

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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第三次甲烷和一氧化氮减排会议

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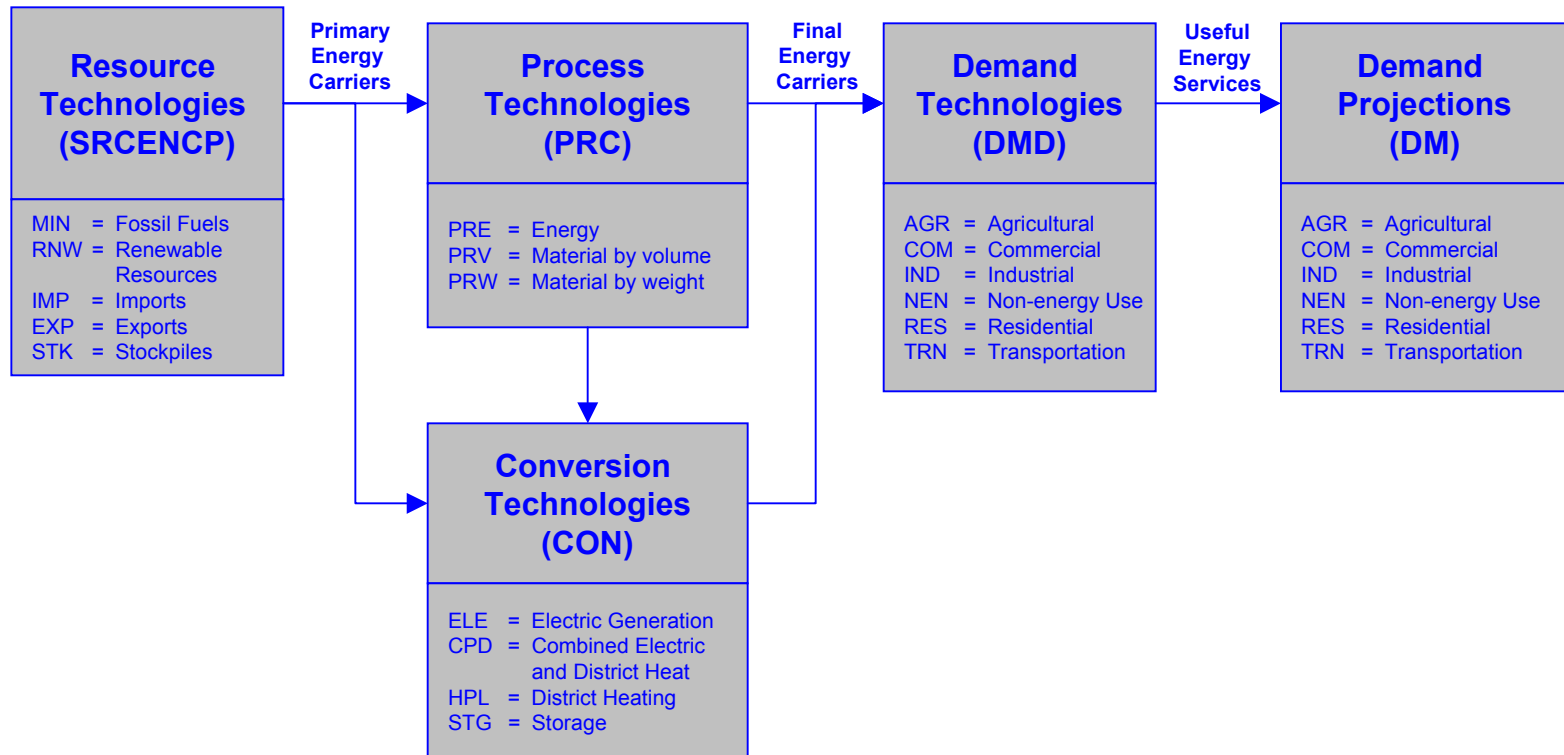


Overview of Presentation

发言概要

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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

