Modeling of Methane Mitigation Options in US MARKAL
用美国MARKAL模型模拟甲烷减排方案

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Overview of Presentation
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- 初步的结果
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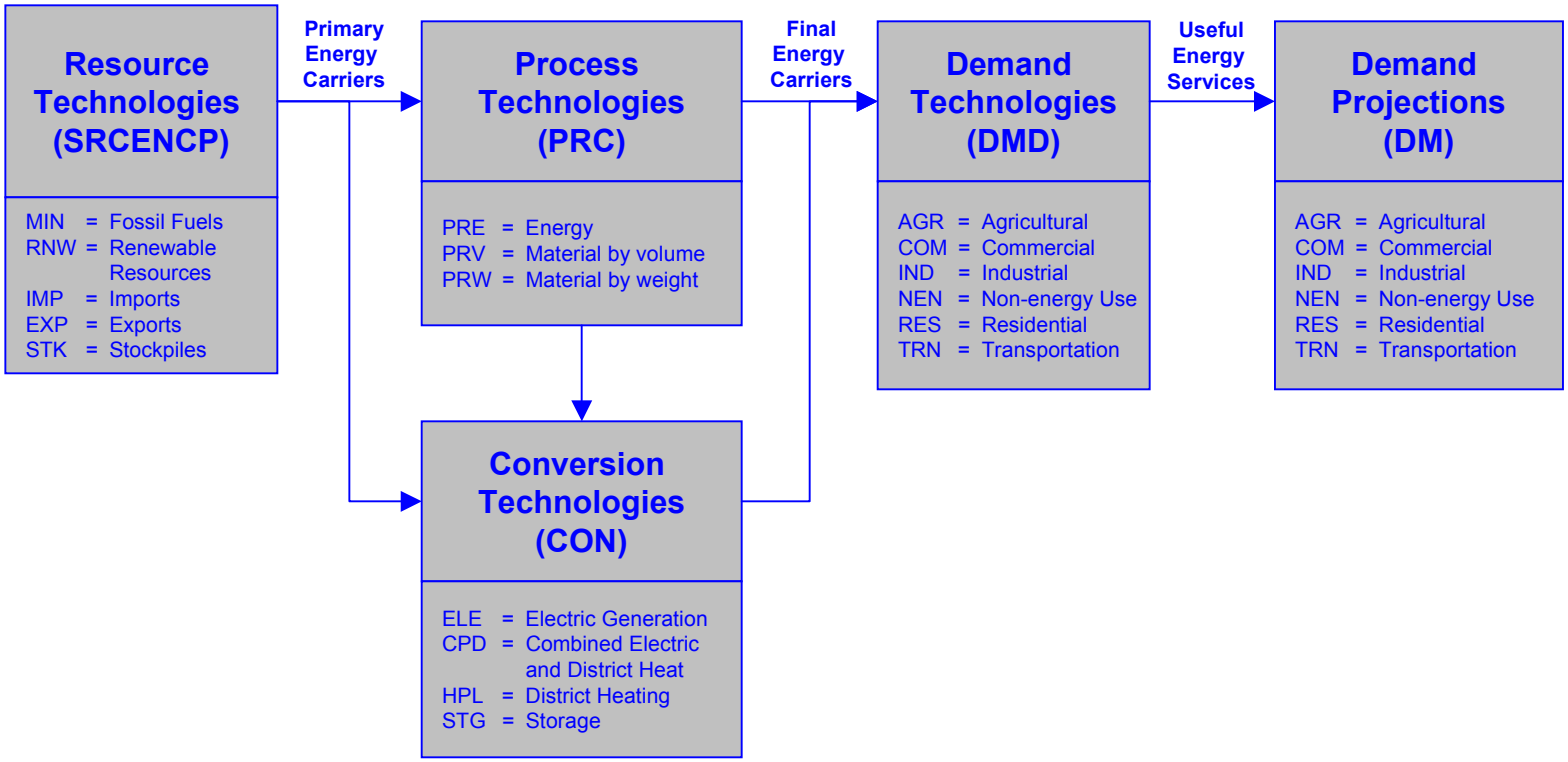
Simplified MARKAL Model Structure



Modeling Objectives 模拟的目的

- Track Methane Emissions
  - Energy System (Coal, Oil and Natural Gas)
  - Other Sources (Landfills and Manure Handling)
- Characterize a Wide Range of Mitigation Technologies That Could Be Introduced to Mitigate Methane Emissions
- Construct the Model As an Alternate Scenario to the Current EPA National Model and Integrated With the Base Scenario.
  - Enables Easy Running of the Model With or Without the Methane Subsystem.

