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% Economic Load Dispatch with Transmission Line Losses using Reduced Gradient Method
% This MATLAB program solves the Economic Load Dispatch problem with consideration
% of transmission line losses using the Reduced Gradient optimization method.
% Author: Vraj Prajapati
% Date: March 2025
clc; clear all; close all;

% Load ELD data
% Format: [a, b, c, pg_min, pg_max, pgi_guess, ploss_coeff]
% a, b, c = Cost function coefficients for each generator (Cost = a*PG^2 + b*PG + c)
% pg_min, pg_max = Minimum and maximum generation limits
% pgi_guess = Initial generator output guess (not used in this implementation)
% ploss_coeff = B-coefficients for transmission loss calculation
PG_data = [0.004, 5.3, 500, 200, 450, 0, 0.00003;
            0.006, 5.5, 400, 150, 350, 0, 0.00009;
            0.009, 5.8, 200, 100, 225, 0, 0.00012]; % a, b, c, low_limit, high_limit, pgi_guess, ploss_coeff

N = length(PG_data(:,1)); % Number of generators
a = PG_data(:,1); % Quadratic cost coefficient
b = PG_data(:,2); % Linear cost coefficient
c = PG_data(:,3); % Constant cost coefficient
pg_min = PG_data(:,4); % Minimum generation limit
pg_max = PG_data(:,5); % Maximum generation limit
ploss_coeff = PG_data(:,7); % Loss coefficients

pd = 975; % Demand value in MW

% Initialize parameters
error_tolerance_reduced_gradient = 1e-6; % Increased precision for gradient convergence
error_tolerance_ploss_diff = 1e-6; % Increased precision for loss convergence
lambda = 10; % Initial value of lambda (Lagrange multiplier)
alpha = 0.001; % Reduced step size for better convergence

% Better initialization - start from feasible solution
% First, check if the demand can be met
total_max_capacity = sum(pg_max);
if total_max_capacity < pd
    error('Error: Maximum generation capacity is less than demand!');
end

% Initialize with generators at their maximum except the last one
% This approach helps to find a feasible starting point
pg = zeros(N, 1);
for i = 1:N-1
    pg(i) = pg_max(i);
end

% Calculate initial losses estimate (rough approximation)
initial_loss_estimate = pd * 0.03; % Assume 3% losses initially
target_gen = pd + initial_loss_estimate;

% Adjust to meet the target generation + estimated losses
% If too much generation, reduce from most expensive generator first
if sum(pg(1:N-1)) > target_gen
    % Sort by marginal cost (descending) to reduce most expensive first
    [~, cost_order] = sort([2*a(1:N-1).*pg_max(1:N-1) + b(1:N-1)], 'descend');

    excess = sum(pg(1:N-1)) - target_gen;
    for idx = 1:N-1
        i = cost_order(idx);
        reduction = min(excess, pg(i) - pg_min(i));

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pg(i) = pg(i) - reduction;
excess = excess - reduction;
if excess <= 0
    break;
end
end

% Set the swing generator to balance
pg(N) = pd - sum(pg(1:N-1)); % Initial estimate without losses

% Calculate initial losses and update swing generator
ploss = sum(ploss_coeff .* pg.^2);
pg(N) = pd + ploss - sum(pg(1:N-1)); % Update with losses

% Check if swing generator exceeds limits and redistribute if necessary
if pg(N) < pg_min(N)
    % Need to increase other generators to reduce swing generator load
    deficit = pg_min(N) - pg(N);
    pg(N) = pg_min(N);

    % Distribute deficit to other generators based on cost
    [~, cost_order] = sort([2*a(1:N-1).*pg(1:N-1) + b(1:N-1)]); % Sort by marginal cost (ascending)

    for idx = 1:N-1
        i = cost_order(idx);
        increase = min(deficit, pg_max(i) - pg(i));
        pg(i) = pg(i) + increase;
        deficit = deficit - increase;
        if deficit <= 0
            break;
        end
    end
elseif pg(N) > pg_max(N)
    % Need to decrease swing generator by increasing others
    excess = pg(N) - pg_max(N);
    pg(N) = pg_max(N);

    % Distribute excess to other generators based on cost
    [~, cost_order] = sort([2*a(1:N-1).*pg(1:N-1) + b(1:N-1)], 'descend'); % Sort by marginal cost (descending)

    for idx = 1:N-1
        i = cost_order(idx);
        decrease = min(excess, pg(i) - pg_min(i));
        pg(i) = pg(i) - decrease;
        excess = excess - decrease;
        if excess <= 0
            break;
        end
    end
end