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								

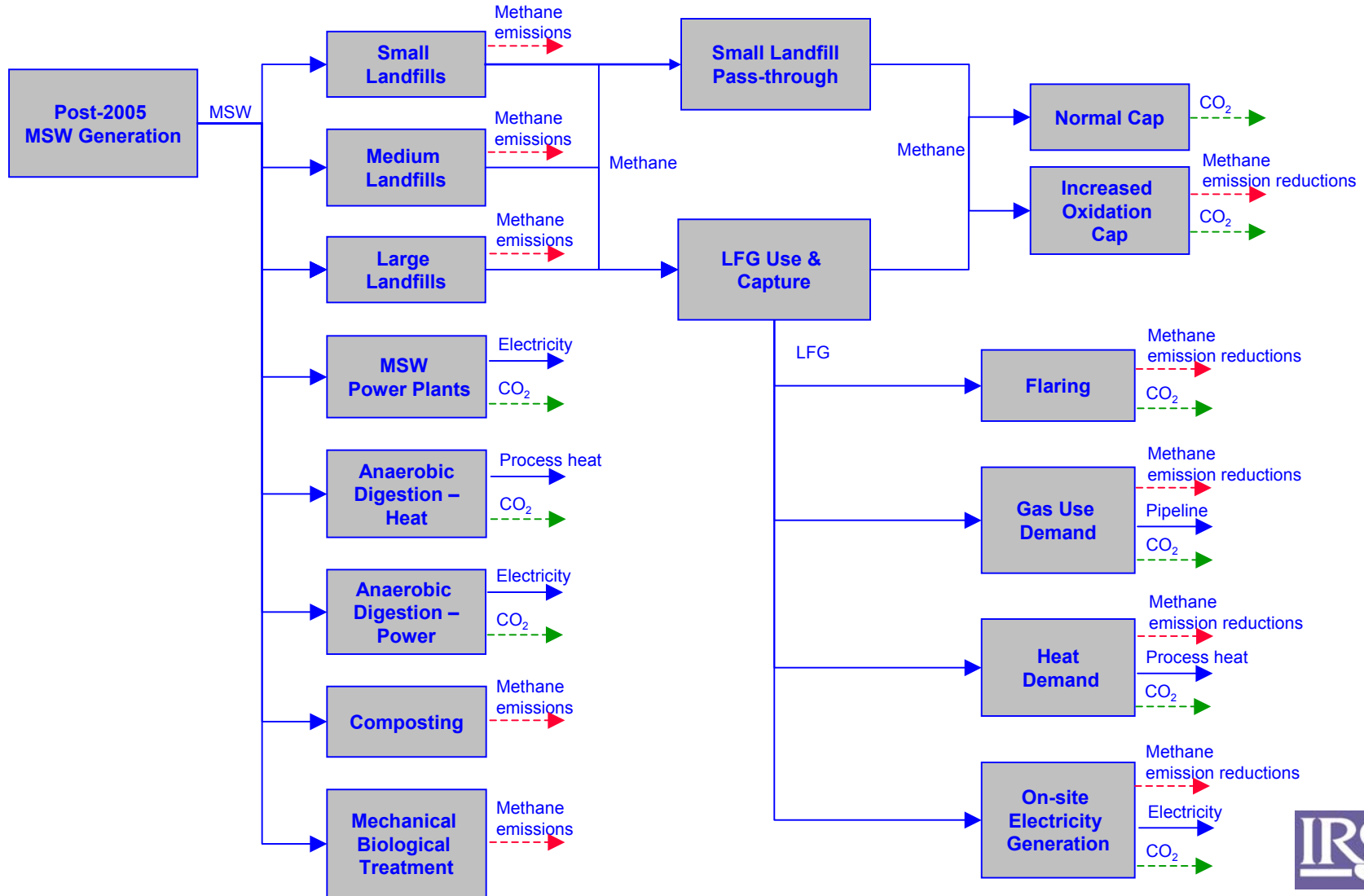


New MSW Subsystem