- 跟踪甲烷排放
  - 能源系统（煤炭、石油和天然气）
  - 其它能源（填埋和粪便处理）
- 介绍能够用来减少甲烷排放的技术的特点
- 建立不同于当前美国国家环保局使用的"国家模型"的替代模型,并且同基准情景相结合
  - 在考虑和不考虑甲烷次系统的情况下保证模型的运行

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Data Sources 数据来源

- Historical data and projections of future emissions from EPA documents, most importantly:
  - Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021
  - U.S. Methane Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions
  - Addendum to the U.S. Methane Emissions 1990-2020: 2001 Update for Inventories, Projections, and Opportunities for Reductions
- Additional data from the AEO 2002

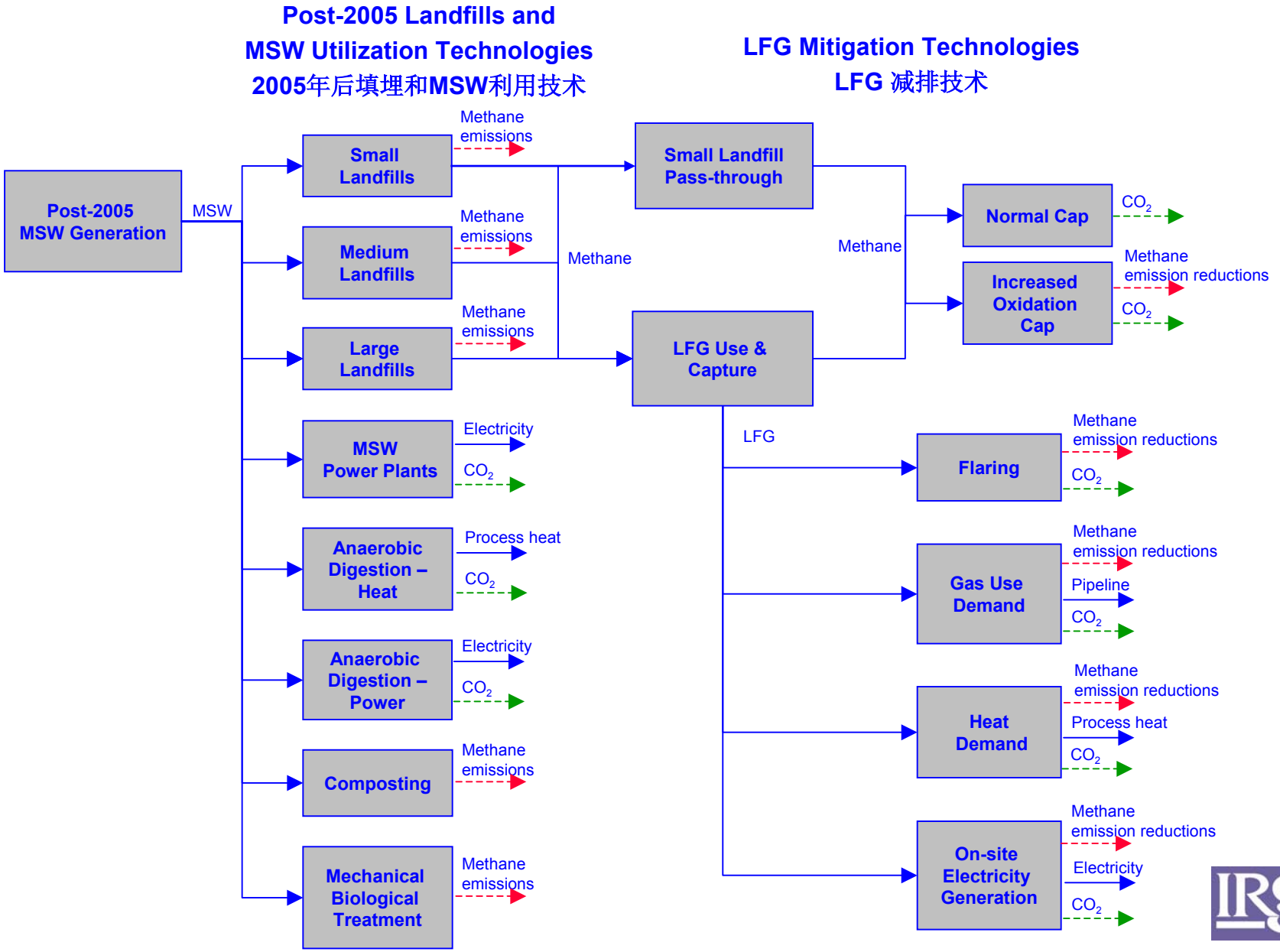
- 环保局文件提供的历史排放数据和未来排放量预测，主要是：
  - 1990-2020年美国温室气体排放和吸收汇的清单
  - 1990-2020年美国甲烷排放报告：清单、预测和可能的减排
  - 1990-2020年美国甲烷减排报告附件：2001年更新的清单、预测和可能的减排
- 2002年《年度能源展望》提供的补充数据