% Recalculate losses after initialization
ploss = sum(ploss_coeff .* pg.^2);

% Initial penalty factors
% Penalty factors account for the effect of losses on incremental costs
pf = 1./(1 - 2*pg.*ploss_coeff);
pg_old = pg;

% Display initial values
fprintf('Initial conditions:\n');
fprintf('Initial pg: [%s]\n', sprintf('.2f ', pg));

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fprintf('Initial penalty factors: [%s]\n', sprintf('.4f ', pf));
fprintf('Initial ploss: %.4f MW\n', ploss);
fprintf('Initial power balance: %.4f MW\n', sum(pg) - (pd + ploss));

% Main iteration loop
max_iterations = 500; % Increased max iterations to ensure convergence
for iteration = 1:max_iterations
    fprintf('\n----- Iteration %d -----', iteration);

    % Call modified reduced gradient function to optimize generator outputs
    [pg, lambda, ploss_new] = reduced_gradient_function(alpha, N, error_tolerance_reduced_gradient, ...
        a, b, c, lambda, ploss_coeff, pd, ploss, pf, pg_old, pg_min, pg_max);

    % Update penalty factors based on new generation values
    pf_new = 1./(1 - 2*pg.*ploss_coeff);

    % Calculate difference in losses to check convergence
    diff_ploss = sum(ploss_new) - sum(ploss);

    % Display iteration results
    fprintf('pg: [%s]\n', sprintf('.2f ', pg));
    fprintf('lambda: %.6f\n', lambda);
    fprintf('ploss: %.4f MW\n', ploss_new);
    fprintf('ploss difference: %.6f MW\n', diff_ploss);

    % Check power balance (generation = demand + losses)
    power_balance = sum(pg) - (pd + ploss_new);
    fprintf('Power balance: %.6f MW\n', power_balance);

    % Check if any generators violate their limits
    limits_violated = false;
    for i = 1:N
        if pg(i) < pg_min(i) - 0.01 || pg(i) > pg_max(i) + 0.01
            limits_violated = true;
            fprintf('WARNING: Generator %d (%.2f MW) outside limits (%.0f-%.0f)\n', i, pg(i), pg_min(i), pg_max(i));
        end
    end

    % Check for convergence using multiple criteria
    is_converged_loss = (abs(diff_ploss) < error_tolerance_ploss_diff);
    is_within_limits = ~limits_violated;
    is_balanced = (abs(power_balance) < 0.1);

    if is_converged_loss && is_within_limits && is_balanced
        fprintf('\nConverged after %d iterations!\n', iteration);
        break;
    end

    % Update for next iteration
    ploss = ploss_new;
    pf = pf_new;
    pg_old = pg;

    % Adaptive step size adjustment to improve convergence
    if iteration > 10
        if abs(diff_ploss) > error_tolerance_ploss_diff*10 || abs(power_balance) > 1
            alpha = alpha * 0.95; % Gradually reduce step size for convergence issues
        elseif iteration > 30 && abs(diff_ploss) < error_tolerance_ploss_diff*100 && abs(power_balance) < 10
            alpha = alpha * 1.05; % Gradually increase step size for slow convergence
            alpha = min(alpha, 0.01); % Cap step size
        end
        fprintf('Current step size: %.8f\n', alpha);
    end
end

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end

if iteration == max_iterations
    fprintf('\nWARNING: Maximum iterations reached. Solution may not have fully converged.\n');
end

% Final adjustment to ensure power balance
% Distribute any remaining imbalance to generators with available capacity
final_balance = pd + ploss - sum(pg);
if abs(final_balance) > 0.1
    fprintf('\nPerforming final balance adjustment of %.4f MW\n', final_balance);

    if final_balance > 0
        % Need more generation
        [~, cost_order] = sort([2*a.*pg + b]); % Sort by marginal cost (ascending)

        for idx = 1:N
            i = cost_order(idx);
            if pg(i) < pg_max(i)
                increase = min(final_balance, pg_max(i) - pg(i));
                pg(i) = pg(i) + increase;
                final_balance = final_balance - increase;
                fprintf('Increased G%d by %.4f MW\n', i, increase);
            end
            if final_balance <= 0.1
                break;
            end
        end
    else
        % Need less generation
        [~, cost_order] = sort([2*a.*pg + b], 'descend'); % Sort by marginal cost (descending)

        for idx = 1:N
            i = cost_order(idx);
            if pg(i) > pg_min(i)
                decrease = min(-final_balance, pg(i) - pg_min(i));
                pg(i) = pg(i) - decrease;
                final_balance = final_balance + decrease;
                fprintf('Decreased G%d by %.4f MW\n', i, decrease);
            end
            if final_balance >= -0.1
                break;
            end
        end
    end
end