新的MSW次系统

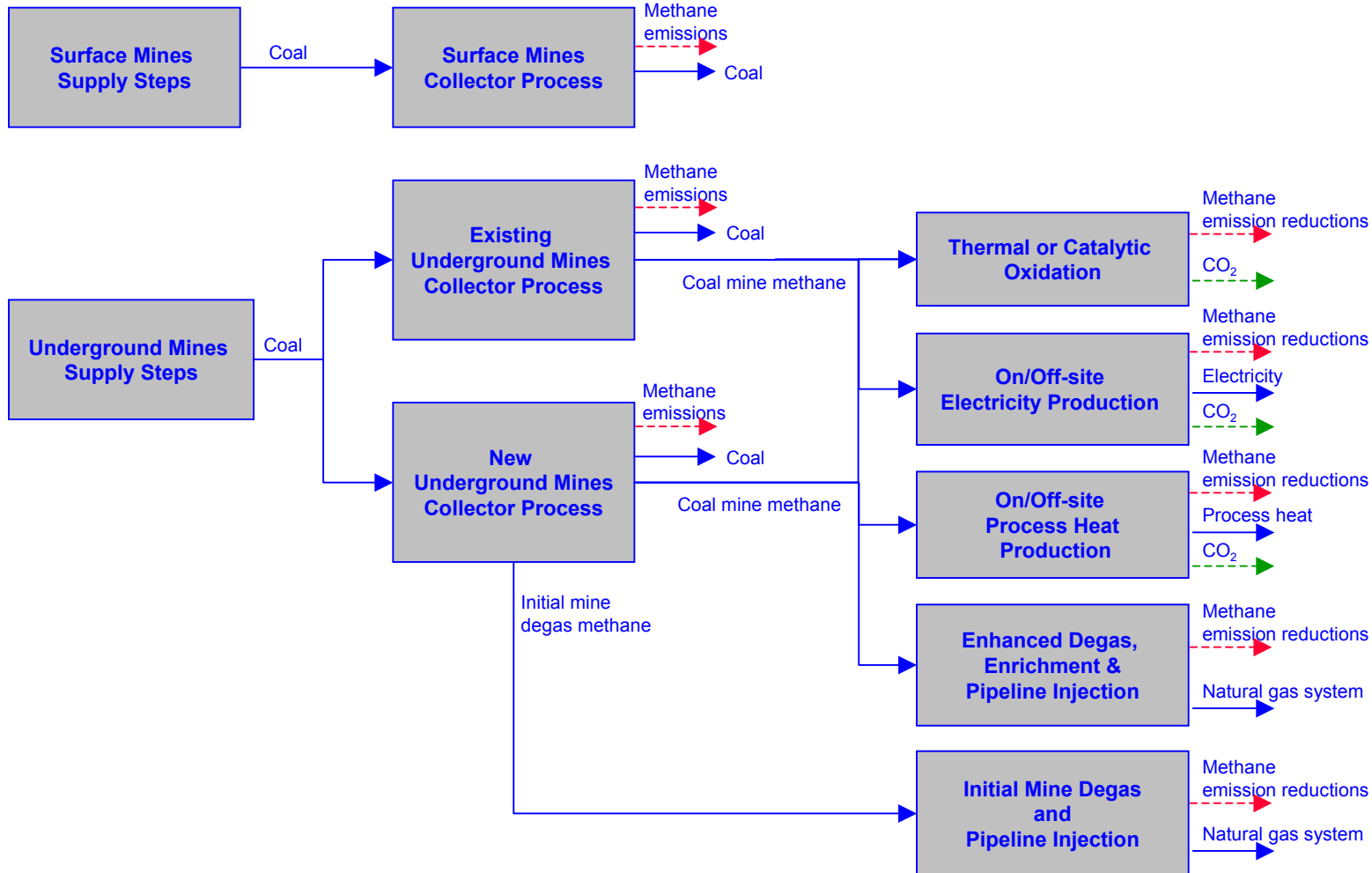
Post-2005 Landfills and MSW Utilization Technologies 2005年后填埋和MSW利用技术