Data Development Spreadsheet
数据处理表格

Methane Tracking and Mitigation Options - EPA-CMOP Version 0.0 - Updated 9/26/2003

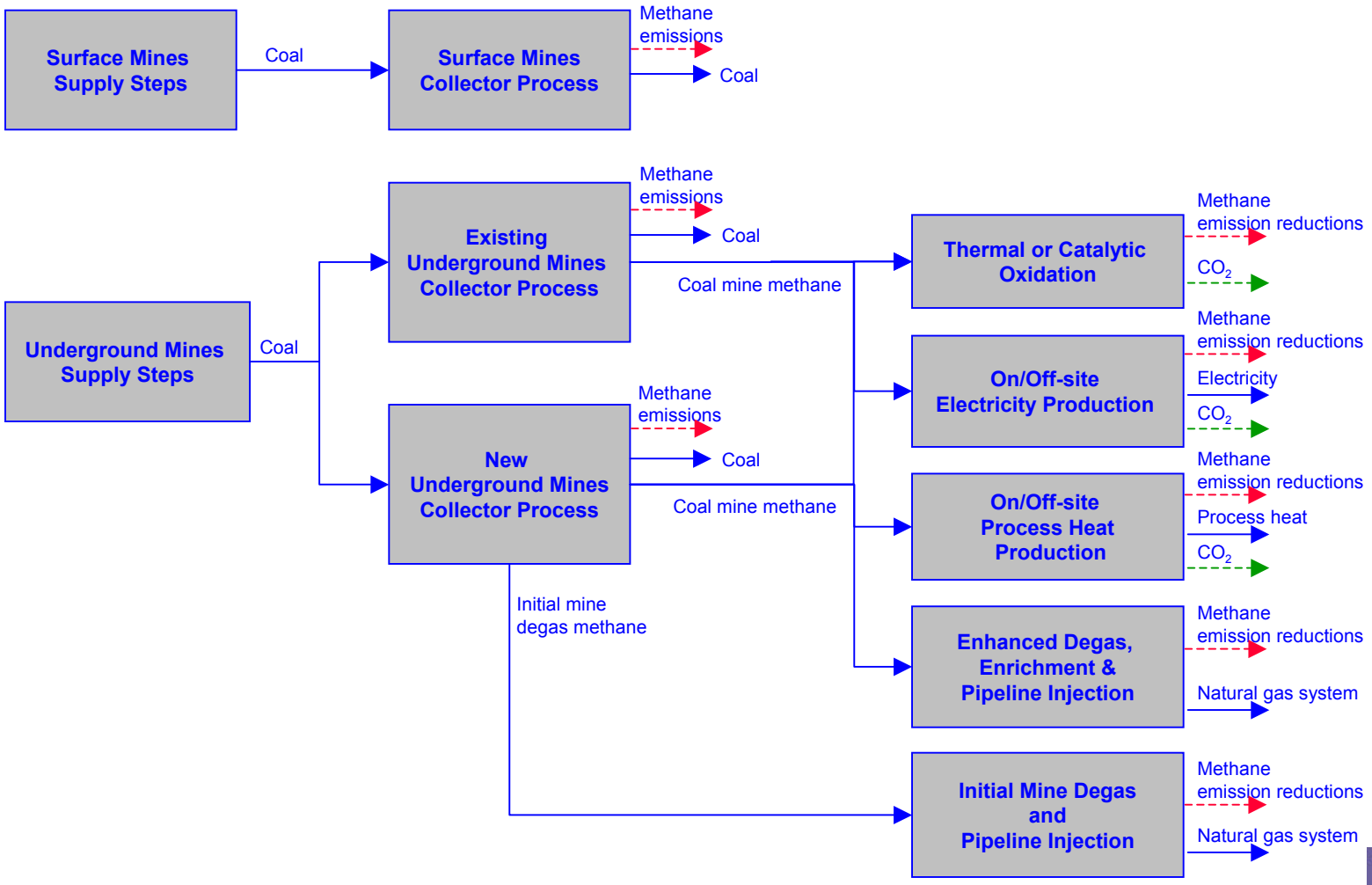
Group	Model Item Name
Municipal Solid Waste	
Source data for MSW	
MSW Mitigation technologies	
MSW Model data	
Landfills	
Source data for LFG	
LFG Mitigation Technologies	
LFG Model data	
Coal Mining	
Source data for CBM	
CBM Mitigation Technologies	
CBM Model data	
Manure Sources	
Source data for Manure	
Manure Mitigation Technologies	
Manure Model data	
Natural Gas System	
Source data for NGS	
NGS Mitigation Technologies	
NGS Model data	
Oil Production	
Source data for Oil	
Oil Mitigation Technologies	
Oil Model data	

