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June 27, 2006

## MEMORANDUM

**TO:** Power Committee

**FROM:** Jeff King

**SUBJECT:** Briefing regarding forecast of power system CO<sub>2</sub> production

Earlier this year, staff completed an analysis of the marginal carbon dioxide production of the regional power system for purposes of valuing the CO<sub>2</sub> offsets attributable to new conservation and low-carbon resources. The results of that study were described in an April 2006 briefing to the Power Committee. The Power Committee requested a follow-on study - a forecast of the total CO<sub>2</sub> production of the power system. The purpose of this briefing is to describe and discuss the results of the follow-on effort.

Staff used the AURORA<sup>xmp</sup> Electric Market Model to forecast the total and unit (per kilowatt-hour) production of CO<sub>2</sub> resulting from operation of the power system. Two cases were compared: future system build-out assuming the levels of conservation recommended in the 5<sup>th</sup> power Plan are achieved (Portfolio L27a), and system build-out assuming reduced rates of conservation acquisition (Portfolio L28c "Status Quo"). Forecasts extended from 2005 through 2025 and are based on average hydropower conditions, medium case load growth rates, medium case fuel prices and expected development of generating resources.

With implementation of the resource portfolio recommendations of the 5<sup>th</sup> Power Plan, average per-kilowatt-hour production of CO<sub>2</sub> by the Northwest power system is forecast to decline from 0.54 lb/kWh in 2005 to 0.53 lb/kWh in 2025. Reduced (L28c) rates of conservation acquisition will result in a slight increase over the same period, to 0.57 lb/kWh. For comparison, average WECC unit production of CO<sub>2</sub> is forecast to increase from 1.01 lb/kWh to 1.08 lb/kWh over the same period (not considering recent increases in California RPS targets, nor Colorado and Montana RPS targets adopted following the 5<sup>th</sup> Plan).

With implementation of the conservation recommendations of the 5<sup>th</sup> Plan, annual Northwest power system CO<sub>2</sub> production rates are forecast to increase from 54 to 59 million tons. Total production for 2005 through 2025 is estimated to be 1125 million tons. Reduced (L28c) rate of conservation acquisition are forecast to result in annual Northwest CO<sub>2</sub> production rates increasing to 64 million tons by 2025. Total production for the period 2005 through 2025 under the reduced conservation case is estimated to be 1214 million tons, an 8% increase over the base case.

The PowerPoint for this briefing is attached. The staff will be looking for Power Committee direction regarding possible follow-on analysis.

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# Forecast Power System CO2 Production

