

HEAVY INDUSTRIAL CONSTRUCTION AND MAINTENANCE WORKFORCE OUTLOOK TO 2023

November 2016



PURPOSE AND BASIS OF WORKFORCE PROJECTIONS

- The SIM-Construction, formerly OILMAP, is a collaboration between the government of Alberta and COAA that has been in place since January 2012.
 - The purpose is to provide a better understanding of heavy industrial construction and maintenance workforce demands in Alberta.
- The projects are based on micro-economic modelling and are updated twice a year: Spring (May) and Fall (November)
- The forecasts are based on projects that have been reported by individual companies and from online public announcements identified in the Economic Development and Trade major projects list.
- The forecasts for the ongoing and turnaround maintenance are based on historical data from the General Presidents' Maintenance Committee for Canada and the National Maintenance Council for Canada.

UPDATES IN NOVEMBER 2016 – 2016 FALL PROJECTION

Forecasts were collected from companies between August and September 2016 and includes the following:

1) Heavy Industrial Construction Projects

- On-Site Construction
 - Oil Sands (Mining, In-situ, Upgrading)
 - Petrochemical
 - Pipeline (Pipelines, Pump-stations, Terminals)
 - Power Generation (Wind & Gas)
- Off-Site Module Fabrication

2) Maintenance Projects

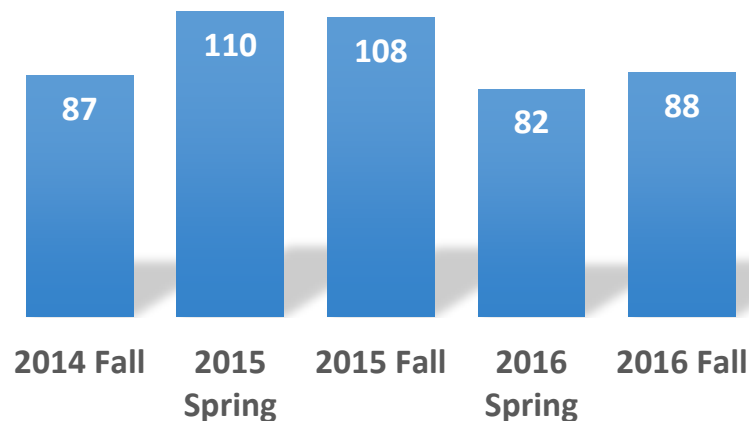
- Ongoing Maintenance
- Turn-around maintenance

PROJECTS CATEGORIES IN PROJECTION

- **There are six categories of projects:**
- **Projects included in the model are:**
 - **APPROVED:** individual companies have reported that they already have regulatory approval.
 - **PENDING APPROVAL:** individual companies have reported they are waiting for the regulatory approval.
 - **UNKNOWN STATUS:** individual companies that did not confirm the projects status, publicly announced projects on-line, and projects collected by EDT. The regulatory status are unknown for these projects.
- **Projects removed from the forecast model are:**
 - **ON HOLD:** individual companies have reported that the projects are currently put on hold.
 - **CANCELLED:** individual companies have reported that the projects are cancelled.
 - **COMPLETED:** individual companies have reported that the projects are completed.

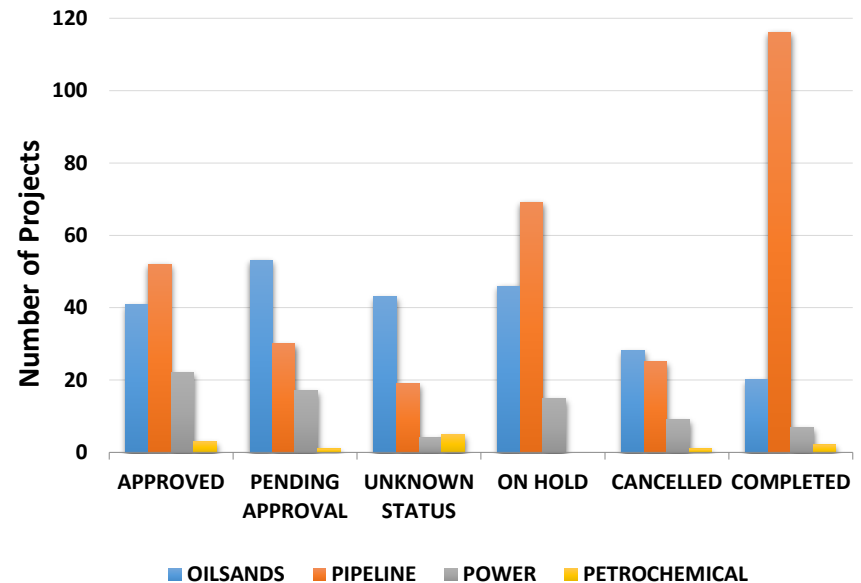
NUMBER OF COMPANIES

- **A total of 88 companies were surveyed to provide updates.**
- **Companies include:**
 - **Oil Sands – 39 in situ, 7 mining, and 5 upgrading**
 - **Petrochemical – 10**
 - **Pipeline – 14**
 - **Power – 13**
- **46 companies out of 88 responded to the Ministry**



PROJECTS IN THE FALL 2016 PROJECTION

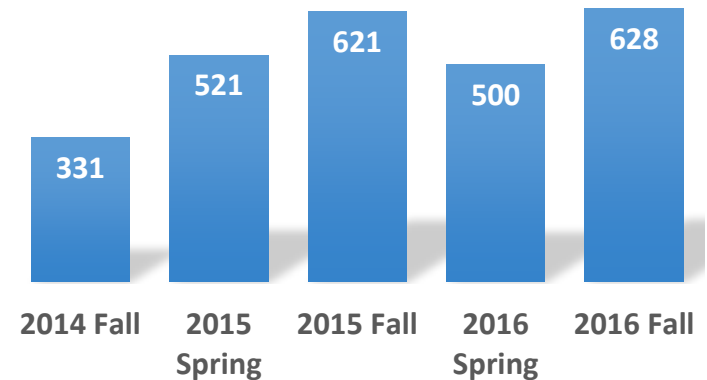
- **A total of 628 projects were identified for this forecast.**
 - **APPROVED: 118 projects**
 - 68 projects are started for construction prior to Jan 2017
 - 27 projects are planned to start construction in 2017
 - 23 projects are planned to start construction from 2018 on words
 - **PENDING APPROVAL: 101 projects**
 - 22 projects are started for construction prior to Jan 2017
 - 17 projects are planned to start construction in 2017
 - 62 projects are planned to start construction from 2018 on words
 - **UNKNOWN STATUS: 71 projects**
 - 31 projects are started for construction prior to Jan 2017
 - 12 projects are planned to start construction in 2017
 - 28 projects are planned to start construction from 2018 on words
 - **CANCELLED & ON HOLD: 193 projects**
 - **COMPLETED: 145 projects**



