown in Figure 5 below.

Figure 5 - SoCalGas 2023 Supplier Diversity Highlights

SoCalGas's supplier diversity initiatives, such as hosting webinars, networking sessions, business boot camps, matchmaking and mentoring events further contribute to supporting diverse business enterprises. Investments in technical assistance and development programs continue with capacity building, mentoring, outreach, and alliances and allows opportunities for the local communities to be engaged and benefit from these programs.

8. STAKEHOLDER FEEDBACK

SoCalGas presented opportunities for the PAG and CBOSG to provide feedback at four key milestones in the course of conducting this study: (1) the draft description of the Scope of Work, (2) the draft Technical Approach, (3) Preliminary Findings and Data, and (4) the Draft Report. These milestones were selected because they are critical points at which relevant feedback can meaningfully influence the study.

[15] SoCalGas Supplier Diversity Report 2023 Annual Report, https://www.socalgas.com/sites/default/files/2024-03/2023-24_SD_annual_report.pdf

Table 6 – Key Milestone Dates

Milestone	Date Provided to PAG/CBOSG	Comment Due Date	Responses to Comments in Quarterly Report[16]
1. Draft Scope of Work	July 6, 2023	July 31, 2023	Q3 2023
2. Draft Technical Approach	September 7, 2023	October 13, 2023	Q3 2023
3. Preliminary Findings and Data	April 11, 2024	May 3, 2024	Q2 2024
4. Draft Report	July 5, 2024	August 2, 2024	Q3 2024

Feedback provided at the PAG/CBOSG meetings is memorialized in the transcripts of the meeting. Written feedback received is included in the quarterly reports, along with responses. Meeting transcripts are also included in the quarterly reports. The quarterly reports are submitted to the CPUC and are published on SoCalGas's website.

Feedback was incorporated as applicable at each milestone throughout the progression of the study. Some feedback was not incorporated for various reasons including feedback that was outside the scope of the Phase 1 Decision or feasibility study or feedback that may be anticipated to be addressed in future phases.

Key feedback incorporated through the development of this study is summarized in the table below.

[16] Each Quarterly Report can be accessed at https://www.socalgas.com/sustainability/hydrogen/angeles-link

Table 7: Summary of Incorporated Stakeholder Feedback	
Thematic Comments from PAG/CBOSG Members	**Incorporation of and Response to Feedback**
Angeles Link Job Creation Stakeholders suggested inclusion of job estimates potentially created by Angeles Link.	In response to this feedback, an Employment Impact Analysis that estimates job creation associated with Angeles Link was conducted and is provided in Appendix A.
Employee Safety Stakeholders requested including references to worker safety concerns related to transporting 100% hydrogen by pipeline.	Consistent with this feedback, employee safety is addressed in Section 3.2 - Education, Operator Qualifications, and Training and specifically in 3.2.4 - Environmental and Safety Compliance Management Program. In addition, essential employee safety concerns related to purging procedures, leak detection, hydrogen Personal Protective Equipment (PPE) and drug & alcohol testing is specifically described in the Evaluation of Applicable Safety Requirements (Safety Study), Section 8.0 – Specifications, Standards, and Procedures Evaluations.
Additional Workforce Analysis Stakeholders generally requested additional analysis related to workforce planning and workforce safety related to constructing and operating a hydrogen pipeline system.	In response to this feedback, a new Section 9 – Future Considerations was added to this study summarizing additional analysis and information that will be considered at the appropriate stage of project development related to workforce planning.

9. FUTURE CONSIDERATIONS

9.1 Hydrogen vs. Natural Gas Workforce Planning

In future phases of the project, SoCalGas will address how the workforce will carry out the tasks specific to hydrogen as compared to how tasks are performed today with natural gas. As mentioned in Section 6.1 Job Classifications, SoCalGas may also consider separate job classifications for the natural gas and hydrogen gas systems. Certain tasks for hydrogen operations and natural gas operations may involve similar work and require similar training, skills, knowledge, and expertise. Additionally, the Safety Study, in section 8.0 Specifications, Standards, & Procedures Evaluation, explains how regulations and industry best practices will inform the requirements of

company standard operating procedures and how the workforce personnel will execute the procedures. In order to determine if the differences between the job functions would warrant separate job tasks, information will need to be collected on the knowledge and skills required for those tasks. Conducting future assessments such as an operator qualifications gap analysis, a detailed procedures evaluation, systems/workflow analysis and/or workforce capacity planning will support defining job duties and requirements.