Jeff King

Northwest Power and Conservation Council

Power Committee

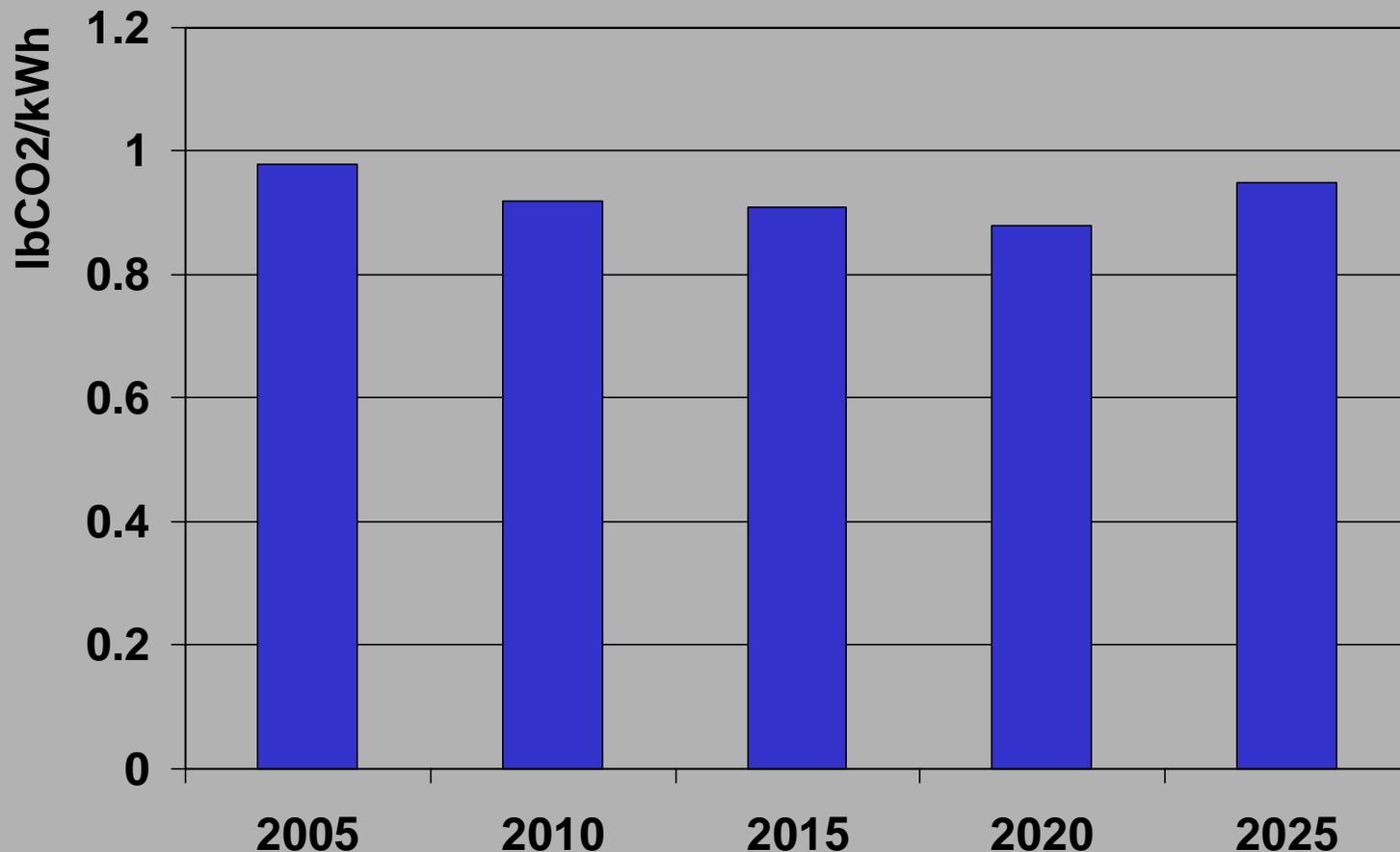
Missoula, MT

July 11, 2006



# Forecast annual average marginal system CO<sub>2</sub> production factors (April discussion)

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# Power Committee requested, at its April meeting, a forecast of power system CO<sub>2</sub> production

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- The amount of carbon dioxide produced by expected operation of the power system

Unit production (lb CO<sub>2</sub>/kWh)

Annual production (tons CO<sub>2</sub>/yr)

Cumulative production (tons CO<sub>2</sub>)

