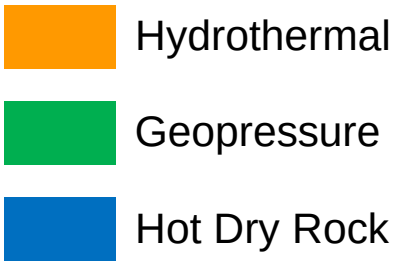
Extending Shale Gas Well Lif

Agenda

- Introduction
- Models for geothermal heat extraction
- Geothermal Power Plant
- Project Economics
- Conclusions and recommendations
- Future work

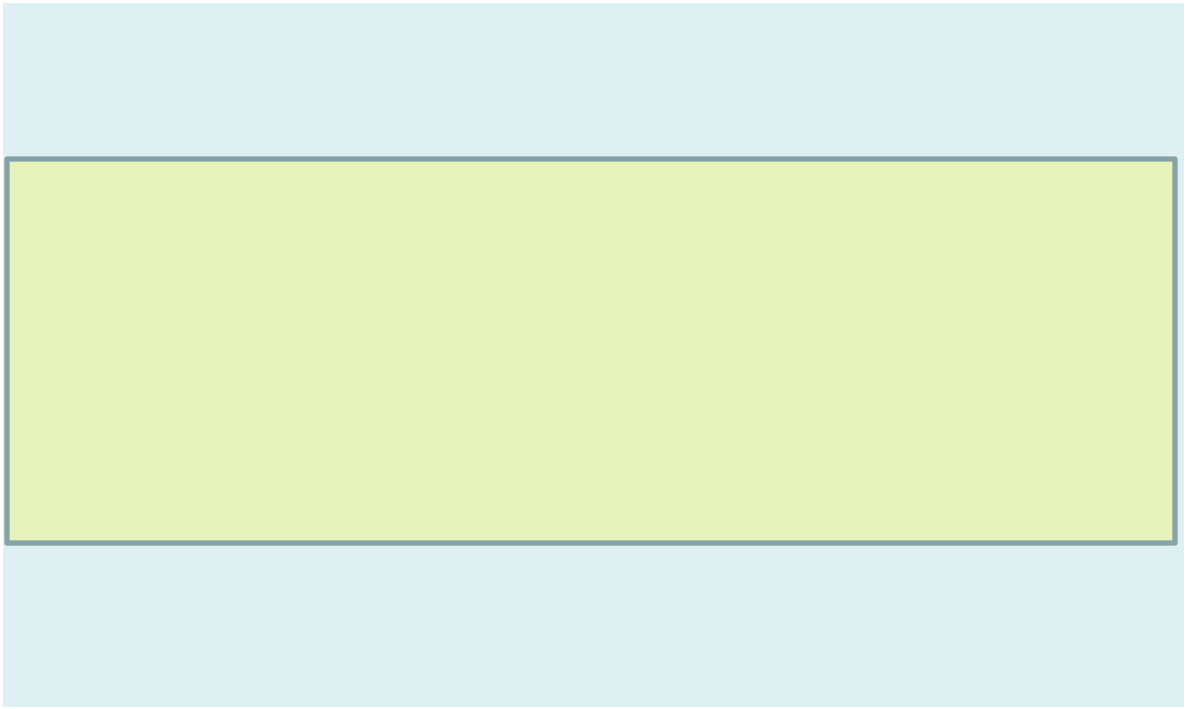
Haynesville Shale



Source: DrillingInfo

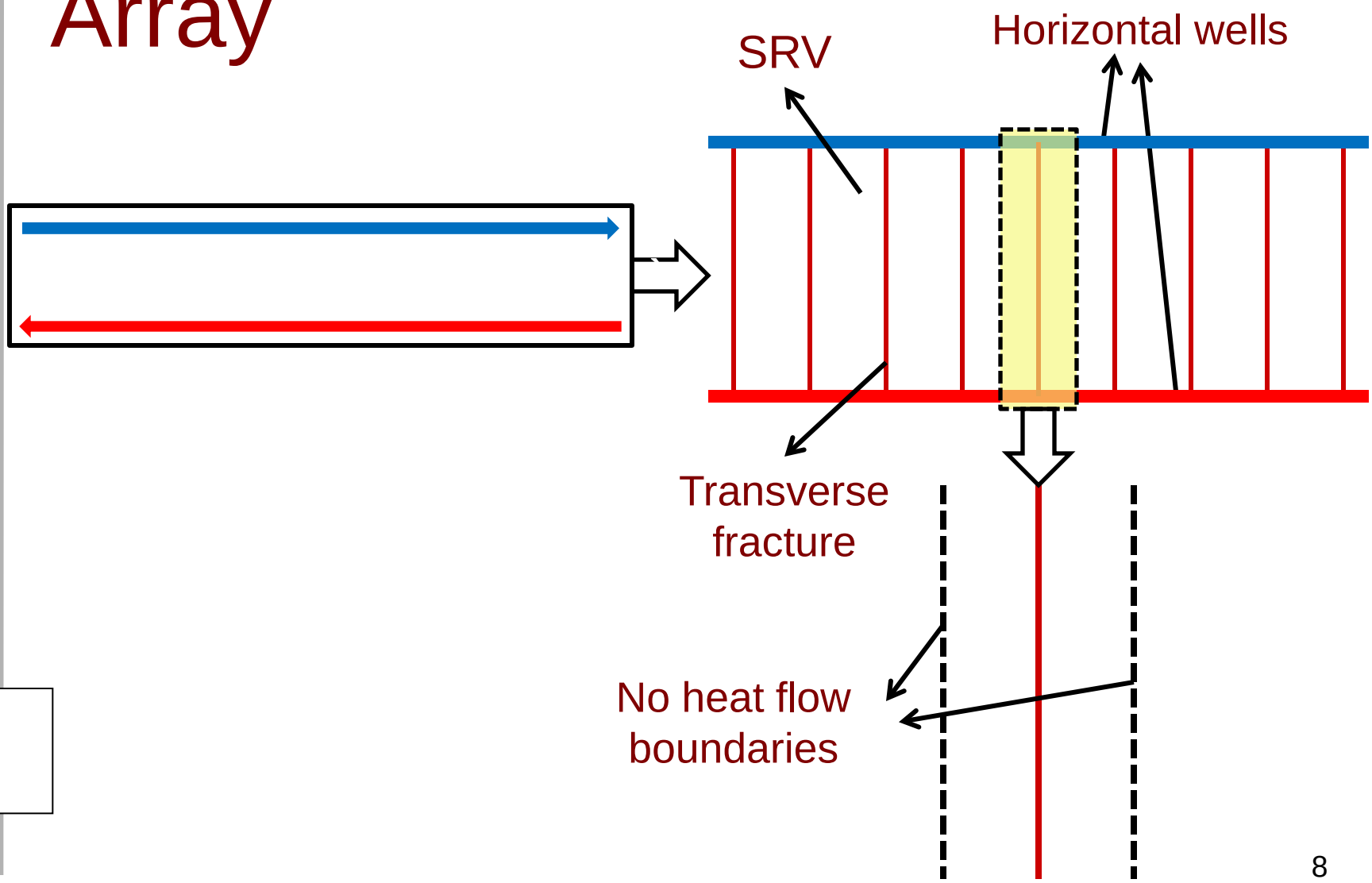
Haynesville Production Behavior

Planar view of the Stimulated Re
Volume

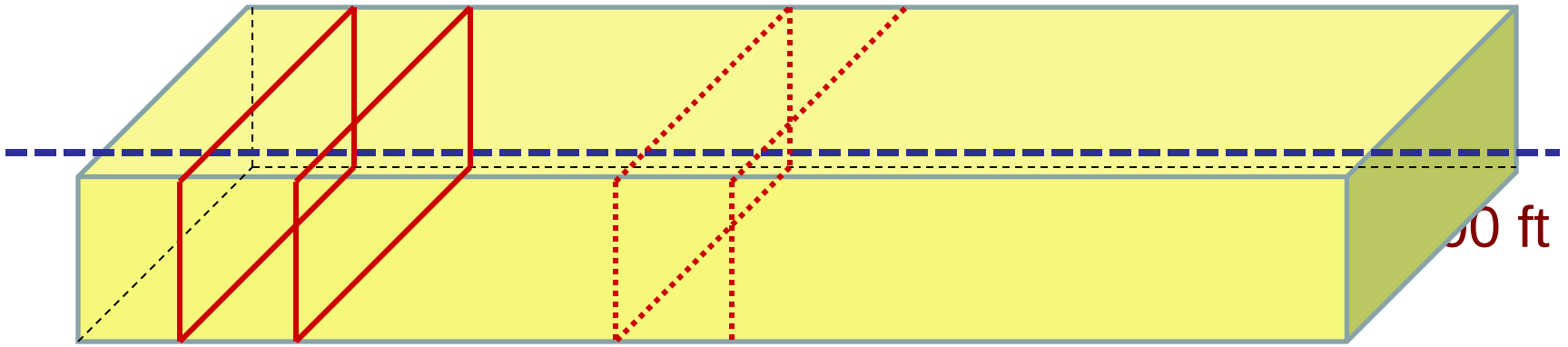


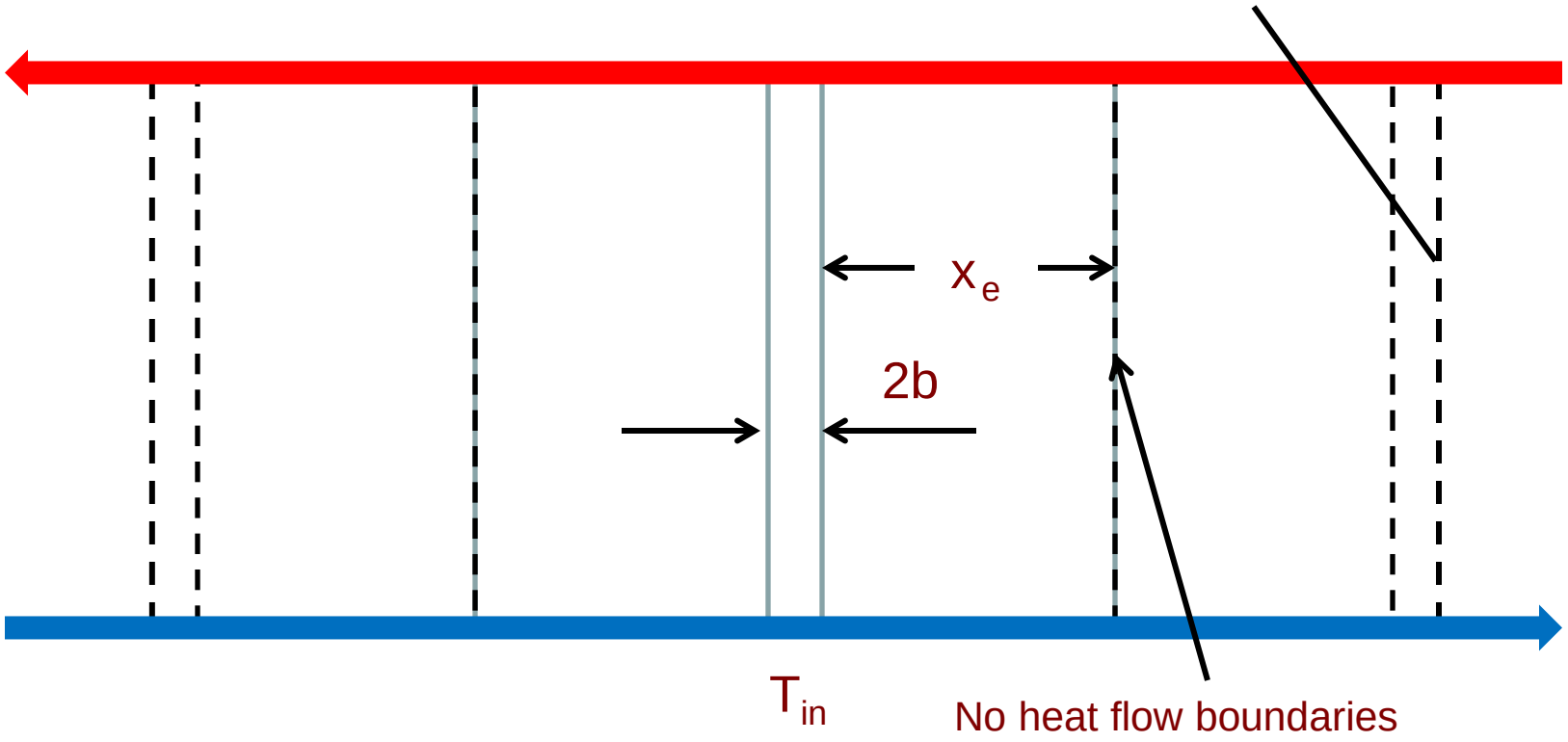
Pad Drilling

Idealization of Haynesville Shale Array