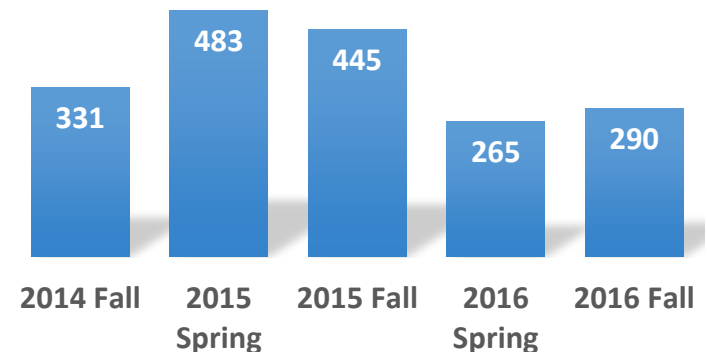
PROJECTS IN THE FALL 2016 PROJECTION – COMPARISON ACROSS PROJECTIONS

- A total of 628 heavy industrial construction projects were identified.
 - Include all six categories (Approved, Pending Approval, Unknown Status, on hold/cancelled, completed)
 - The project numbers vary since projects are removed and added if no information can be obtained from the company or found online.
- 290 projects were used for labour demand projection.
 - Include three categories (Approved, Pending Approval, and Unknown Status)

Total Number of Projects



Projects in Labour Demand Projection



PROJECT PLAN — 2016 FALL PROJECTION PROJECTIONS

Project Timing

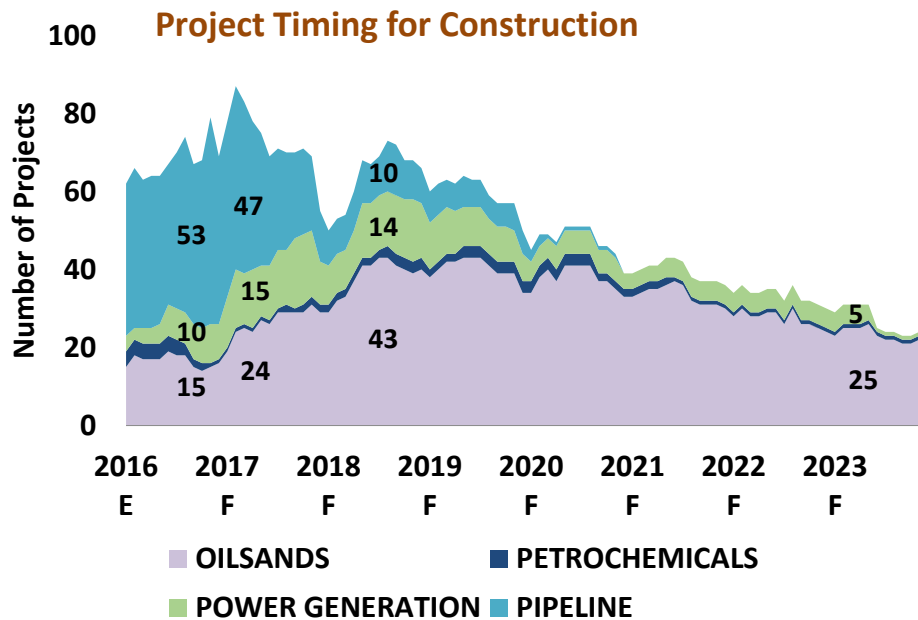
- In Nov 2016, 79 projects were under construction
 - 15 oil sands, 1 petrochemical, 10 power, and 53 pipeline
- In February 2017, 87 projects will be under construction
 - 24 oil sands, 1 petrochemical, 15 power, and 47 pipeline
- In July 2018, 69 projects will be under construction
 - 43 oil sands, 2 petrochemical, 14 power, and 10 pipeline

Project Planned to Start

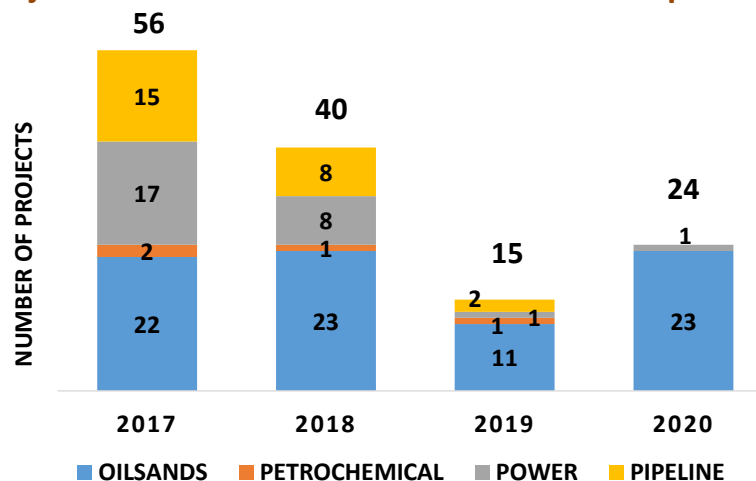
- In 2017, 56 projects are planned to start construction
 - 22 oil sands, 2 petrochemical, 17 power, and 15 pipeline
- In 2018, 40 projects will start construction
 - 23 oil sands, 1 petrochemical, 8 power, and 8 pipeline
- In 2019, 15 projects will start construction
 - 11 oil sands, 1 petrochemical, 1 power, and 2 pipeline
- In 2020, 24 projects will start construction
 - 23 oil sands, and 1 power

Note

- Projects start and end dates vary and project durations are different depending on the type and size of particular projects