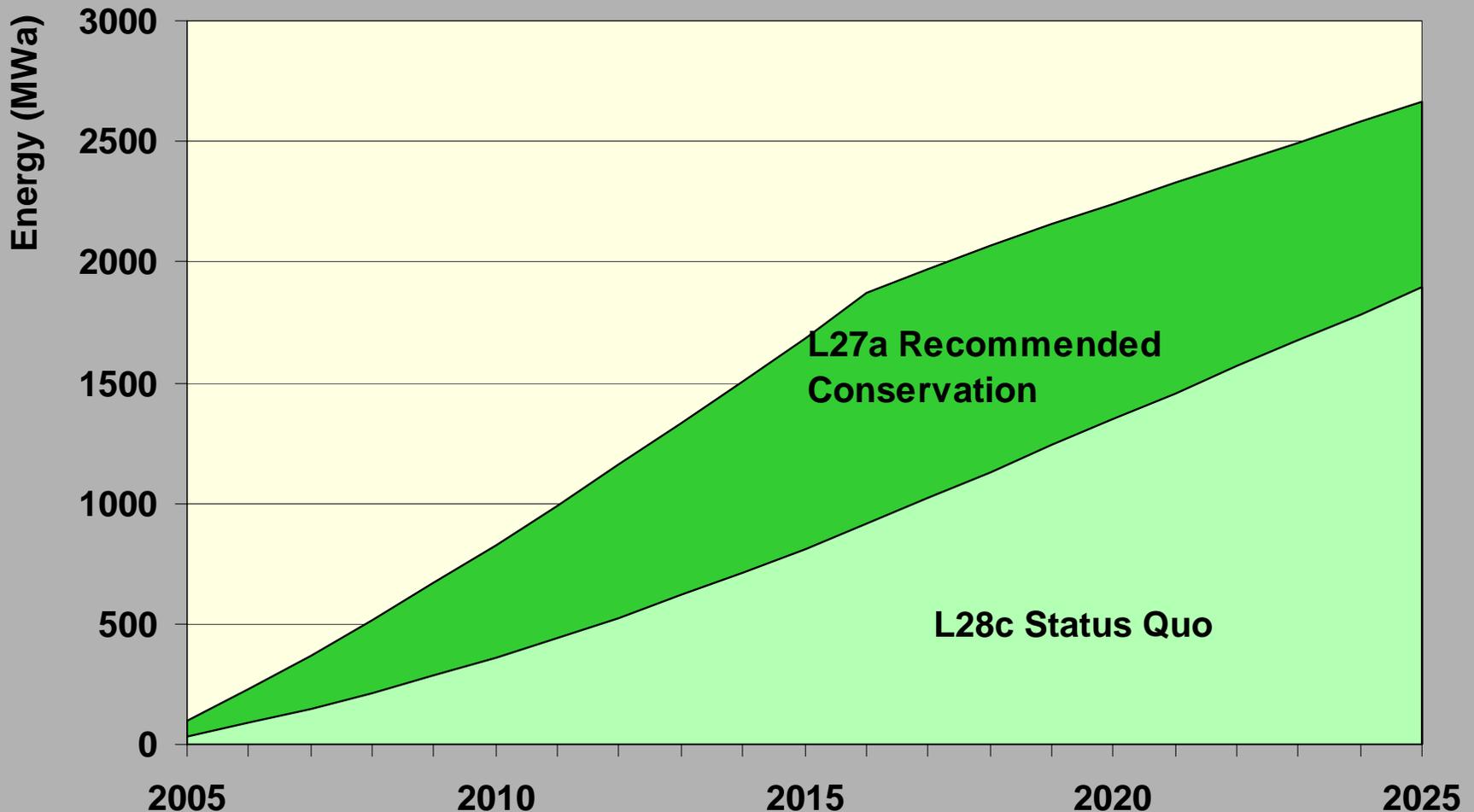
- 2005 - 2025

# Approach

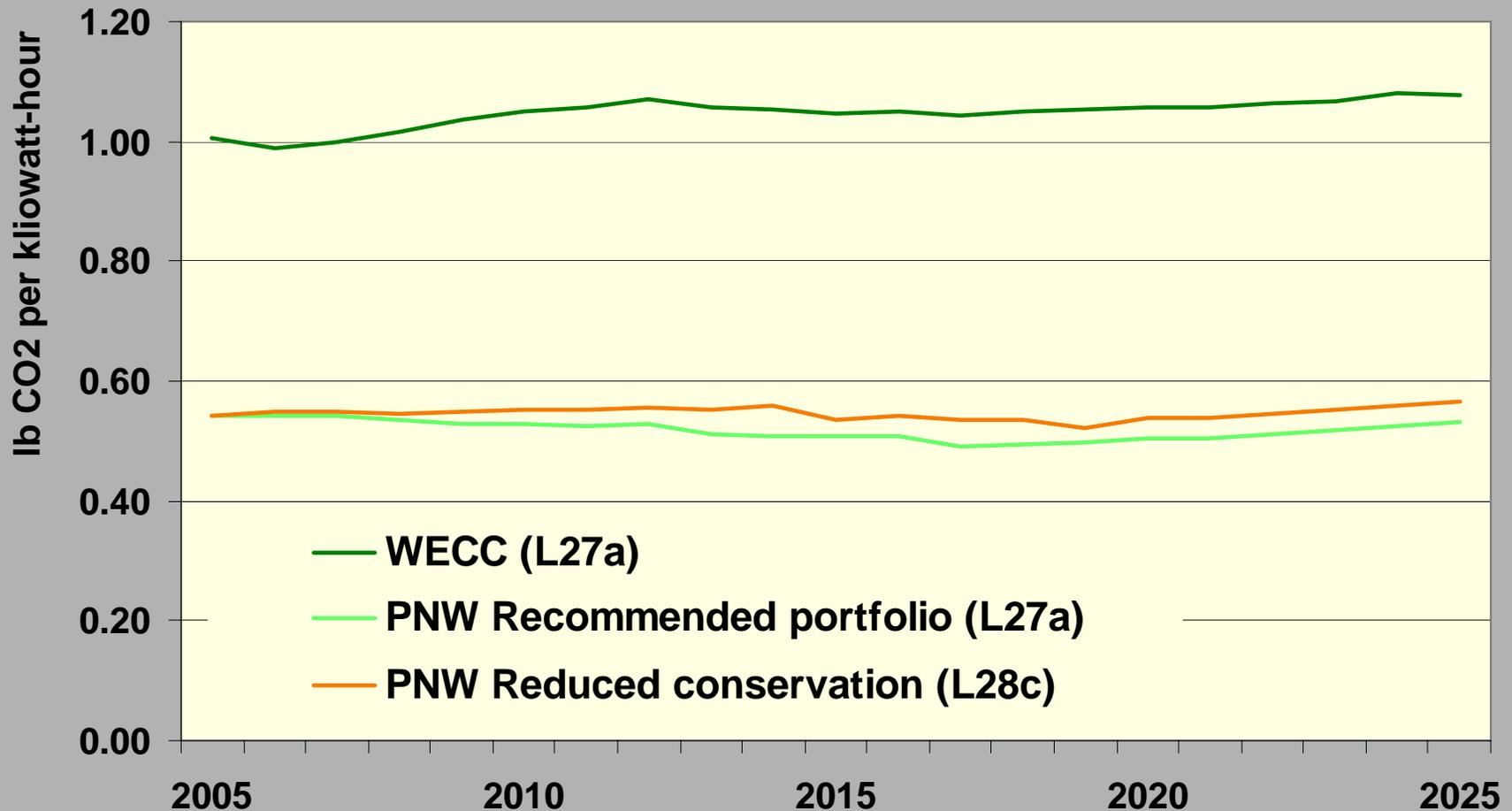
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- Two 20-yr hourly system dispatch runs using AURORA
  - 5<sup>th</sup> Plan recommended portfolio (L27a)
  - “Status Quo” (L28c) Portfolio (Reduced conservation acquisition)
- Standard CO<sub>2</sub> emission factors
  - Natural gas: 117 lb/MMBtu
  - Fuel Oil: 161 lb/MMBtu
  - Subbituminous coal: 212 lb/MMBtu
  - Petroleum coke: 225 lb/MMBtu
  - Flashed-steam geothermal releases: 17 lb/MMBtu
- Tracked CO<sub>2</sub> production by
  - Load-resource area
  - Resource group (conventional coal, gas combined-cycle, etc.)
  - Individual fossil & geothermal units