10. CONCLUSION

Angeles Link requires careful workforce planning and resourceful training to confirm the safety, efficiency, and success of the project. Workforce planning involves strategic management of human resources, and training is essential to equip personnel with the necessary skills and knowledge for the construction and operation of a hydrogen system. A pure clean renewable hydrogen system can leverage many of the existing requirements of SoCalGas's natural gas system. In consideration of Angeles Link, SoCalGas's existing procedures and training for natural gas infrastructure can be applied to hydrogen infrastructure, with modifications where necessary to account for differences in properties between the two gases. Workforce planning and training for the Angeles Link infrastructure can therefore utilize the existing models and philosophies in place for the natural gas infrastructure as a baseline for development.

As proposed, Angeles Link has potential for significant impact to job creation during both construction and operation. The Employment Impact Analysis included in Appendix A concludes that Angeles Link could generate approximately 75,000 jobs when considering direct, indirect, and induced impacts. It is estimated that 53,000 direct construction-related jobs could be created (approximately 10,500 jobs per year during peak construction) while approximately 100 direct annual operations and maintenance-related jobs could be added as part of Angeles Link. These employment estimates represent full-time, part-time, and seasonal employment based on specific routing scenario for a 390-mile route with two compressor stations[17].

SoCalGas is uniquely well-positioned to operate and maintain a clean renewable hydrogen pipeline system due to its vast experience operating and maintaining a highly developed gas transmission and distribution system, existing highly trained and qualified workforce, and comprehensive programs and procedures. SoCalGas will be able to leverage its existing operations and maintenance, technical/ engineering, and management/supervisory workforce to support and develop Angeles Link. Additionally, SoCalGas's well-developed and proven control room management and OQ programs

[17] The number of jobs will be refined in a future phase once the preferred route is identified and refined.

will provide an excellent foundation for corresponding Angeles Link workforce programs. The existing SoCalGas personnel can successfully transition to these O&M tasks with additional training to hydrogen specific equipment and procedures. Leak management is a critical component of system operations and maintenance for several reasons including safety, environmental protection, resource conservation, and infrastructure integrity. The SoCalGas natural gas workforce is experienced and trained in the required skills needed to conduct leak survey and use of leak detection equipment per existing Operator Qualifications and O&M procedures. These personnel can transition to the leak survey tasks with training on the hydrogen leak detection equipment and hydrogen leak consequences.

Control room operations are critical elements for safely and efficiently operating hydrogen pipeline infrastructure. Independent of Angeles Link, SoCalGas is in the process of implementing a Control Center Modernization (CCM) program, which will enable Gas Control to further digitalize the existing natural gas transmission system with new field assets. The CCM will enhance the real-time monitoring on SoCalGas's pipeline system, and it presents opportunities that can be leveraged to result in robust oversight on future clean renewable hydrogen pipelines. SoCalGas may consider separate system gas controllers and emergency response teams for the natural and hydrogen gas systems. Gas controllers' training will require operator qualifications unique to the hydrogen system, including knowledge of the abnormal operating conditions associated with hydrogen compressor and pipeline operations.

SoCalGas actively monitors emerging issues through participation in industry associations, review of PHMSA advisory bulletins, and open communication and collaboration with legislative and regulatory groups as well participation in public forums. For the Angeles Link Project, through utilization and modification where necessary of existing procedures, programs, and practices, SoCalGas can effectively implement comprehensive workforce training and qualification for Angeles Link personnel. This will include O&M and OQ training programs, implementation of the ESCMP program, and adaptation of the comprehensive Gas Safety Plan. Implementation of federal and state pipeline safety requirements across the required aspects of design, material sourcing, construction, operation, maintenance, inspection, and reporting for a natural gas transmission and distribution system can support mitigation of critical considerations associated with workforce planning for Angeles Link. These same efforts can be applied externally while supporting and collaborating with industry partners, academia, unions, government, and communities. Specifically, within the industry, SoCalGas is in partnership with a joint industry project to develop a conceptual hydrogen certification pathway to educate a range of personnel. Nationally, SoCalGas has joined the Hydrogen Education for a Decarbonized Global Economy (H2EDGE) initiative to advance emerging hydrogen workforce by developing newly trained personnel and

enabling the existing workforce to migrate into the hydrogen field by way of enhanced industry coordination and workforce readiness initiatives, made possible by training, education, and recruitment of qualified people.