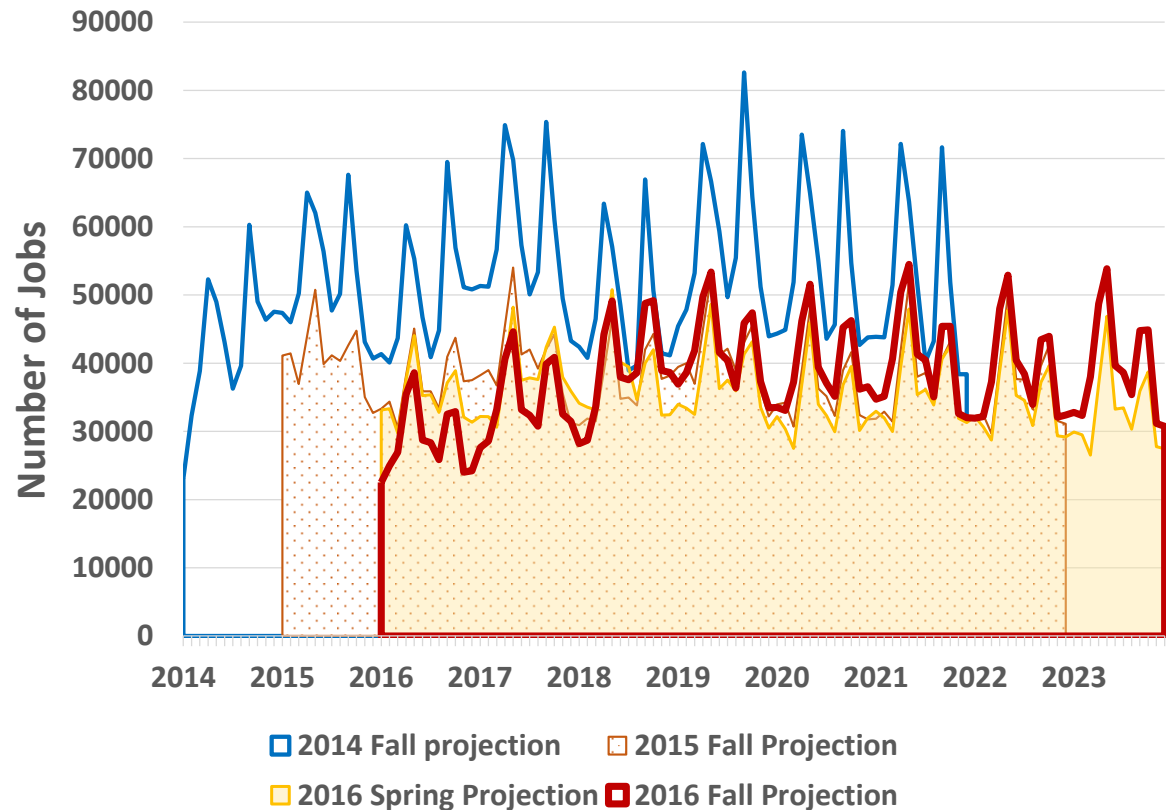


Projects Planned to Start Construction in Respective Year



OVERALL HEAVY INDUSTRIAL CONSTRUCTION AND MAINTENANCE WORKFORCE REQUIREMENTS – COMPARISON ACROSS PROJECTIONS

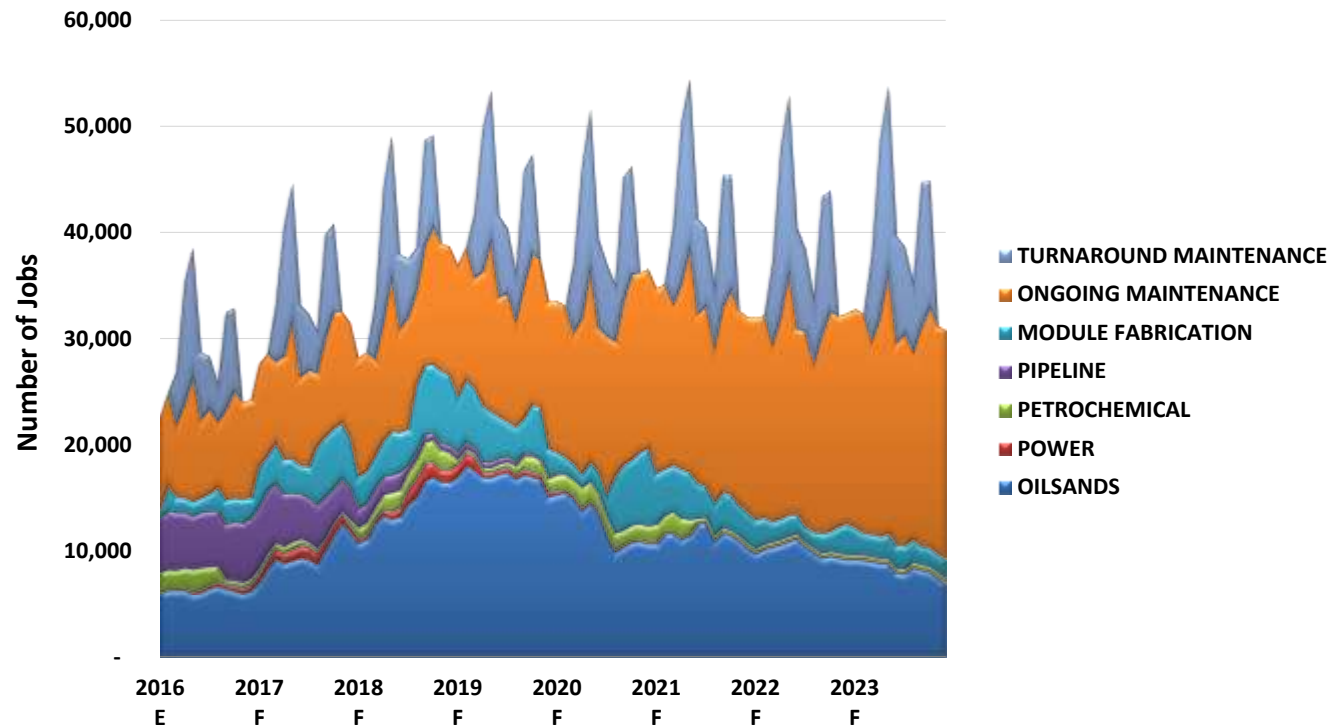
- In 2017, approximately 45,000 jobs will be required.
 - 6.6% lower than the 2016 spring projection of 48,200 jobs
 - 16.6% lower than the 2015 fall projection of 54,000 jobs
 - 40% lower than the 2014 fall projection of 75,300 jobs



OVERALL HEAVY INDUSTRIAL CONSTRUCTION WORKFORCE REQUIREMENT BY SUB-SECTORS – 2016 FALL PROJECTION

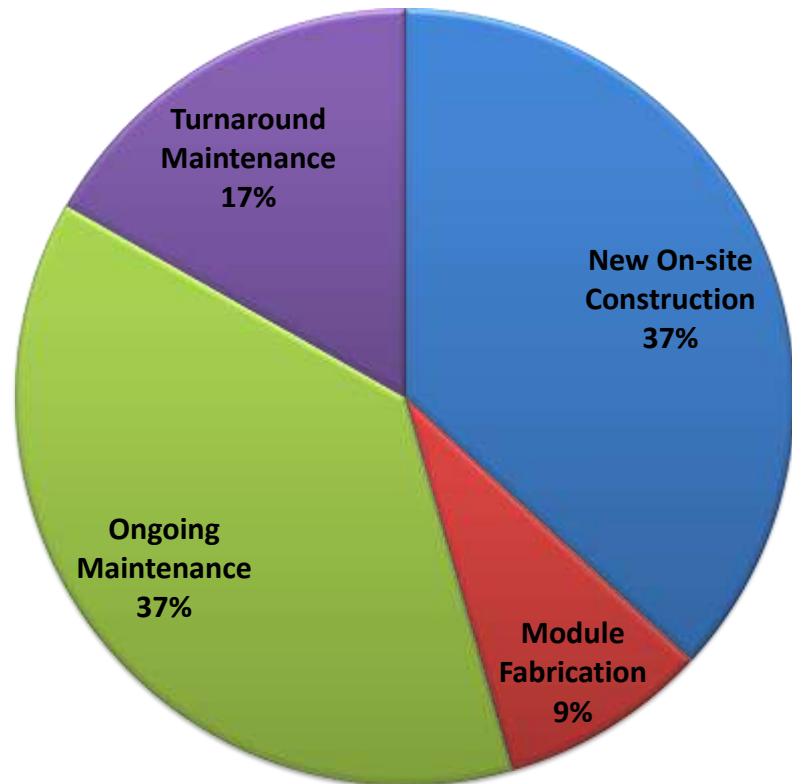
Workforce requirements in each sector are as follows.