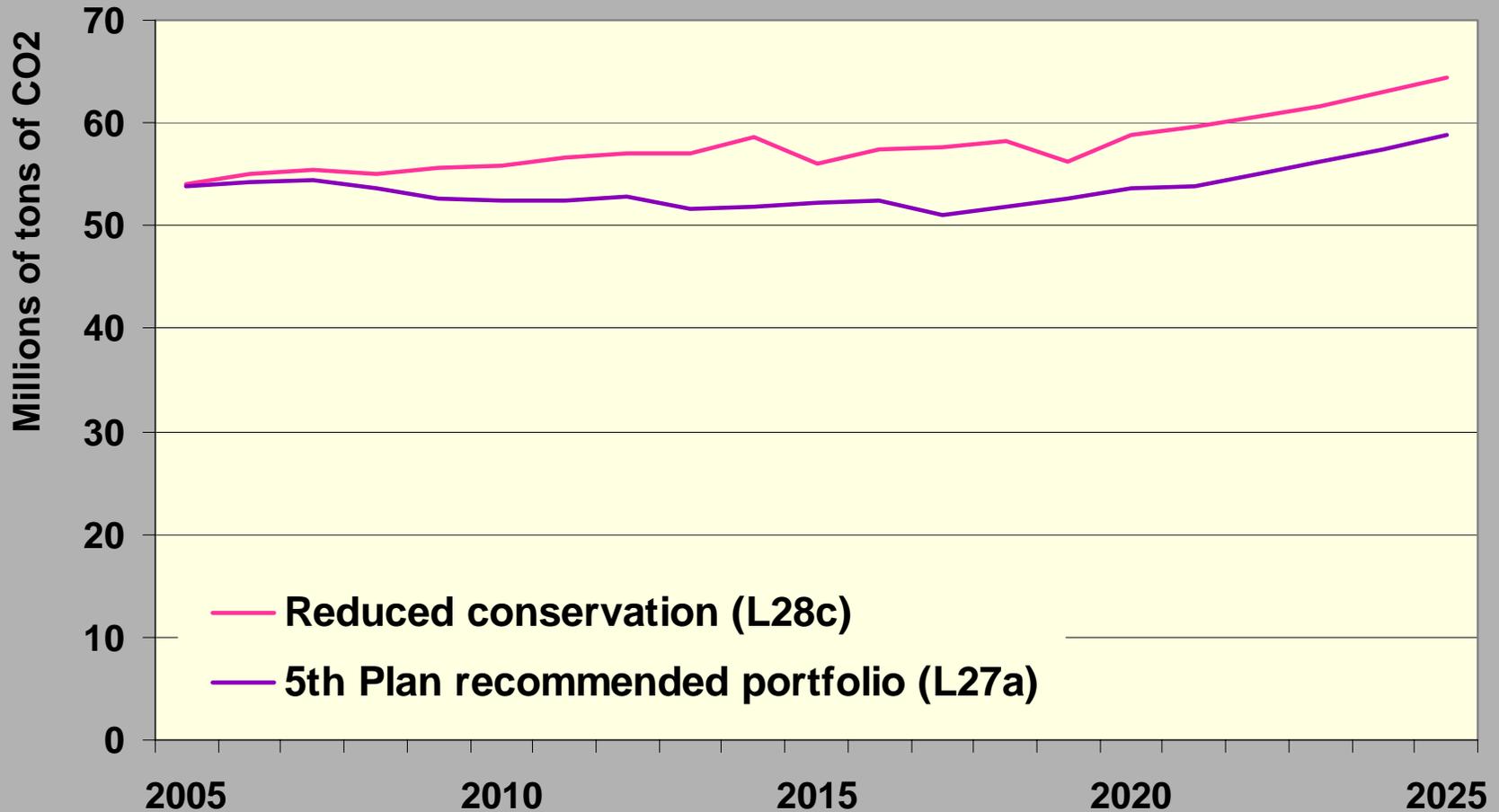
# 5<sup>th</sup> Plan Recommended & “Status Quo” portfolios were compared