LFG Mitigation Technologies LFG 减排技术



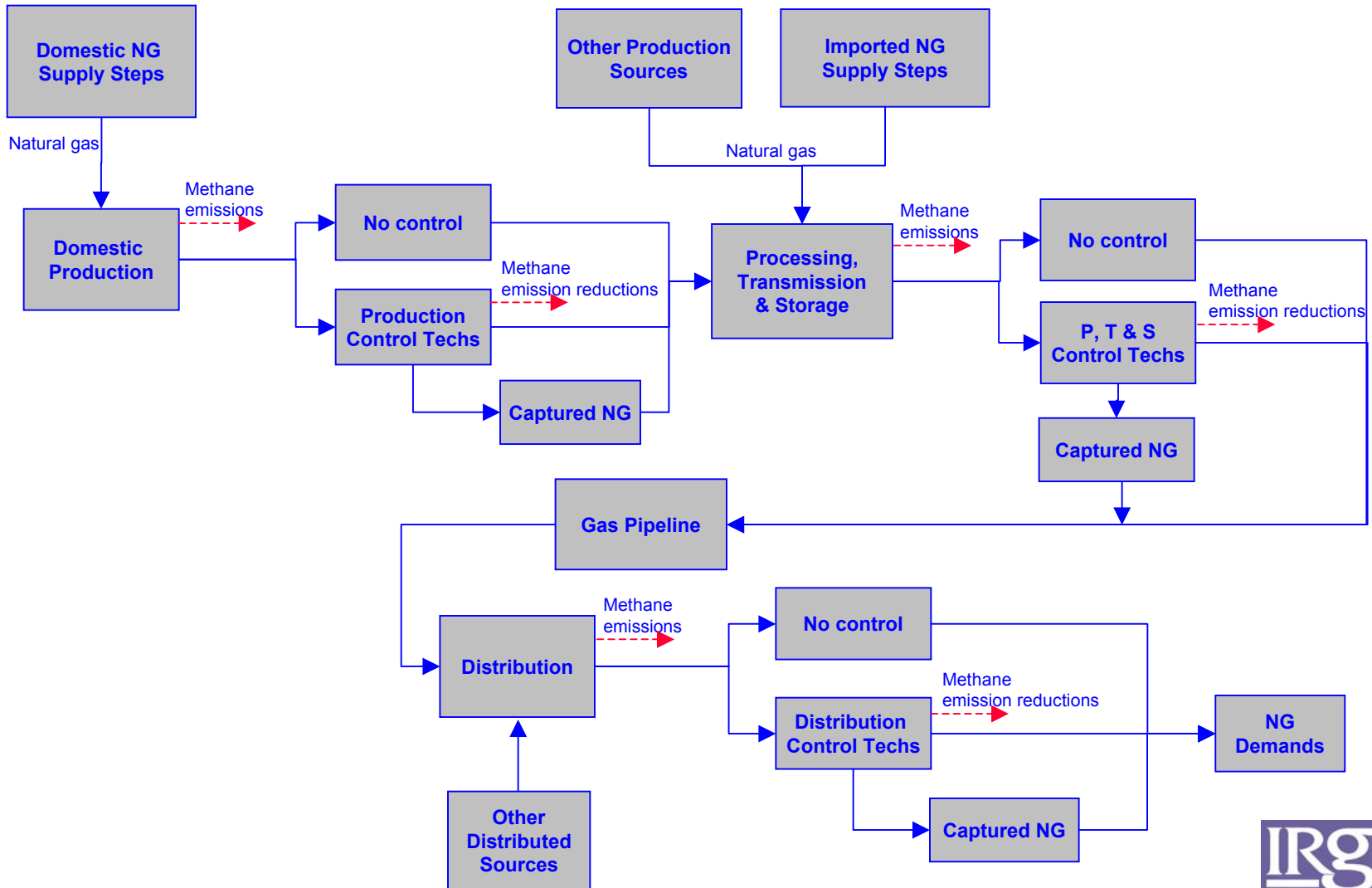
Coal Mine Methane Subsystem 煤层气次系统

Example: Appalachian High Sulfur 例子：山区高硫煤