- **Oil sands:** will peak at 18,000 jobs in 2019.
- **Power:** will peak at 1,800 jobs in 2018.
- **Petrochemical:** will peak at 2,000 jobs in 2018.
- **Pipeline:** will peak at 6,000 jobs in 2017.
- **Module Fabrication:** will peak at 7,300 jobs in 2020.
- **Ongoing Maintenance:** increase to 24,600 jobs in 2023, 48% higher than 12,900 jobs in 2017.
- **Turnaround Maintenance:** increase to 17,600 jobs in 2023, 26% higher than 13,000 jobs in 2017.

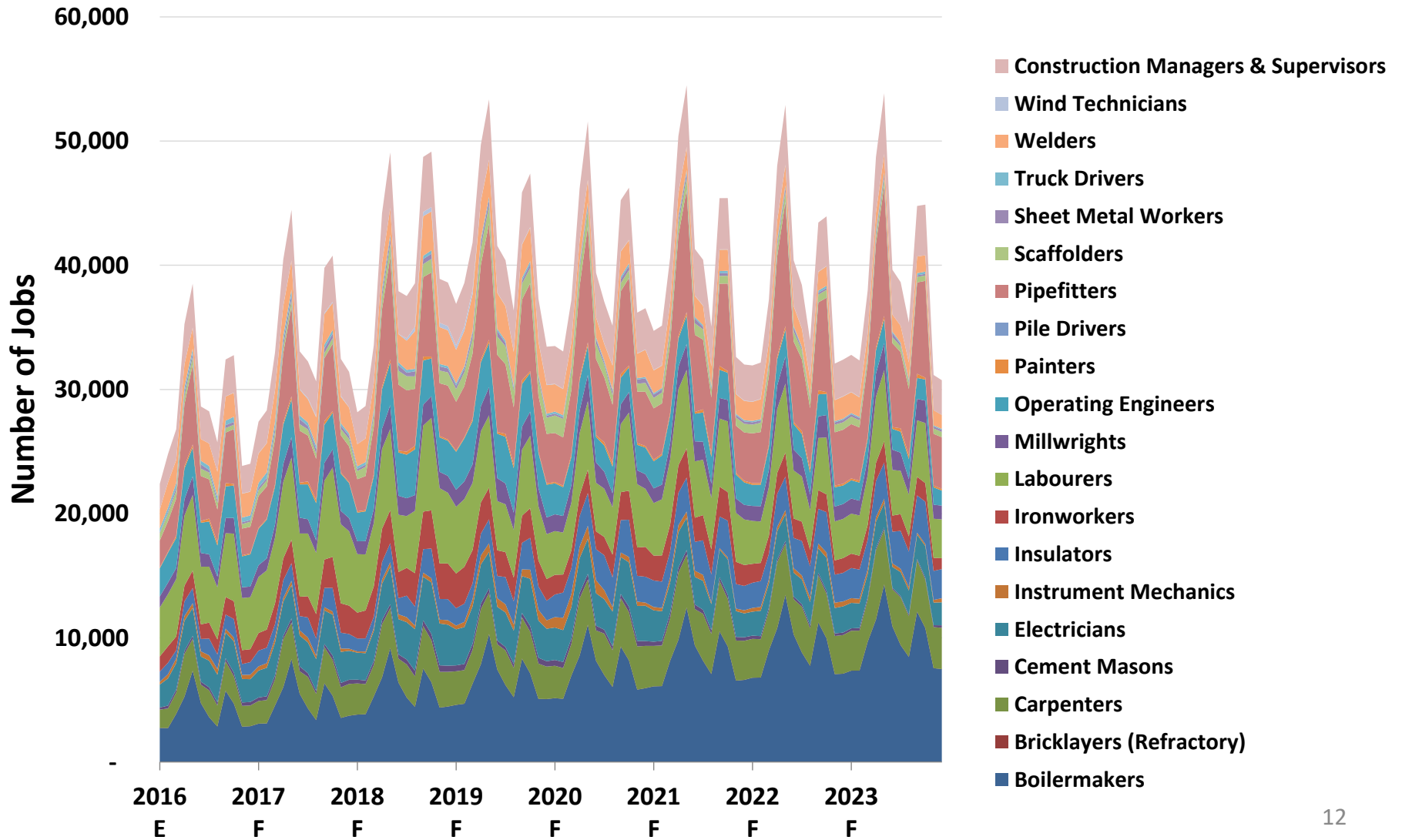


DISTRIBUTION OF WORKFORCE REQUIREMENT BY TYPE OF PROJECTS – 2016 FALL PROJECTION

- For the periods 2016 – 2023, the projection horizon, 37% of construction workforce will be needed in new on-site construction and 9% will be needed in off-site module fabrication.
- Workforce requirements in maintenance sector increase over time and account for 54% of total heavy industrial construction workforce.
 - Existing facilities are getting older and require more maintenance.
 - New facilities are coming online.

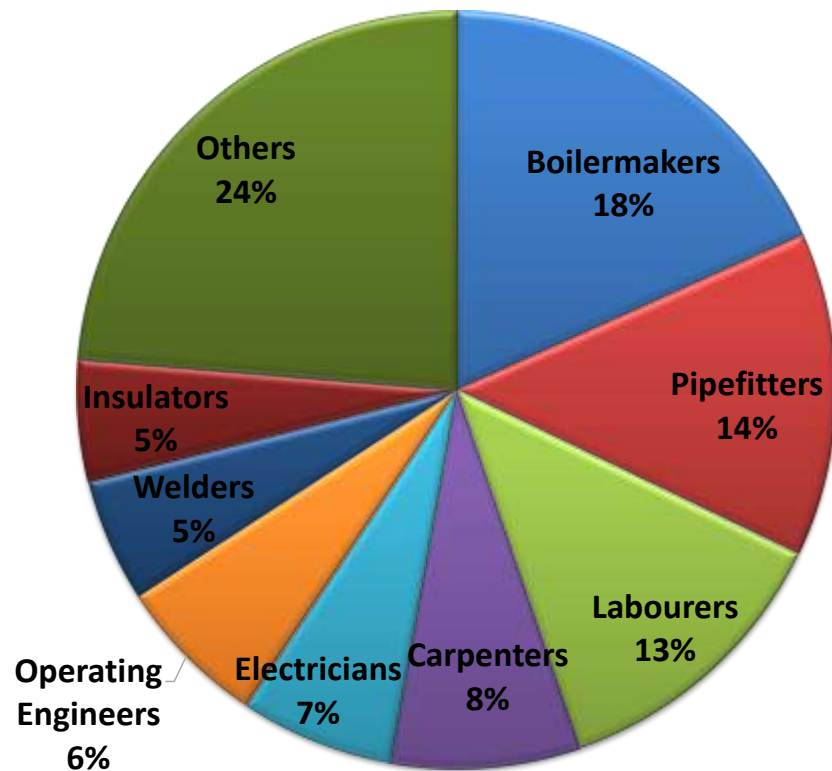


OVERALL HEAVY INDUSTRIAL CONSTRUCTION WORKFORCE REQUIREMENT BY OCCUPATIONS — 2016 FALL PROJECTION



DISTRIBUTION OF WORKFORCE REQUIREMENT FOR HEAVY INDUSTRIAL CONSTRUCTION BY OCCUPATION – 2016 FALL PROJECTION

- For the period 2016 - 2023, the top eight major trades account for 76% of total construction and maintenance workforce:
 - Boilermakers 18% - 14,300 jobs
 - Pipefitters 14% - 100,400 jobs
 - Labourers 13% - 7,400 jobs
 - Carpenters 8% - 5,500 jobs
 - Electricians 7% - 4,100 jobs
 - Operating Engineers 6% - 3,700 jobs
 - Insulators 5% - 3,400 jobs
 - Welders 5% - 3,200 jobs