The workforce needed to construct, operate, and maintain the proposed Angeles Link project will include, but is not limited to, the field workforce responsible for constructing, operating, and maintaining the Angeles Link infrastructure, including management personnel responsible for the field workforce. It also includes engineering and technical staff supporting the hydrogen infrastructure and field workforce. As proposed, Angeles Link could be an economic boon that extends California's position as a leader on clean energy well into the future, potentially attracting thousands of upskilled and reskilled jobs. The estimates from the Employment Impact Analysis also represent the potential availability of well-paid jobs. More significantly the possibility of potentially creating up to almost 75,000 jobs (when direct, indirect, and induced impacts are included), represents real and meaningful opportunities for participation in the clean energy economy.

11. GLOSSARY

California Public Utilities Commission (CPUC) - Regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies, in addition to authorizing video franchises. [18]

Cathodic Protection - A technique to prevent corrosion of a metal surface by making that surface the cathode of an electrochemical cell. [19]

Centrifugal compression - Compresses fluid (a gas or gas/liquid mixture) into a smaller volume while simultaneously increasing the pressure and temperature of the fluid. [20]

Close Interval Survey (CIS) - An existing method used to assess the adequacy of cathodic protection (CP) or to identify locations where a current may be leaving the

[18] Auth, T. (n.d.-a). About the California Public Utilities Commission (CPUC). California Public Utilities Commission. https://www.cpuc.ca.gov/about-cpuc/cpuc-overview/about-us#:~:text=About%20the%20California%20Public%20Utilities%20Commission%20%28CPUC%29%20The,transportation%20companies%2C%20in%20addition%20to%20authorizing%20video%20franchises.About the California Public Utilities Commission (CPUC)

[19] Fact Sheet: Cathodic Protection. PHMSA. (n.d.). https://primis.phmsa.dot.gov/comm/FactSheets/FSCathodicProtection.htm

[20] Selecting a centrifugal compressor - aiche. (n.d.-d). https://www.aiche.org/sites/default/files/cep/20130644.pdf

pipeline, such as interruptions in the pipeline external coating which may cause corrosion, and for the purpose of quantifying voltage (IR) drops other than those across the structure electrolyte boundary, such as when performed as a current interrupted, depolarized, or native survey.

Control Center Modernization (CCM) - Will enable Gas Control to further digitalize the existing natural gas transmission system with new field assets such as optical pipeline monitoring (OPM) stations and high consequence area (HCA) methane sensors.

Department of Transportation (DOT) - A federal agency of the United States government that oversees the transportation system of the country. The DOT aims to ensure the safety, efficiency, accessibility, and sustainability of various modes of transportation, such as air, road, rail, water, and transit. The DOT also supports the development and innovation of transportation infrastructure, technology, and policy.

Digital Construction Management (DCM) - These systems take advantage of modern technologies such as cloud computing, artificial intelligence, and real-time data processing to streamline and coordinate work processes across an organization and throughout the project.

Direct Economic and Employment Impacts - The set of expenditures applied to the I-O multipliers for an impact analysis. It is one or more production changes or expenditures made by producers/consumers as a result of an activity or policy. Direct effects can be positive or negative. [21]

Environmental and Safety Compliance Management Program (ESCMP) - Based on compliance, training, environmental & safety goals, and assessments of compliance.

Geographic Information Systems (GIS) - Geographic Information Systems (GIS) are systems that capture, store, analyze, and display spatial or geographic data. GIS can be used to create maps, models, and simulations that show the patterns, relationships, and trends of various phenomena that occur on the Earth's surface or in the atmosphere.