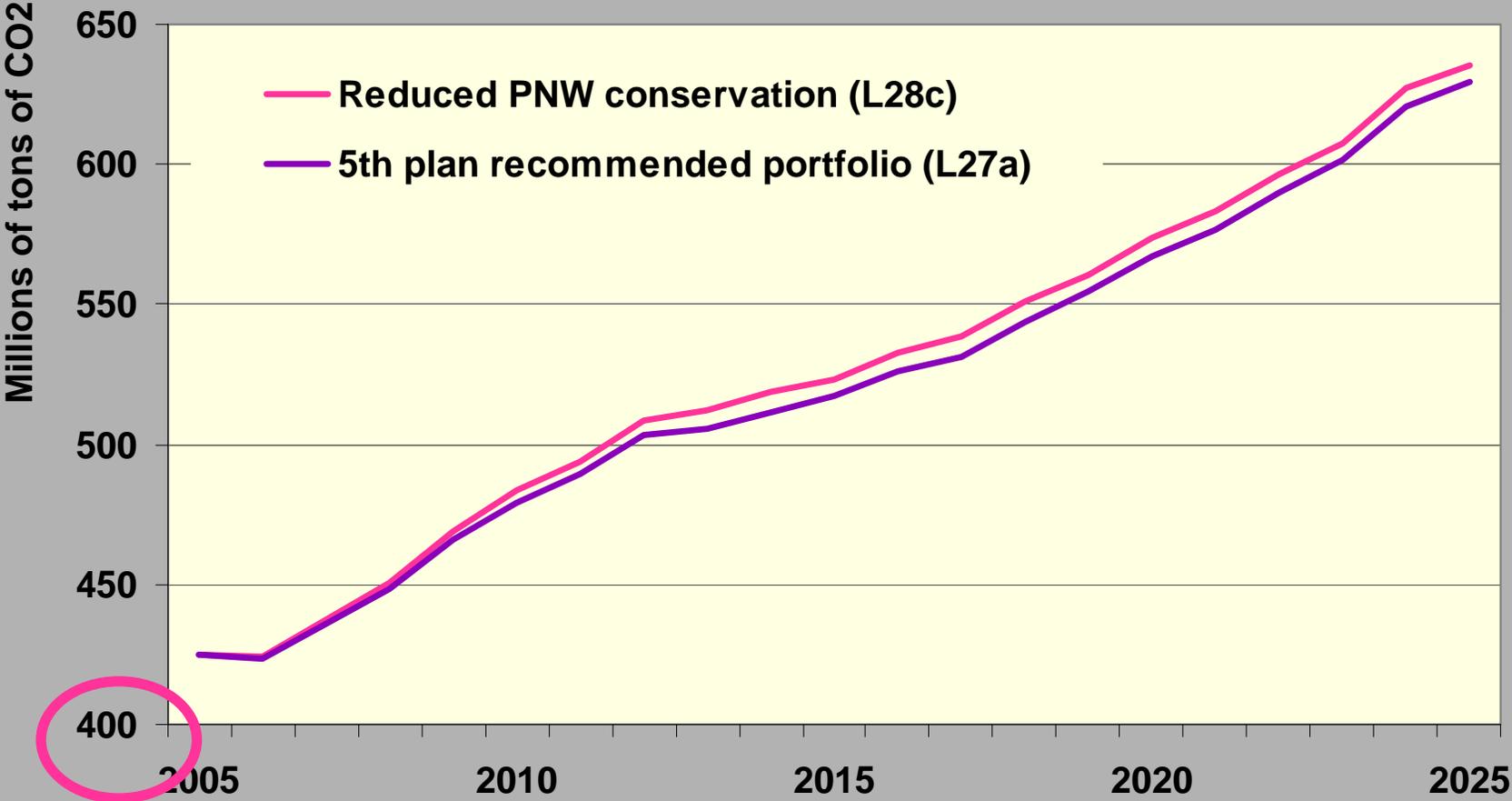
# Forecast unit CO<sub>2</sub> production (net load basis)