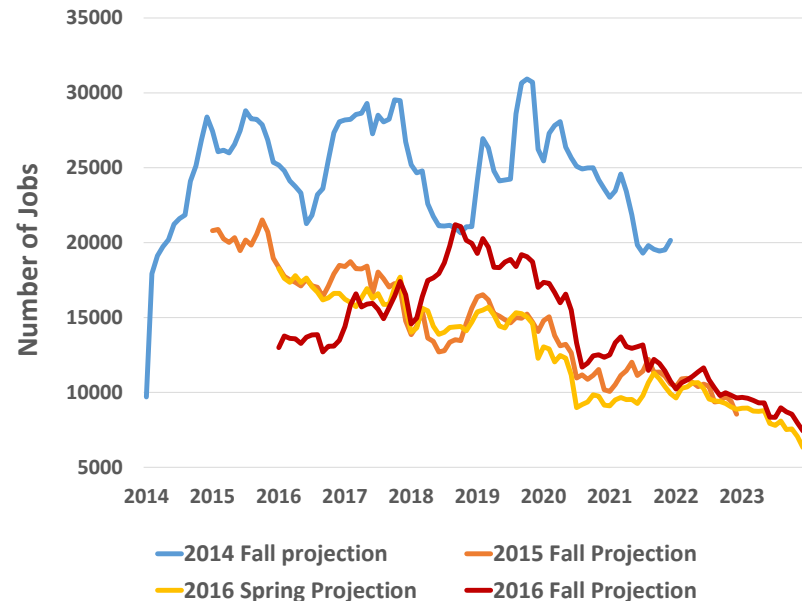


ON-SITE HEAVY INDUSTRIAL WORKFORCE

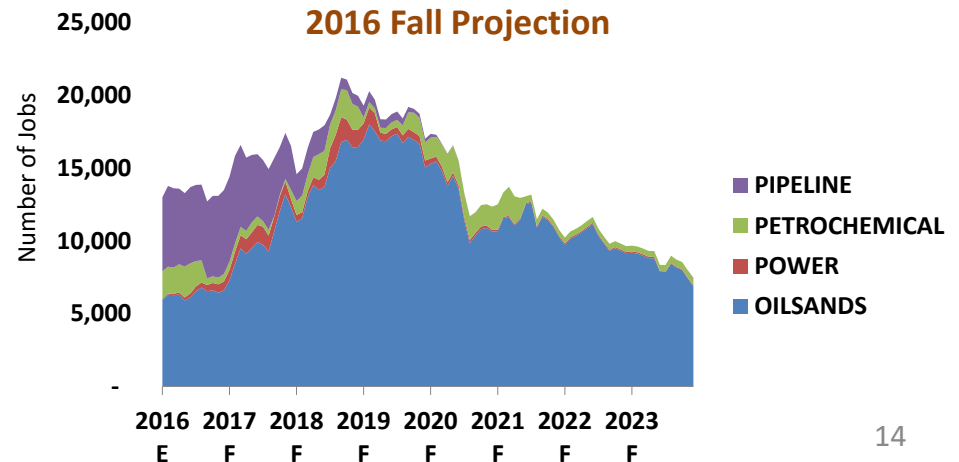
REQUIREMENT - ALL PLANNED NEW CONSTRUCTION

- In 2017, approximately 17,400 jobs will be required.
 - 1.7% lower than the 2016 spring projection of 17,700 jobs
 - 7% lower than the 2015 fall projection of 18,700 jobs
 - 41% lower than the 2014 fall projection of 29,500 jobs
- In 2017, on-site workforce demand for oil sands sector will account for 63% of total on-site workforce demand.

Comparison Across Projection



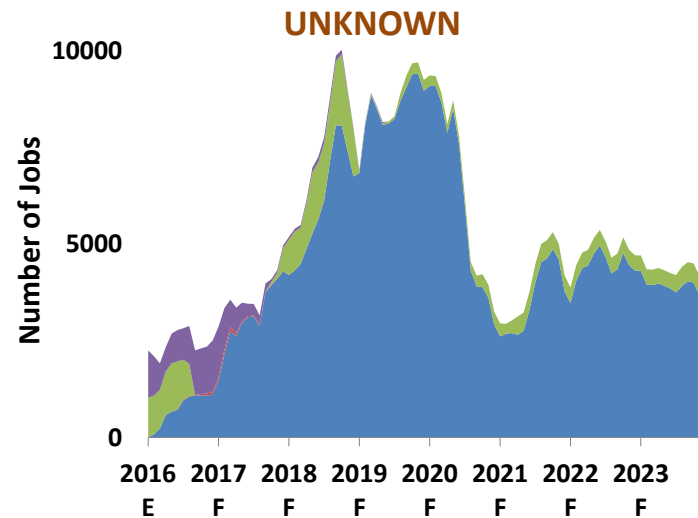
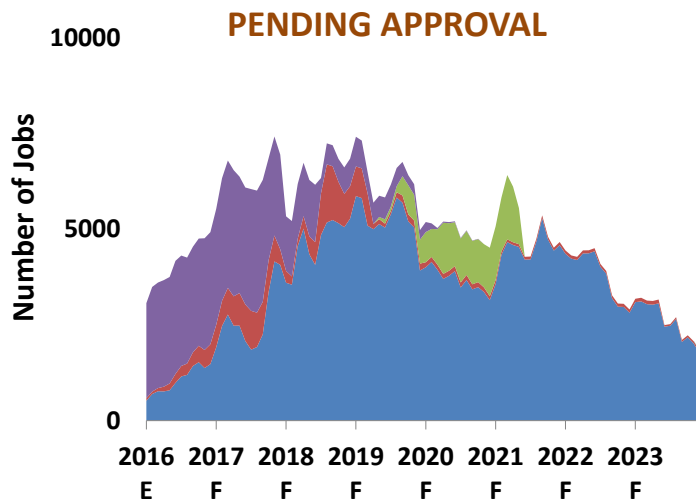
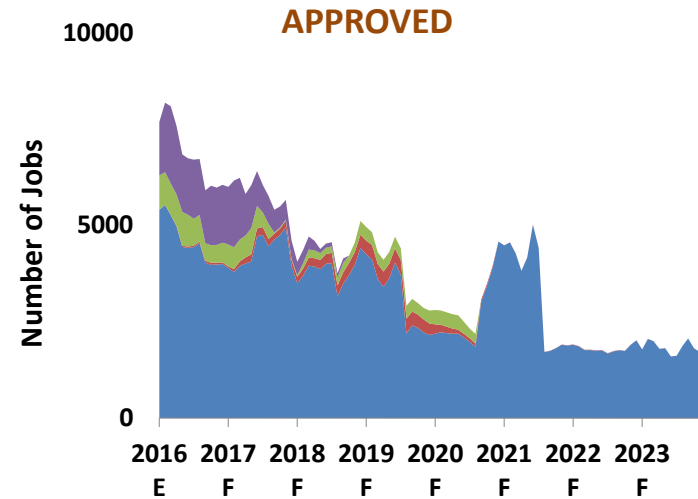
2016 Fall Projection