High Consequence Areas (HCA) - Unusually sensitive environmental areas (defined in 195.6), urbanized areas and other populated places (delineated by the Census Bureau, and commercially navigable waterways. [22]

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[21] Demski, J. (n.d.). Understanding IMPLA
N: Multipliers. Understanding IMPLAN: Multipliers. https://blog.implan.com/understanding-implan-multipliers

[22] HL IM fact sheet. PHMSA. (n.d.-a). https://www.phmsa.dot.gov/pipeline/hazardous-liquid-integrity-management/hl-im-fact-sheet

Indirect Economic and Employment Impacts - Business to business purchases in the supply chain taking place in the region that stem from the initial industry input purchases.[23]

Induced Economic and Employment Impacts - Impacts include the value of **goods and s**ervices purchased throughout the regional economy -- goods and services not directly associated with the project, but which would otherwise not be purchased without the activity generated by that project.

Inline Inspection (ILI) - A technique used to assess the integrity of natural gas transmission pipelines from the inside of the pipe and is used by Southern California Gas Company (SoCalGas) as part of its ongoing pipeline integrity program. [24]

Integrity Management Program (IMP) - The Gas Transmission Integrity Management Rule resulted in regulations (49 CFR Part 192, Subpart O) which specify how pipeline operators must identify, prioritize, assess, evaluate, repair and validate the integrity of gas transmission pipelines that could, in the event of a leak or failure, affect High Consequence Areas (HCAs) within the United States. These HCAs include certain populated and occupied areas.[25]

Location Class 1 - Any 1.6km (1 mile) section that has ten or fewer buildings intended for human occupancy. A Location Class 1 is intended to reflect areas such as wasteland, deserts, wetlands, mountains, grazing land, farmland and sparsely populated areas.[26]

Location Class 1, Division 1 - Not applicable to hydrogen service and not recognized in this Code. [27]

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[23] Demski, J. (n.d.-a). Understanding IMPLAN: Multipliers. Understanding IMPLAN: Multipliers. https://blog.implan.com/understanding-implan-multipliers

[24] In-line inspection of pipelines - SoCalGas. (n.d.-b). https://www.socalgas.com/documents/news-room/fact-sheets/In-LinePipelineInspection.pdf

[25] Transmission Integrity Management Program (TIMP). PHMSA. (n.d.-a). https://www.phmsa.dot.gov/pipeline/gas-transmission-integrity-management/gas-transmission-integrity-management-gt-im-overview

[26] ASME B31.12, PL-3.2.2

[27] ASME B31.8

Location Class 1, Division 2 - Class 1 where the design factor of the pipe is equal to or less than .72 and has been tested to 1.1 times the maximum-operating pressure (ASME B31.12, PL-3.7.1-6 provides exceptions to design factor).[28]

Location Class 2 - Any 1.6 km (1 mile) section that has more than 10 but fewer than 46 buildings intended for human occupancy. A Location Class 2 is intended to reflect areas where the degree of the population is intermediate between Location Class 1 and Location Class 3, such as fringe areas around cities and towns, industrial areas, ranch or country estates, etc.[29]

Location Class 3 - Any 1.6 km (1 mile) section that has 46 or more buildings intended for human occupancy, except when a Location Class 4 prevails. A Location Class 3 is intended to reflect areas such as suburban housing developments, shopping centers, residential areas, industrial areas, and other populated areas not meeting Class 4 requirements.[30]

Location Class 4 - Includes areas where multistory buildings are prevalent, where traffic is heavy or dense, and where there may be numerous other utilities underground. Multistory means four or more floors above ground, including the first or ground floor. The depth of basements or number of basement floors is immaterial.[31]

Longshoremen - A Longshoreman, also known as a dock worker or a stevedore, plays a crucial role in the maritime industry, primarily responsible for the loading, unloading, securing, and transferring of cargo in ports. [32]

Moderate Consequence Areas (MCA) - An onshore area that is within a potential impact circle, as defined in §192.903, containing either: (i) Five or more buildings intended for human occupancy; or (ii) Any portion of the paved surface, including shoulders, of a designated interstate, other freeway, or expressway, as well as any other principal arterial roadway with 4 or more lanes.