New MSW Subsystem 新的MSW次系统

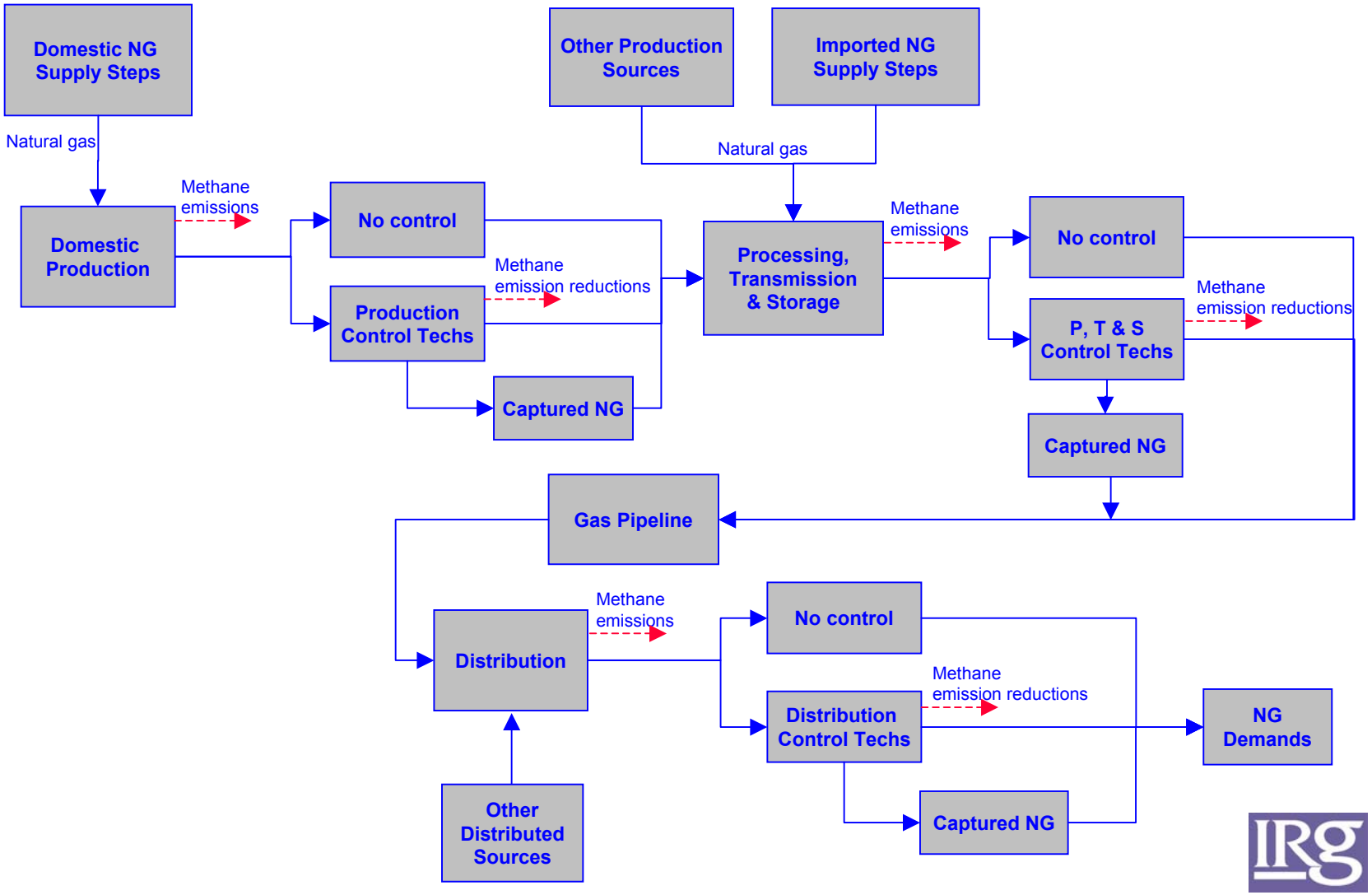


Coal Mine Methane Subsystem 煤层气次系统

Example: Appalachian High Sulfur 例子：山区高硫煤

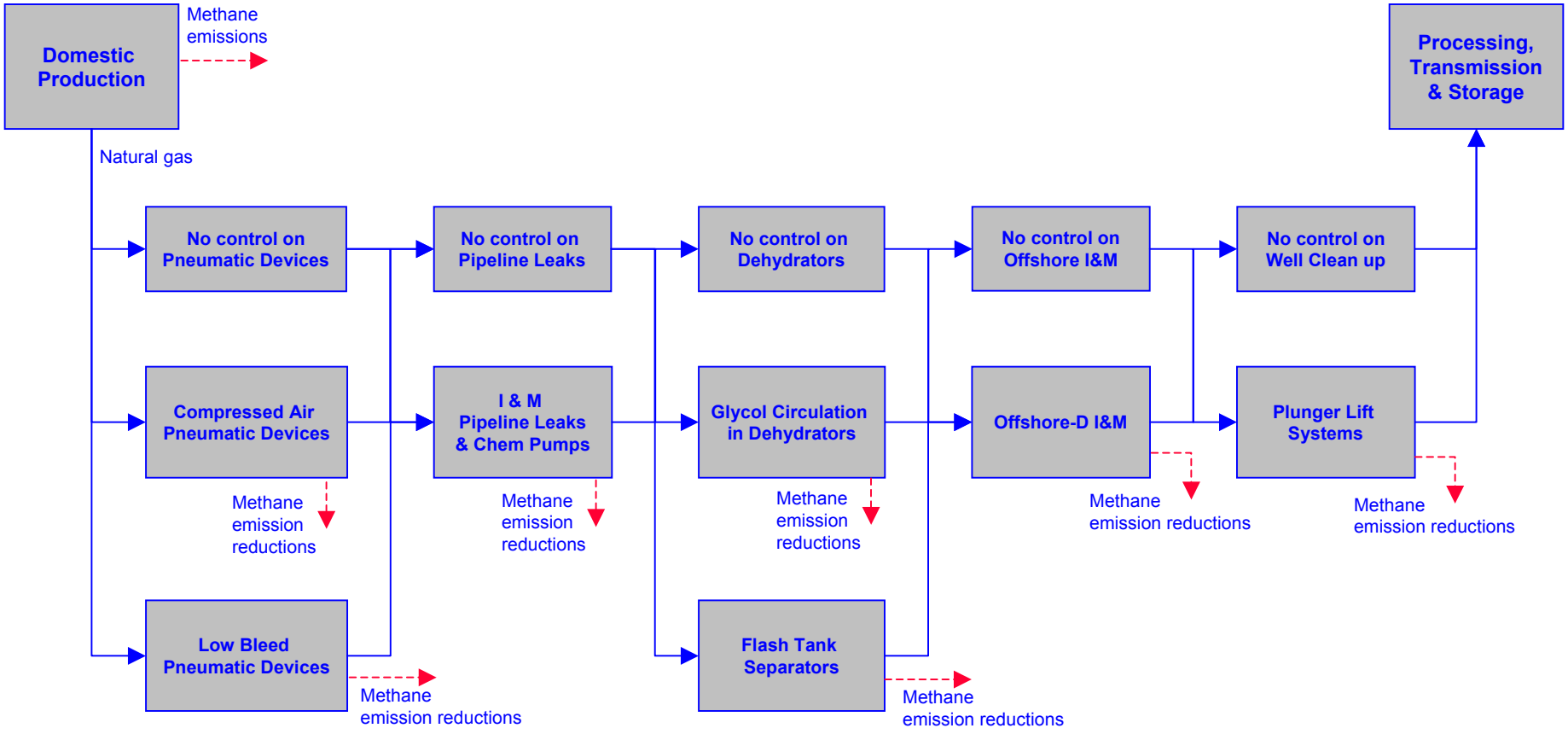


Natural Gas Methane Subsystem
天然气甲烷次系统

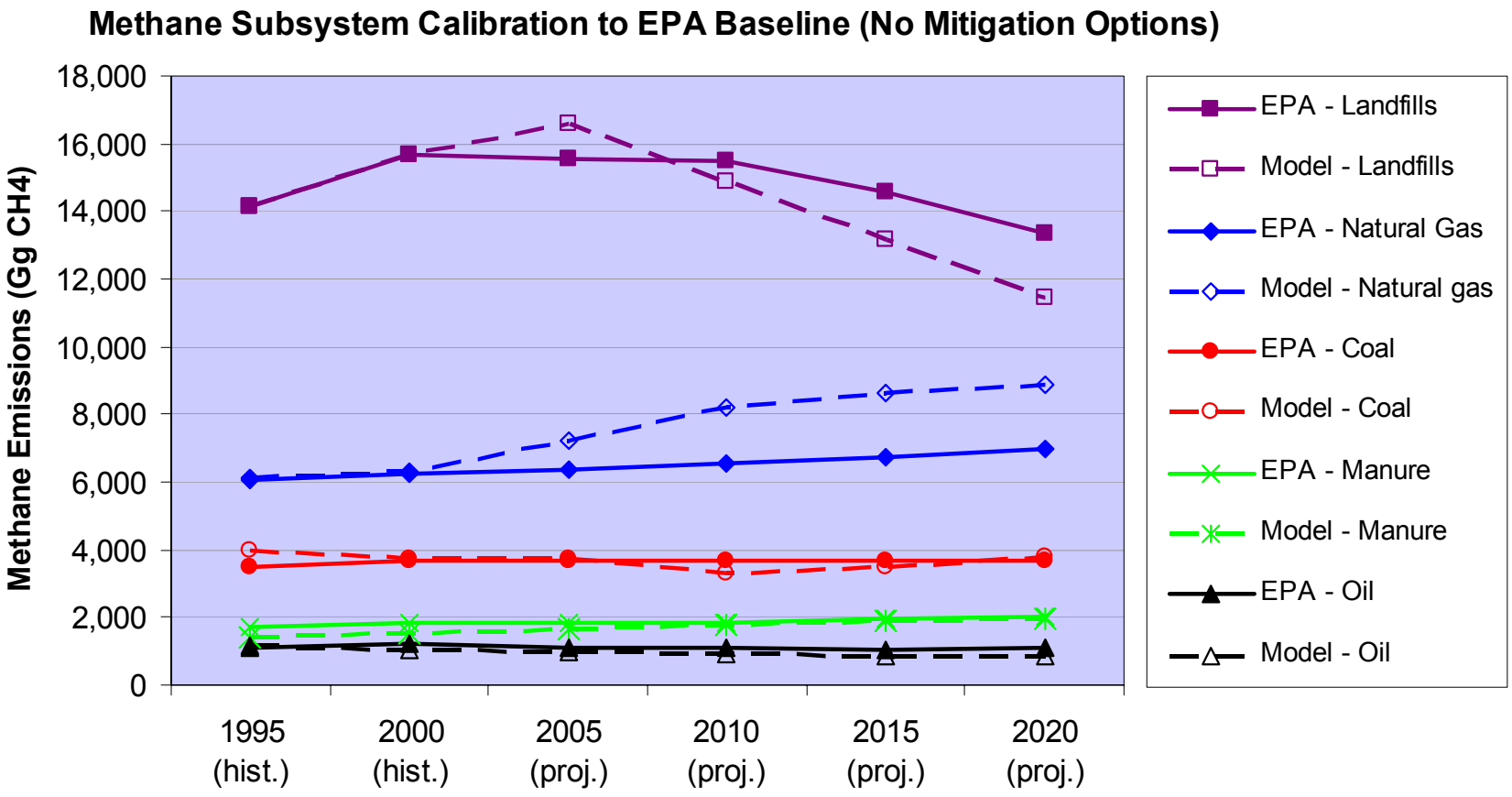


Natural Gas Production: Methane Control Technologies

天然气生产中的甲烷控制技术



Current Calibration Status 当前排放水平

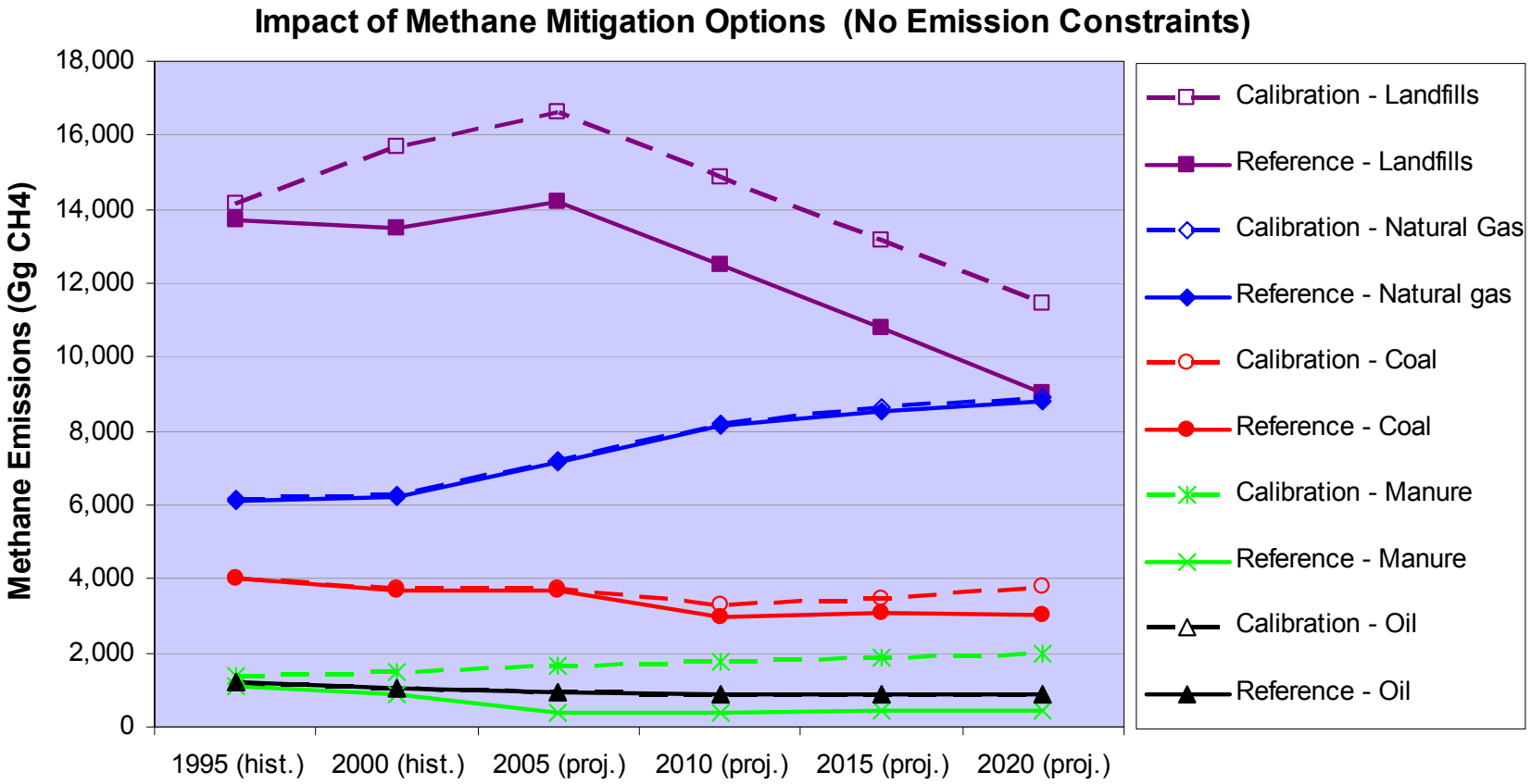