Typical SRV dimensions of a Sha in Haynesville




x_e
2b
T_{in}
No heat flow boundaries

Analytical Model

Heat conduction in rock matrix

Heat conduction and convection for water in fracture

Laplace transform solution

Sensitivity to number of fractures

No. of fractures, fracture spacing, ft.

Dual permeability (DK) and MINC models

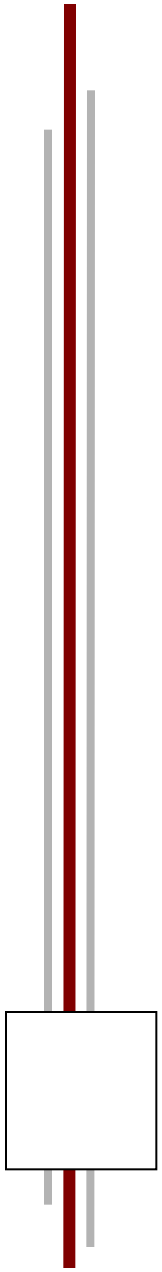
LS-LR-DK

t = 0 years

t = 10 years

t = 30 years

t = 40 years



Simulation Results

Injection rate per fracture, bbl/day

Well Bottom- hole Pressure, psia

Enthalpy Production Rate, MMBtu/day

Average Formation Temperature, F

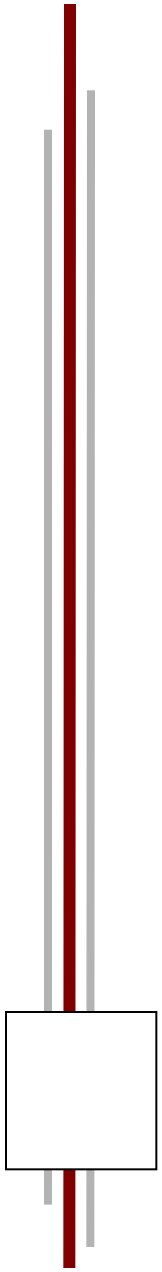
Water outlet temperature

Binary Cycle Power Plant

AspenHYSYS

Basic Binary Power Plant

Dual Pressure Binary Cycle Power Plant



Economics LCOE Comparison

DOE's Geothermal Electricity Technology Evaluation Model

Geothermal Electricity Technology Evaluation Model

Economics: GETEM Model

DOE's Geothermal Electricity Technology Evaluation Model

$72.87 per megawatt hour

Conclusions & Recommendations

- Coupling models with a surface binary cycle power plant suggests that reuse of Haynesville shale gas production wells for low grade geothermal heat extraction after gas production is depleted appears feasible both technically and economically.

- Sufficient connectivity between adjacent wells can greatly aid to project economics by eliminating well drilling and completion costs.

Conclusions & Recommendations

- Dual pressure binary plant is more efficient and results in higher power output.
- Estimated LCOE of $73 per megawatt hour compares favorably to a natural gas power plant.