ON-SITE HEAVY INDUSTRIAL WORKFORCE REQUIREMENT

— BY REGULATORY APPROVAL STATUS

- In 2016, workforce requirement by regulatory approval status are:
 - APPROVED: 8,200 jobs.
 - PENDING APPROVAL: 4,900 jobs (22 projects may have been classified inaccurate by the companies)
 - UNKNOWN: 2,900 jobs
- In 2017, workforce requirement by regulatory approval status are:
 - APPROVED: 6,400 jobs.
 - PENDING APPROVAL: 6,800 jobs.
 - UNKNOWN: 4,900 jobs



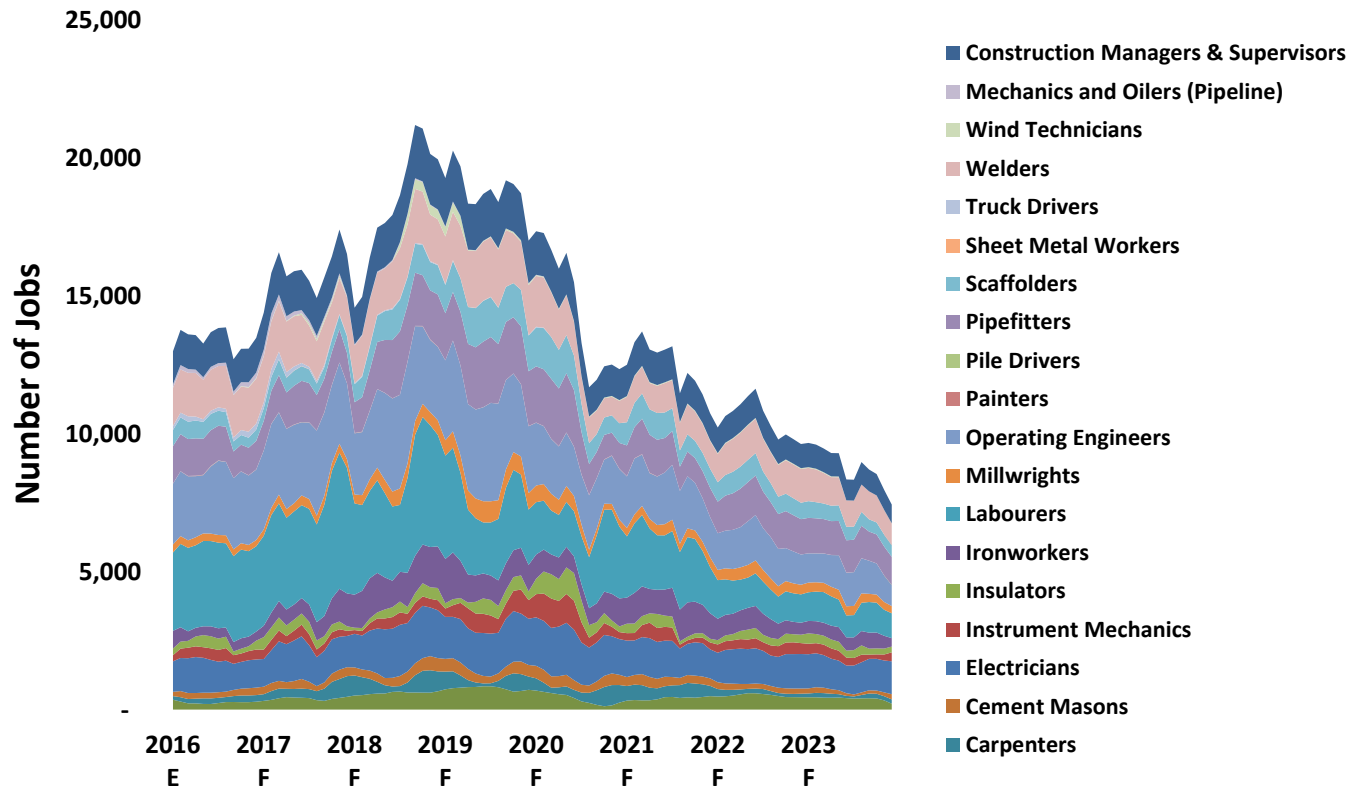
ON-SITE HEAVY INDUSTRIAL CONSTRUCTION WORKFORCE REQUIREMENT — BY OCCUPATIONS

- **Top five occupation include:**

- Labourers
- Operating Engineers
- Welders
- Pipefitters
- Electricians

- **In 2017, onsite workforce requirement is:**

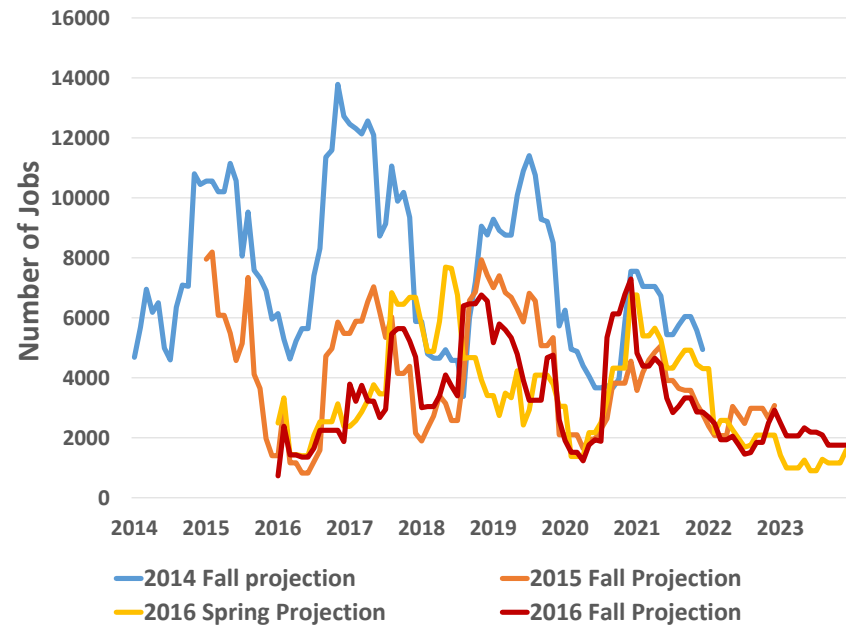
- 4,900 labours
- 3,000 operating engineers
- 1,800 welders
- 1,500 pipefitters
- 1,500 electricians