% Recalculate losses after final adjustment
ploss = sum(ploss_coeff .* pg.^2);
power_balance = sum(pg) - (pd + ploss);
fprintf('Final power balance after adjustment: %.4f MW\n', power_balance);
end

% Final results
fprintf('\n===== Final Results =====\n');
for i = 1:N
    fprintf('Generator %d: %.4f MW (min: %.0f, max: %.0f)\n', i, pg(i), pg_min(i), pg_max(i));
end
fprintf('Total generation: %.4f MW\n', sum(pg));
fprintf('Total demand: %.4f MW\n', pd);
fprintf('Total losses: %.4f MW\n', ploss);
fprintf('Power balance: %.4f MW\n', sum(pg) - (pd + ploss));

% Calculate final cost

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total_cost = 0;
for i = 1:N
    gen_cost = a(i)*pg(i)^2 + b(i)*pg(i) + c(i);
    fprintf('Generator %d cost: %.2f $/h (marginal cost: %.4f $/MWh)\n', i, gen_cost, 2*a(i)*pg(i) + b(i));
    total_cost = total_cost + gen_cost;
end
fprintf('Total cost: %.2f $/h\n', total_cost);

% Calculate incremental cost
fprintf('\nIncremental costs at operating point:\n');
for i = 1:N
    fprintf('Generator %d incremental cost: %.4f $/MWh\n', i, (2*a(i)*pg(i) + b(i)) * pf(i));
end

% Plot generation distribution
figure;
bar([pg pg_min pg_max]);
title('Economic Load Dispatch Solution');
xlabel('Generator Number');
ylabel('Power Output (MW)');
legend('Optimal Output', 'Minimum Limit', 'Maximum Limit');
grid on;

% Plot cost curves
figure;
pg_range = cell(N,1);
cost_range = cell(N,1);
marginal_cost = cell(N,1);

for i = 1:N
    pg_range{i} = linspace(pg_min(i), pg_max(i), 100);
    cost_range{i} = a(i)*(pg_range{i}.^2) + b(i)*pg_range{i} + c(i);
    marginal_cost{i} = 2*a(i)*pg_range{i} + b(i);
end

subplot(2,1,1);
hold on;
for i = 1:N
    plot(pg_range{i}, cost_range{i}, 'LineWidth', 2);
    plot(pg(i), a(i)*pg(i)^2 + b(i)*pg(i) + c(i), 'o', 'MarkerSize', 8, 'MarkerFaceColor', 'r');
end
title('Cost Curves');
xlabel('Power Output (MW)');
ylabel('Cost ($/h)');
legend('Generator 1', 'G1 Operating Point', 'Generator 2', 'G2 Operating Point', 'Generator 3', 'G3 Operating Point');
grid on;

subplot(2,1,2);
hold on;
for i = 1:N
    plot(pg_range{i}, marginal_cost{i}, 'LineWidth', 2);
    plot(pg(i), 2*a(i)*pg(i) + b(i), 'o', 'MarkerSize', 8, 'MarkerFaceColor', 'r');
end
title('Incremental Cost Curves');
xlabel('Power Output (MW)');
ylabel('Incremental Cost ($/MWh)');
grid on;

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Initial conditions:

Initial pg: [450.00 350.00 195.77]

Initial penalty factors: [1.0277 1.0672 1.0493]

Initial ploss: 21.6993 MW

Initial power balance: -0.9243 MW

----- Iteration 1 -----

pg: [450.00 349.92 196.83]

lambda: 9.999956

ploss: 21.7437 MW

ploss difference: 0.044343 MW

Power balance: -0.000024 MW

----- Iteration 2 -----

pg: [450.00 349.84 196.90]

lambda: 9.999956

ploss: 21.7423 MW

ploss difference: -0.001337 MW

Power balance: -0.000024 MW

----- Iteration 3 -----

pg: [450.00 349.76 196.98]

lambda: 9.999956

ploss: 21.7410 MW

ploss difference: -0.001327 MW

Power balance: -0.000024 MW

----- Iteration 4 -----

pg: [450.00 349.68 197.06]

lambda: 9.999956

ploss: 21.7397 MW

ploss difference: -0.001317 MW

Power balance: -0.000024 MW

----- Iteration 5 -----

pg: [450.00 349.60 197.14]