National Center for Construction Education and Research (NCCER) - A non-profit education foundation established in 1996 that provides various credential and certification training.

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[28] ASME B31.12, PL-3.2.2

[29] ASME B31.12, PL-3.2.2

[30] ASME B31.12, PL-3.2.2

[31] ASME B31.12, PL-3.2.2

[32] Longshoreman. BuildStream. (n.d.). https://www.buildstream.co/job-descriptions/longshoreman

National Fire Protection Association (NFPA) - Started as a Boston-based organization for fire sprinkler codes has grown to become the leading global advocate for the elimination of death, injury, property, and economic loss due to fire, electrical, and related hazards. [33]

Operator Qualification (OQ) - Each pipeline operator is responsible for developing an OQ program, following their written OQ plan, establishing a covered task list applicable to their system, and defining the training and qualification requirements for personnel performing covered tasks on their pipeline facility. [34]

Optical Pipeline Monitoring (OPM) - The Optical Pipeline Safety Monitoring System (OPM) sends pulses of light the thickness of a human hair through glass that can be measured inside the optical cable. When installed along a pipeline, the technology can detect vibrations, stress, or abnormal changes in temperature to within 20 feet of where a problem may be developing. [35]

Pipeline and Hazardous Materials Safety Administration (PHMSA) - Mission is to protect people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential to our daily lives.

Pipeline Safety Management System (PSMS) - A holistic approach to enhancing pipeline safety by promoting safety awareness, vigilance, and cooperation company-wide. A successfully implemented PSMS will highlight safety risks and provide a framework for addressing them with the goal of reducing pipeline incident rate and liability costs. [36]

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[33] Learn more about NFPA: The National Fire Protection Association. nfpa.org. (n.d.-a). https://www.nfpa.org/About-NFPA

[34] Operator qualification overview. PHMSA. (n.d.d). https://www.phmsa.dot.gov/pipeline/operator-qualifications/operator-qualification-overview

[35] SoCalGas' Innovative Optical Pipeline Safety Monitoring System set to expand after successful pilot program: SoCalGas Newsroom. SoCalGas. (2023a, September 6). https://newsroom.socalgas.com/stories/socalgas-innovative-optical-pipeline-safety-monitoring-system-set-to-expand-after#:~:text=The%20Optical%20Pipeline%20Safety%20Monitoring%20System%20%28OPM%29%20sends,feet%20of%20where%20a%20problem%20may%20be%20developing.

[36] Aga-Guideline-for-Implementation-of-PSMS.pdf. (n.d.-b). http://pipelinesms.org/wp-content/uploads/2019/05/AGA-guideline-for-implementation-of-PSMS.pdf

Reciprocating Compression - Positive displacement in which the compressing and displacing element is a piston having a reciprocating motion within a cylinder. [37]

Supervisory Control and Data Acquisition Systems (SCADA) - The primary network to monitor pipeline system performance, gather critical operating data (flow, pressures, and temperatures), including leak detection information, and compressor performance among other data.

Systems Analysis Programming (SAP) - SAP has the capabilities to plan, schedule, execute and refine operations and asset maintenance. SAP Plant Maintenance (PM) is a module within the SAP ERP (Enterprise Resource Planning) software suite. Its primary focus is on managing and maintaining an organization's assets and equipment. Here are some key points about SAP PM:

1. Maintenance Activities: SAP PM handles various maintenance activities performed in a plant, including:

- Inspections: Identifying damages and issues.
- Notifications: Reporting maintenance needs.
- Corrective Maintenance: Repairing technical objects.
- Preventive Maintenance: Scheduled maintenance to prevent breakdowns.
- Repairs: Addressing equipment failures.

2. Benefits:

- Streamlines maintenance processes.
- Optimizes resource utilization.
- Improves overall equipment effectiveness.

12. REFERENCES

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[37] PetroWiki. (2015, June 2). Reciprocating compressor. https://petrowiki.spe.org/Reciprocating_compressor

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13. APPENDICES

- Appendix A – Employment Impact Analysis