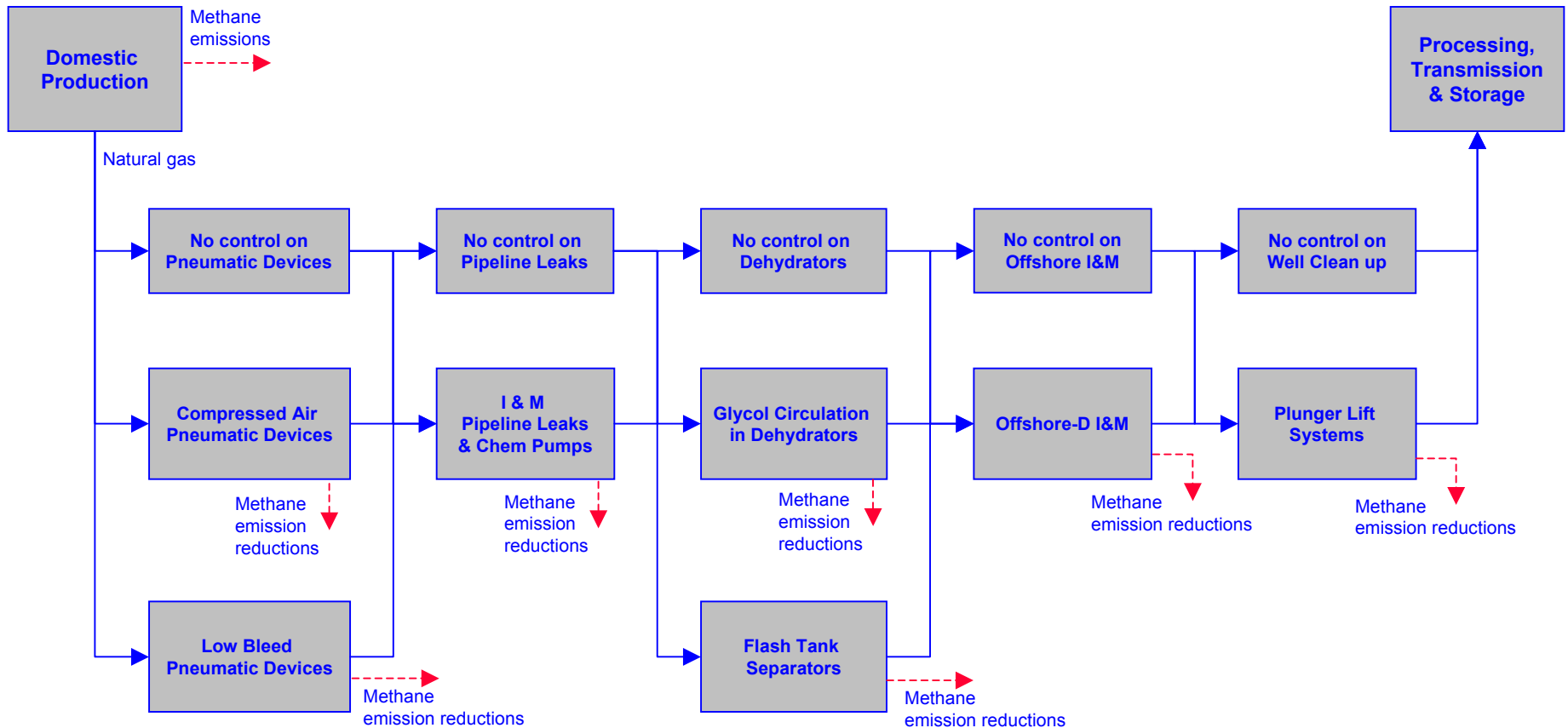
Natural Gas Methane Subsystem

天然气甲烷次系统



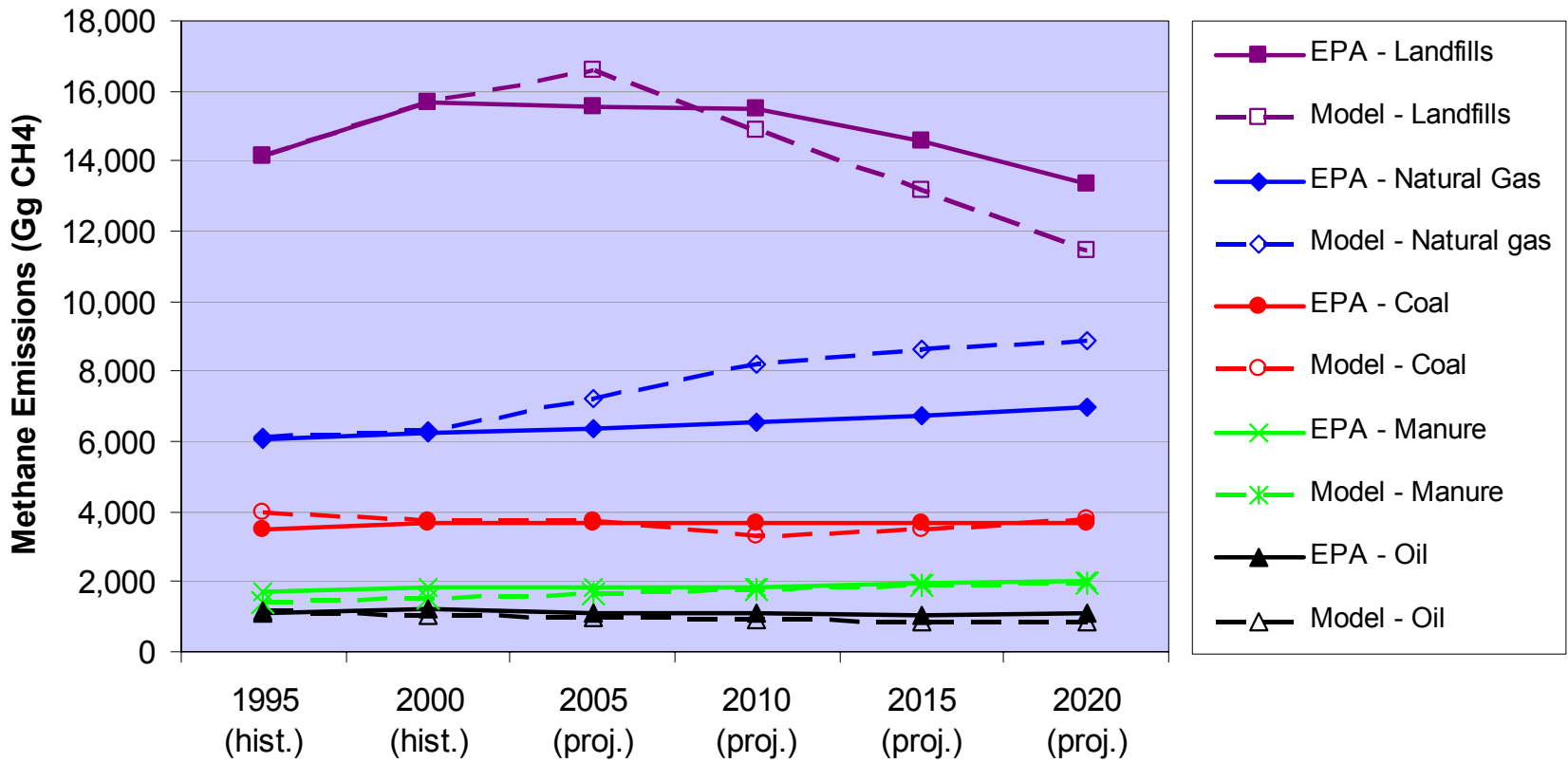
Natural Gas Production: Methane Control Technologies

天然气生产中的甲烷控制技术



Current Calibration Status 当前排放水平

Methane Subsystem Calibration to EPA Baseline (No Mitigation Options)