Comments on Calibration Status
有关排放水平的一些评论

- Model matches historical data quite well – Adjustments needed to
  - Split of surface vs underground coal and
  - Emission factors of different liquid treatment systems
- Reasons for differences in projected future emissions are being explored
  - Rate of decay in landfill emissions
  - Treatment of imported natural gas
- Mitigation technologies are most cost-effective for MSW, landfills and manure treatment

- 对历史数据的模拟比较准确，但需做下列调整
  - 区别表层和地下煤
  - 不同液体处理系统的排放因子
- 研究了不同未来排放预测结果的原因
  - 填埋腐烂程度不同会造成排放量的差异
  - 进口天然气的处理
- 对于MSW、填埋和粪便处理，减排技术在多数情况下有效且成本低

Preliminary Results - Reference Case
初步结果-参照案例



Preliminary Model Assessment
初步的模型评估

- Runs made with 10, 15 and 20% forced reduction in methane emissions
  - Landfills show the greatest reductions at the levels
  - Coal mine methane reductions are selected next
- Run results were used to generate a preliminary continuous emission cost curve
- More work needed to complete methane subsystem calibration and mitigation option characterization

- 就强制性甲烷减排10、15和20%进行模拟
  - 填埋带来的减排最多
  - 其次为煤层气减排
- 模拟结果用来描绘初步的连续减排成本曲线
- 刻划甲烷次系统的排放水平和分析减排方案的特点还需要更多的工作

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Status & Next Steps 当前进展和下步工作

- Methane sub-model is able to handle the complexities of the methane emission sectors and their interactions with the energy system
- Sectoral CO2 accounting will be added to the EPA national model
- Conduct an analysis setting CO2, CH4 and GHG mitigation goals
- Approach is portable to other MARKAL models, with “hooks” to the existing RES

- 甲烷次模型可以处理甲烷排放行业的复杂性及其同能源系统的相互作用
- 环保局“国家模型”中将加入行业二氧化碳的计算
- 为制定CO2, CH4 和其它温室气体减排目标进行分析
- 该方法对于其它MARKAL模型同样适用，且适合现有的能源系统