lambda: 9.999956

ploss: 21.7384 MW

ploss difference: -0.001307 MW

Power balance: -0.000024 MW

----- Iteration 6 -----

pg: [450.00 349.52 197.22]

lambda: 9.999956

ploss: 21.7371 MW

ploss difference: -0.001298 MW

Power balance: -0.000024 MW

----- Iteration 7 -----

pg: [450.00 349.44 197.30]

lambda: 9.999956

ploss: 21.7358 MW

ploss difference: -0.001288 MW

Power balance: -0.000023 MW

----- Iteration 8 -----

pg: [450.00 349.36 197.37]

lambda: 9.999956

ploss: 21.7345 MW

ploss difference: -0.001279 MW

Power balance: -0.000023 MW

----- Iteration 9 -----

pg: [450.00 349.28 197.45]

lambda: 9.999955

ploss: 21.7333 MW

ploss difference: -0.001269 MW

Power balance: -0.000023 MW

----- Iteration 10 -----

pg: [450.00 349.21 197.53]

lambda: 9.999955

ploss: 21.7320 MW

ploss difference: -0.001260 MW

Power balance: -0.000023 MW

----- Iteration 11 -----

pg: [450.00 349.13 197.60]

lambda: 9.999955

ploss: 21.7308 MW

ploss difference: -0.001251 MW

Power balance: -0.000023 MW

Current step size: 0.00095000

----- Iteration 12 -----

pg: [450.00 349.05 197.67]

lambda: 9.999955

ploss: 21.7296 MW

ploss difference: -0.001179 MW

Power balance: -0.000022 MW

Current step size: 0.00090250

----- Iteration 13 -----

pg: [450.00 348.99 197.74]

lambda: 9.999955

ploss: 21.7285 MW

ploss difference: -0.001113 MW

Power balance: -0.000021 MW

Current step size: 0.00085737

----- Iteration 14 -----

pg: [450.00 348.92 197.81]

lambda: 9.999955

ploss: 21.7274 MW

ploss difference: -0.001050 MW

Power balance: -0.000019 MW

Current step size: 0.00081451

----- Iteration 15 -----

pg: [450.00 348.86 197.87]

lambda: 9.999955

ploss: 21.7264 MW

ploss difference: -0.000992 MW

Power balance: -0.000018 MW

Current step size: 0.00077378

----- Iteration 16 -----

pg: [450.00 348.80 197.92]

lambda: 9.999955

ploss: 21.7255 MW

ploss difference: -0.000937 MW

Power balance: -0.000017 MW

Current step size: 0.00073509

----- Iteration 17 -----

pg: [450.00 348.75 197.98]

lambda: 9.999955

ploss: 21.7246 MW

ploss difference: -0.000885 MW

Power balance: -0.000017 MW

Current step size: 0.00069834

----- Iteration 18 -----

pg: [450.00 348.69 198.03]

lambda: 9.999955

ploss: 21.7238 MW

ploss difference: -0.000836 MW

Power balance: -0.000016 MW

Current step size: 0.00066342

----- Iteration 19 -----

pg: [450.00 348.64 198.08]

lambda: 9.999955

ploss: 21.7230 MW

ploss difference: -0.000790 MW

Power balance: -0.000015 MW

Current step size: 0.00063025

----- Iteration 20 -----

pg: [450.00 348.60 198.13]

lambda: 9.999955

ploss: 21.7222 MW

ploss difference: -0.000747 MW

Power balance: -0.000014 MW

Current step size: 0.00059874

----- Iteration 21 -----

pg: [450.00 348.55 198.17]

lambda: 9.999955

ploss: 21.7215 MW

ploss difference: -0.000707 MW

Power balance: -0.000013 MW

Current step size: 0.00056880

----- Iteration 22 -----

pg: [450.00 348.51 198.21]

lambda: 9.999955

ploss: 21.7208 MW

ploss difference: -0.000669 MW

Power balance: -0.000013 MW

Current step size: 0.00054036

----- Iteration 23 -----

pg: [450.00 348.47 198.25]

lambda: 9.999954

ploss: 21.7202 MW

ploss difference: -0.000633 MW

Power balance: -0.000012 MW

Current step size: 0.00051334

----- Iteration 24 -----

pg: [450.00 348.43 198.29]

lambda: 9.999954

ploss: 21.7196 MW

ploss difference: -0.000599 MW

Power balance: -0.000011 MW

Current step size: 0.00048767

----- Iteration 25 -----

pg: [450.00 348.40 198.32]

lambda: 9.999954

ploss: 21.7190 MW

ploss difference: -0.000567 MW

Power balance: -0.000011 MW
Current step size: 0.00046329

----- Iteration 26 -----
pg: [450.00 348.36 198.35]
lambda: 9.999954
ploss: 21.7185 MW
ploss difference: -0.000536 MW
Power balance: -0.000010 MW
Current step size: 0.00044013