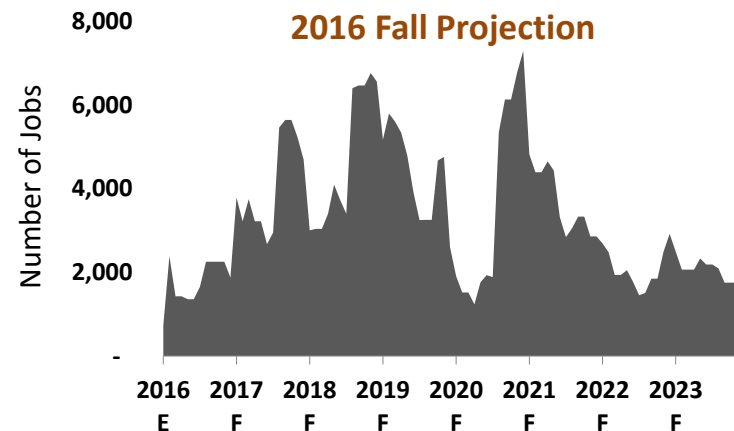
OFF-SITE MODULE FABRICATION WORKFORCE REQUIREMENT FOR PLANNED OIL SANDS CONSTRUCTION PROJECTS

- **In 2017, approximately 5,600 jobs will be required.**
 - 16.4% lower than the 2016 spring projection of 6,700 jobs
 - 20% lower than the 2015 fall projection of 7,000 jobs
 - 55% lower than the 2014 fall projection of 12,500 jobs
- **Workforce requirement for off-site module fabrication will peak twice:**
 - 6,700 jobs in 2018
 - 7,300 jobs in 2020

Comparison Across Projection

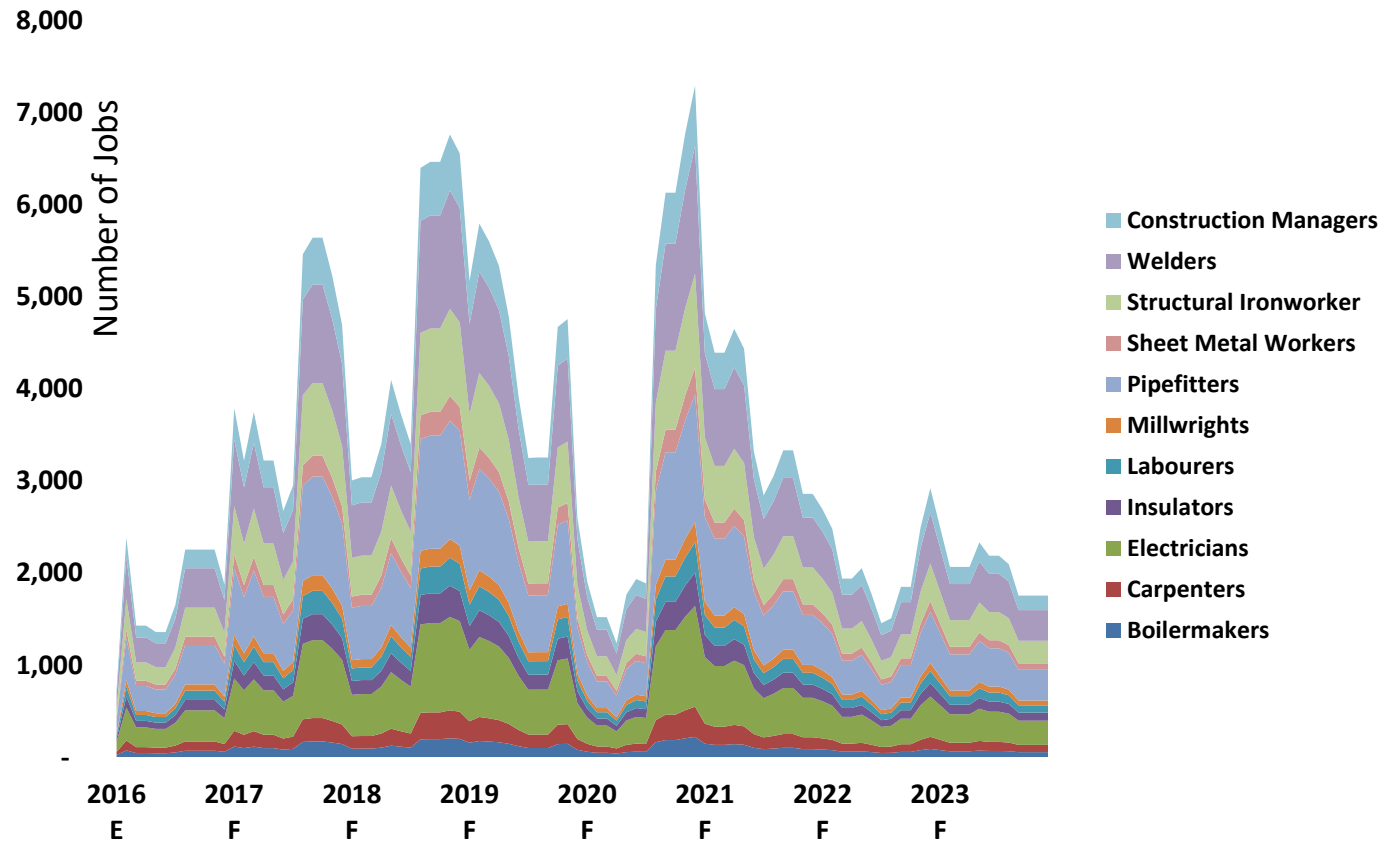


2016 Fall Projection



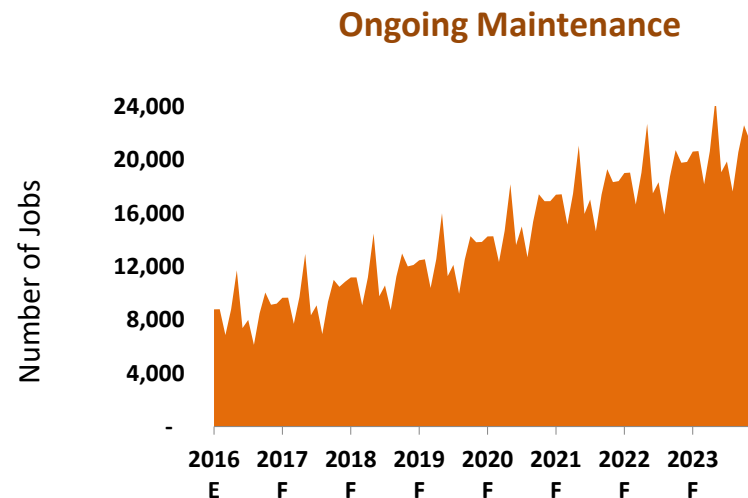
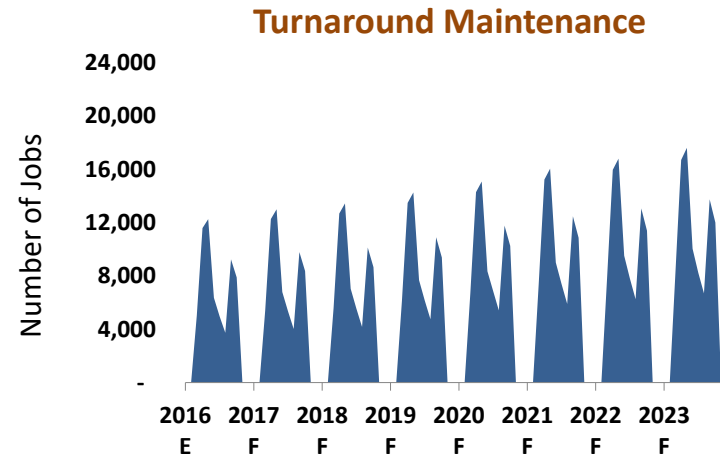
OFF-SITE MODULE FABRICATION WORKFORCE REQUIREMENT FOR PLANNED OIL SANDS CONSTRUCTION PROJECTS – BY OCCUPATIONS