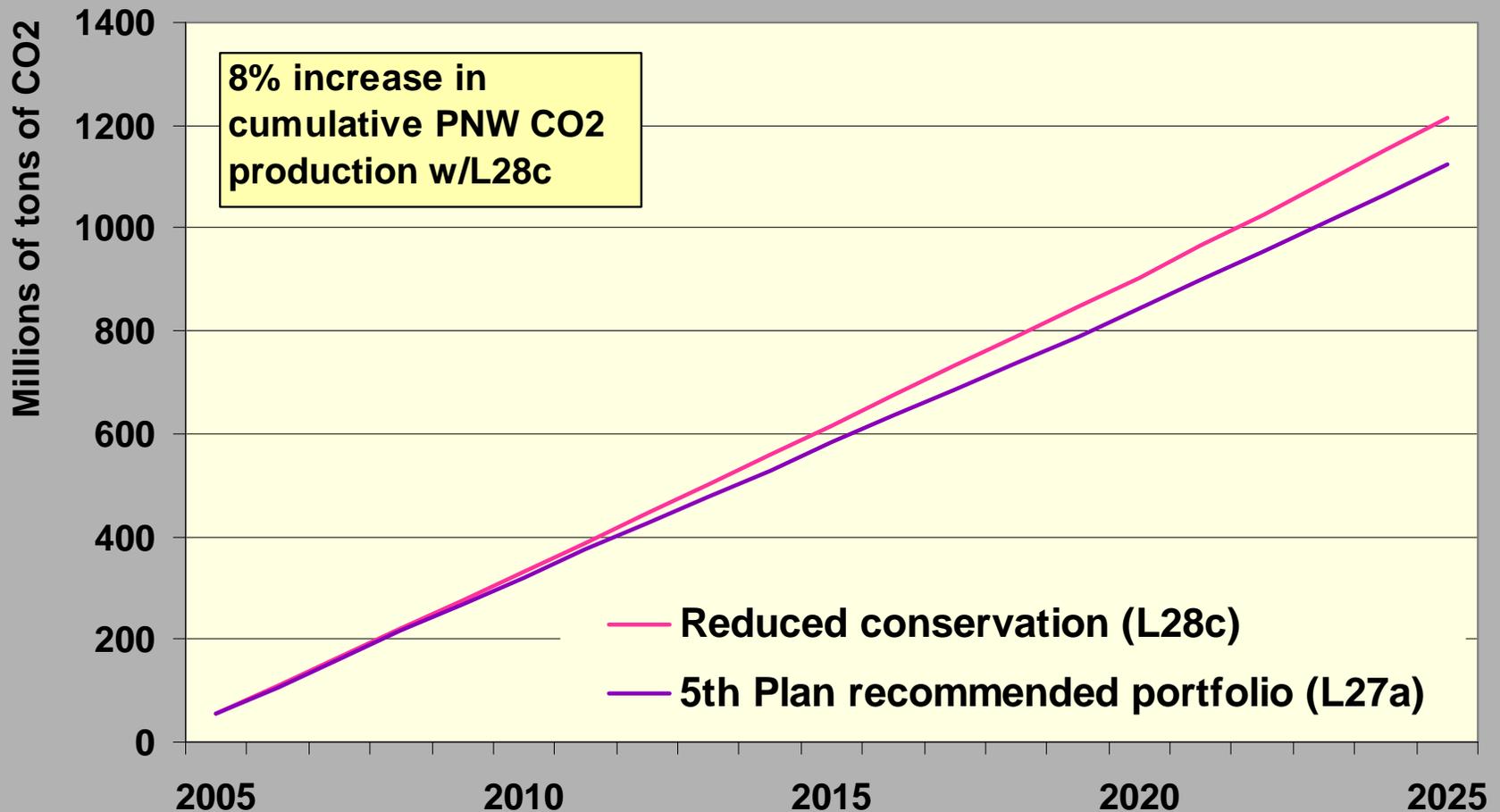
# Forecast annual Northwest power system CO<sub>2</sub> production