----- Iteration 27 -----
pg: [450.00 348.33 198.39]
lambda: 9.999954
ploss: 21.7180 MW
ploss difference: -0.000508 MW
Power balance: -0.000010 MW
Current step size: 0.00041812

----- Iteration 28 -----
pg: [450.00 348.30 198.42]
lambda: 9.999954
ploss: 21.7175 MW
ploss difference: -0.000481 MW
Power balance: -0.000009 MW
Current step size: 0.00039721

----- Iteration 29 -----
pg: [450.00 348.27 198.44]
lambda: 9.999954
ploss: 21.7171 MW
ploss difference: -0.000456 MW
Power balance: -0.000009 MW
Current step size: 0.00037735

----- Iteration 30 -----
pg: [450.00 348.25 198.47]
lambda: 9.999954
ploss: 21.7166 MW
ploss difference: -0.000432 MW
Power balance: -0.000008 MW
Current step size: 0.00035849

----- Iteration 31 -----
pg: [450.00 348.22 198.50]
lambda: 9.999954
ploss: 21.7162 MW
ploss difference: -0.000409 MW
Power balance: -0.000008 MW
Current step size: 0.00034056

----- Iteration 32 -----
pg: [450.00 348.20 198.52]
lambda: 9.999954
ploss: 21.7158 MW
ploss difference: -0.000387 MW
Power balance: -0.000007 MW
Current step size: 0.00032353

----- Iteration 33 -----
pg: [450.00 348.17 198.54]
lambda: 9.999954
ploss: 21.7155 MW

ploss difference: -0.000367 MW
Power balance: -0.000007 MW
Current step size: 0.00030736

----- Iteration 34 -----
pg: [450.00 348.15 198.57]
lambda: 9.999954
ploss: 21.7151 MW
ploss difference: -0.000348 MW
Power balance: -0.000007 MW
Current step size: 0.00029199

----- Iteration 35 -----
pg: [450.00 348.13 198.59]
lambda: 9.999954
ploss: 21.7148 MW
ploss difference: -0.000330 MW
Power balance: -0.000006 MW
Current step size: 0.00027739

----- Iteration 36 -----
pg: [450.00 348.11 198.61]
lambda: 9.999954
ploss: 21.7145 MW
ploss difference: -0.000313 MW
Power balance: -0.000006 MW
Current step size: 0.00026352

----- Iteration 37 -----
pg: [450.00 348.09 198.62]
lambda: 9.999954
ploss: 21.7142 MW
ploss difference: -0.000296 MW
Power balance: -0.000006 MW
Current step size: 0.00025034

----- Iteration 38 -----
pg: [450.00 348.07 198.64]
lambda: 9.999954
ploss: 21.7139 MW
ploss difference: -0.000281 MW
Power balance: -0.000005 MW
Current step size: 0.00023783

----- Iteration 39 -----
pg: [450.00 348.06 198.66]
lambda: 9.999954
ploss: 21.7136 MW
ploss difference: -0.000267 MW
Power balance: -0.000005 MW
Current step size: 0.00022594

----- Iteration 40 -----
pg: [450.00 348.04 198.67]
lambda: 9.999954
ploss: 21.7134 MW
ploss difference: -0.000253 MW
Power balance: -0.000005 MW
Current step size: 0.00021464

----- Iteration 41 -----
pg: [450.00 348.02 198.69]
lambda: 9.999954

ploss: 21.7131 MW
ploss difference: -0.000240 MW
Power balance: -0.000005 MW
Current step size: 0.00020391

----- Iteration 42 -----
pg: [450.00 348.01 198.70]
lambda: 9.999954
ploss: 21.7129 MW
ploss difference: -0.000227 MW
Power balance: -0.000004 MW
Current step size: 0.00019371

----- Iteration 43 -----
pg: [450.00 348.00 198.72]
lambda: 9.999954
ploss: 21.7127 MW
ploss difference: -0.000216 MW
Power balance: -0.000004 MW
Current step size: 0.00018403