- **Top five occupation and the requirement in 2017:**
 - 1,000 pipefitters
 - 1,000 welders
 - 850 electricians
 - 790 iron workers
 - 500 construction managers



MAINTENANCE WORKFORCE – ONGOING AND TURNAROUND

- Both turnaround and ongoing maintenance shows an upward trend as the industry shift from new construction to maintaining existing facilities for efficiency gain.
- By 2023, workforce requirement for:
 - Short-term turn around maintenance will need 17,600 jobs, and
 - Stable ongoing maintenance will need 24,600 jobs.
- Labour is moved from ongoing maintenance to turnaround projects during peak periods.



MAINTENANCE WORKFORCE – ONGOING AND TURNAROUND

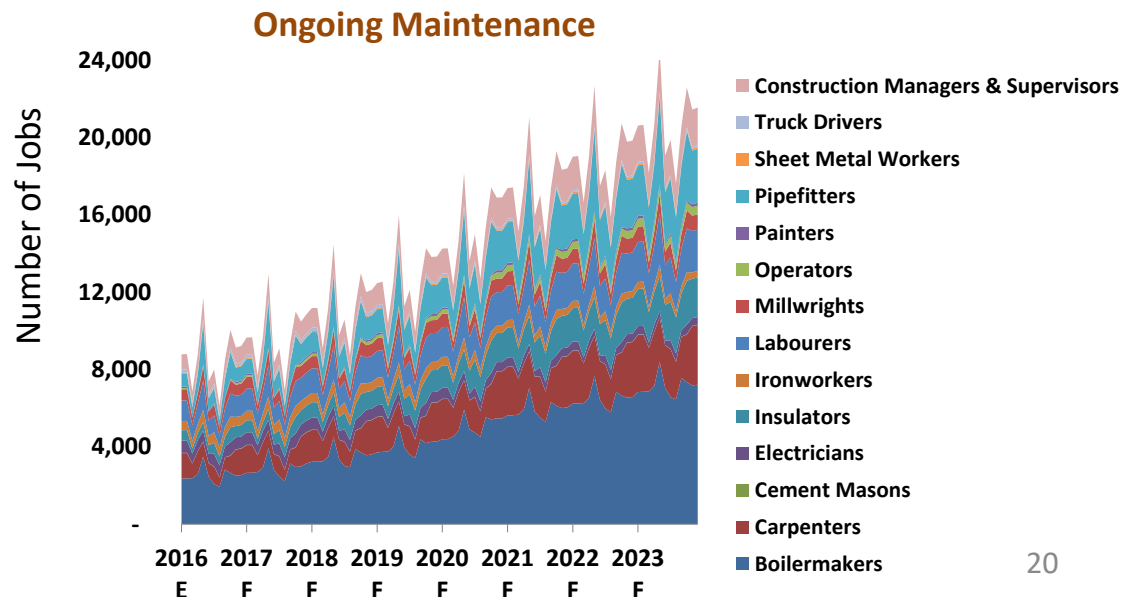
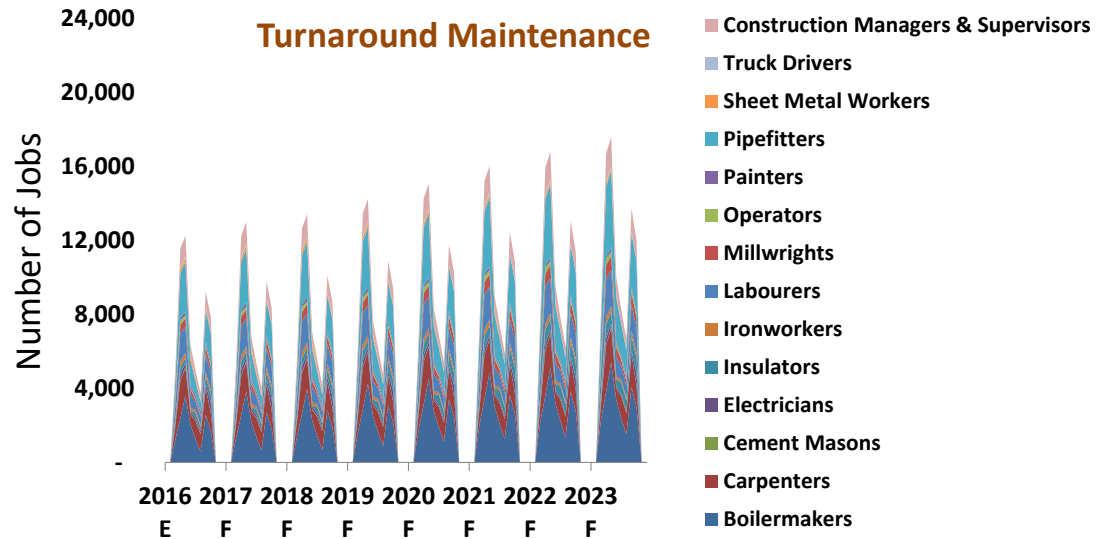
BY OCCUPATIONS

- Top five occupation for short-term (turnaround) maintenance work and required jobs in 2017:

- Boilermakers (3,850 jobs)
- Pipefitters (2,900 jobs)
- Carpenters (2,100 jobs)
- Labourers (1,600 jobs)
- Managers (1,200 jobs)

- Top five occupation for regular (ongoing) maintenance work and required jobs in 2017:

- Boilermakers (3,900 jobs)
- Pipefitters (2,400 jobs)
- Carpenters (1,600 jobs)
- Labourers (1,600 jobs)
- Managers (1,200 jobs)



CONCLUSION

- Due to steep decline of crude oil price since mid 2014, capital expenditures in the oil sands sector decreased nearly 50% to 2016.
- The sector was further challenged by the Fort McMurray wildfires in Mid 2016.
- Uncertainty of prices, higher environmental concerns, less market access, and undiversified market condition appears to have discourage the industry from further new investments and capital spending in the oil and gas sector.
- With current oil sands construction projects nearing completion and fewer new expansion projects on the horizon, the onsite construction and module fabrication subsectors will see a reduction of 4,000 workers by 2023.
- However, the reduced demand for new constructions (4,000 workers) will be offset by an increased requirement of about 18,000 workers for ongoing and turnaround maintenance activities which will create a requirement for 14,000 new jobs in 2023.
- A modest recovery is expected from 2018 onward if the sector can adjust to low oil price and low carbon economy by incorporating innovative technology for cost competitiveness and lower environmental foot-print.