Comments on Calibration Status

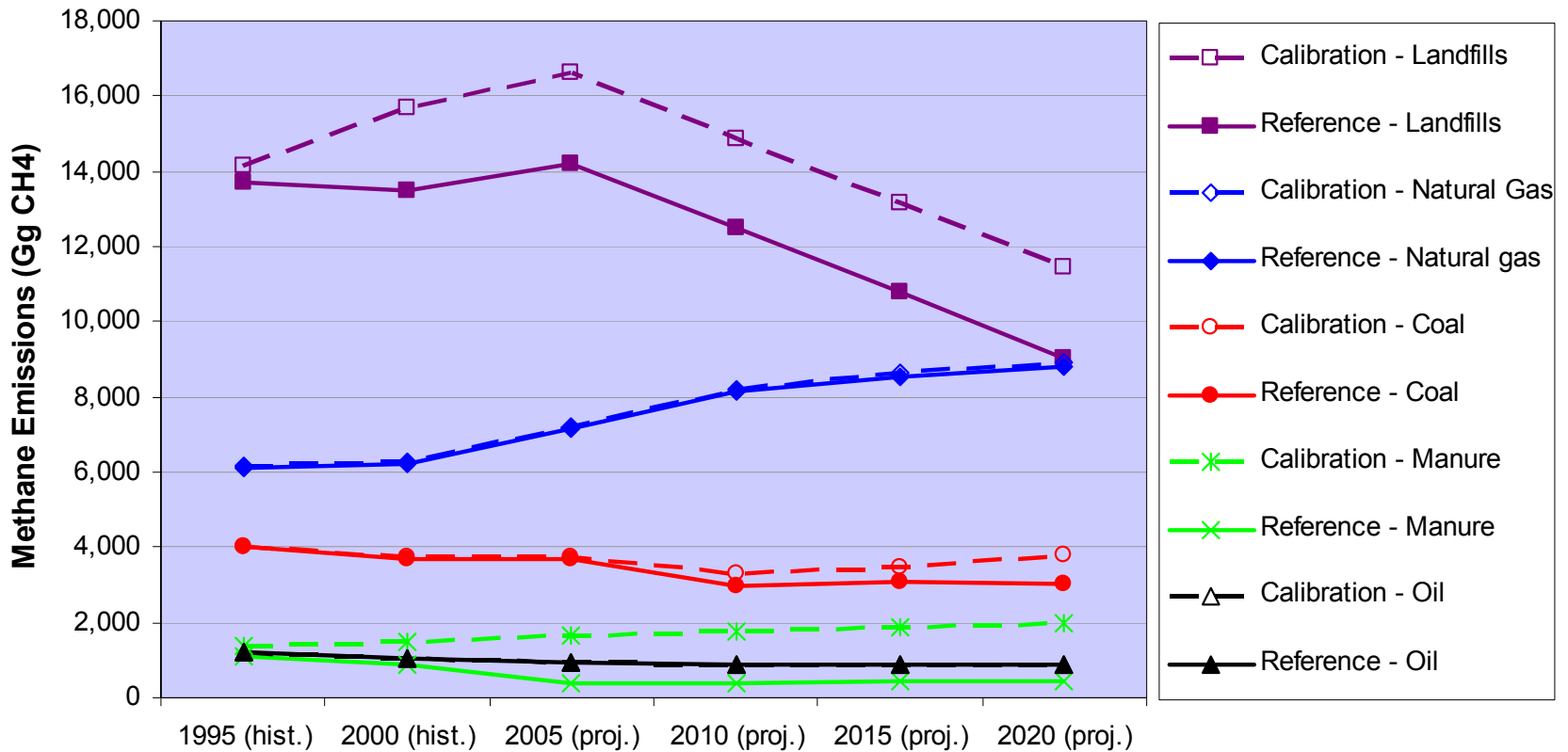
有关排放水平的一些评论

- 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

Impact of Methane Mitigation Options (No Emission Constraints)



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

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