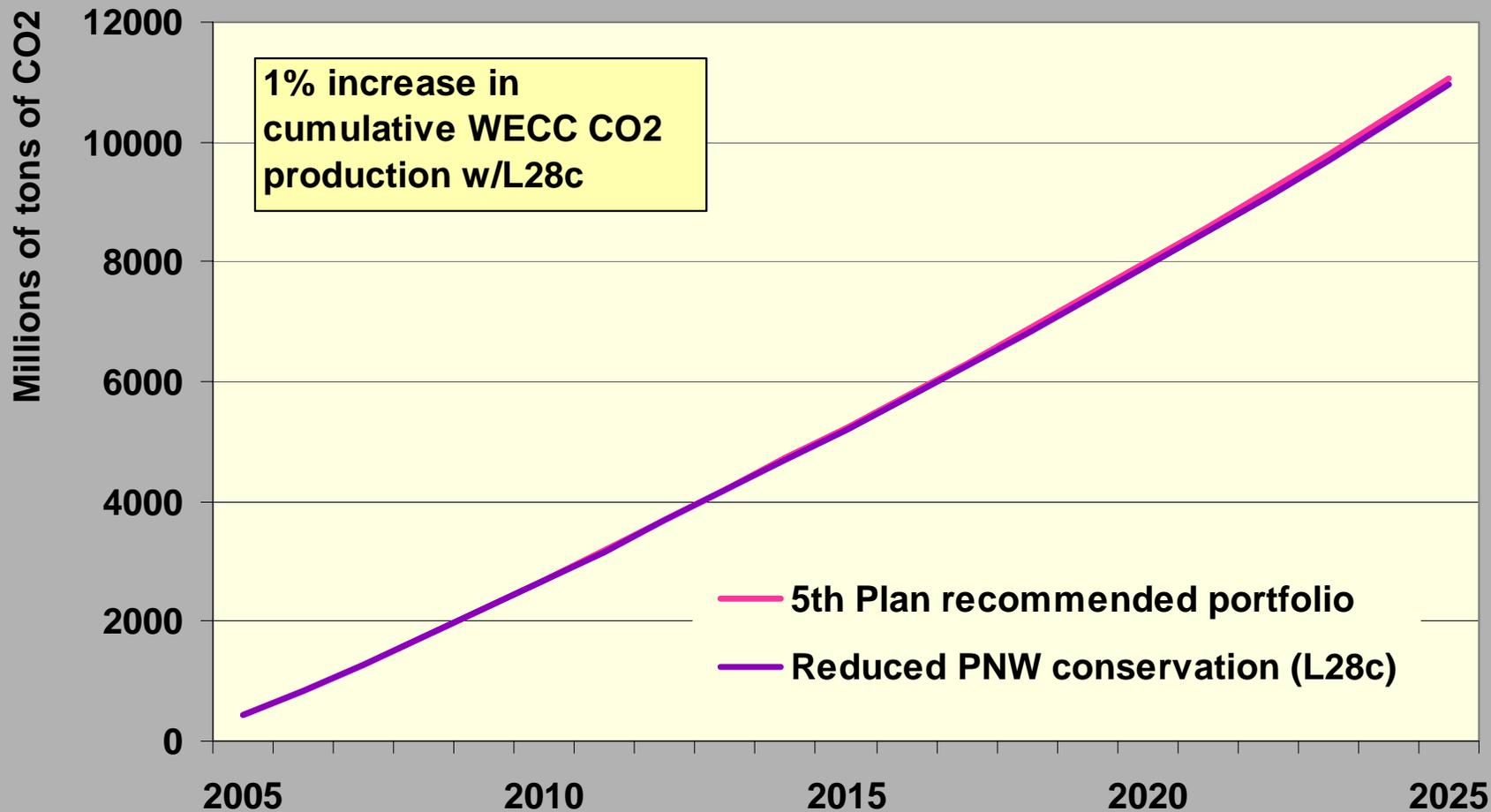
# Forecast annual WECC power system CO<sub>2</sub> production



# Forecast cumulative Northwest power system CO<sub>2</sub> production

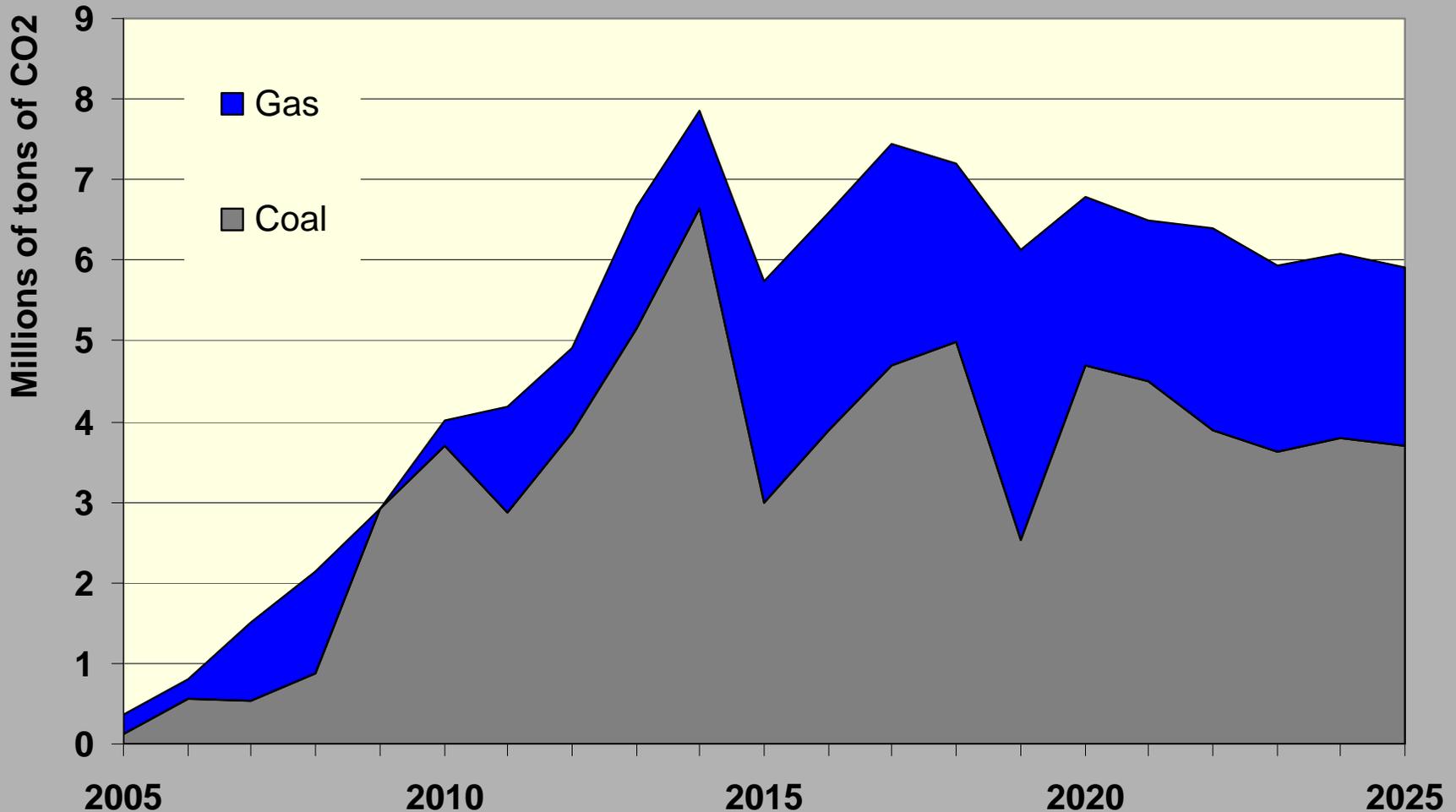


# Forecast cumulative WECC power system CO<sub>2</sub> production



# Source of CO2 reductions

Reduced conservation case less recommended portfolio



Questions?

Further analysis?