----- Iteration 44 -----
pg: [450.00 347.98 198.73]
lambda: 9.999954
ploss: 21.7125 MW
ploss difference: -0.000205 MW
Power balance: -0.000004 MW
Current step size: 0.00017482

----- Iteration 45 -----
pg: [450.00 347.97 198.74]
lambda: 9.999954
ploss: 21.7123 MW
ploss difference: -0.000194 MW
Power balance: -0.000004 MW
Current step size: 0.00016608

----- Iteration 46 -----
pg: [450.00 347.96 198.75]
lambda: 9.999954
ploss: 21.7121 MW
ploss difference: -0.000184 MW
Power balance: -0.000004 MW
Current step size: 0.00015778

----- Iteration 47 -----
pg: [450.00 347.95 198.76]
lambda: 9.999954
ploss: 21.7119 MW
ploss difference: -0.000175 MW
Power balance: -0.000003 MW
Current step size: 0.00014989

----- Iteration 48 -----
pg: [450.00 347.94 198.78]
lambda: 9.999954
ploss: 21.7118 MW
ploss difference: -0.000166 MW
Power balance: -0.000003 MW
Current step size: 0.00014240

----- Iteration 49 -----
pg: [450.00 347.93 198.78]

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lambda: 9.999954
ploss: 21.7116 MW
ploss difference: -0.000157 MW
Power balance: -0.000003 MW
Current step size: 0.00013528
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----- Iteration 50 -----
pg: [450.00 347.92 198.79 ]
lambda: 9.999954
ploss: 21.7115 MW
ploss difference: -0.000149 MW
Power balance: -0.000003 MW
Current step size: 0.00012851
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----- Iteration 51 -----
pg: [450.00 347.91 198.80 ]
lambda: 9.999954
ploss: 21.7113 MW
ploss difference: -0.000142 MW
Power balance: -0.000003 MW
Current step size: 0.00012209
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----- Iteration 52 -----
pg: [450.00 347.90 198.81 ]
lambda: 9.999954
ploss: 21.7112 MW
ploss difference: -0.000135 MW
Power balance: -0.000003 MW
Current step size: 0.00011598
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----- Iteration 53 -----
pg: [450.00 347.89 198.82 ]
lambda: 9.999954
ploss: 21.7111 MW
ploss difference: -0.000128 MW
Power balance: -0.000002 MW
Current step size: 0.00011018
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----- Iteration 54 -----
pg: [450.00 347.88 198.83 ]
lambda: 9.999954
ploss: 21.7109 MW
ploss difference: -0.000121 MW
Power balance: -0.000002 MW
Current step size: 0.00010467
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----- Iteration 55 -----
pg: [450.00 347.88 198.83 ]
lambda: 9.999954
ploss: 21.7108 MW
ploss difference: -0.000115 MW
Power balance: -0.000002 MW
Current step size: 0.00009944
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----- Iteration 56 -----
pg: [450.00 347.87 198.84 ]
lambda: 9.999954
ploss: 21.7107 MW
ploss difference: -0.000109 MW
Power balance: -0.000002 MW
Current step size: 0.00009447
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----- Iteration 57 -----
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pg: [450.00 347.86 198.85 ]
lambda: 9.999954
ploss: 21.7106 MW
ploss difference: -0.000104 MW
Power balance: -0.000002 MW
Current step size: 0.00008974
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----- Iteration 58 -----
pg: [450.00 347.86 198.85 ]
lambda: 9.999954
ploss: 21.7105 MW
ploss difference: -0.000099 MW
Power balance: -0.000002 MW
Current step size: 0.00008526
```

```
----- Iteration 59 -----
pg: [450.00 347.85 198.86 ]
lambda: 9.999954
ploss: 21.7104 MW
ploss difference: -0.000094 MW
Power balance: -0.000002 MW
Current step size: 0.00008099
```

```
----- Iteration 60 -----
pg: [450.00 347.84 198.87 ]
lambda: 9.999954
ploss: 21.7103 MW
ploss difference: -0.000089 MW
Power balance: -0.000002 MW
Current step size: 0.00007694
```

```
----- Iteration 61 -----
pg: [450.00 347.84 198.87 ]
lambda: 9.999954
ploss: 21.7103 MW
ploss difference: -0.000084 MW
Power balance: -0.000002 MW
Current step size: 0.00007310
```

```
----- Iteration 62 -----
pg: [450.00 347.83 198.88 ]
lambda: 9.999954
ploss: 21.7102 MW
ploss difference: -0.000080 MW
Power balance: -0.000002 MW
Current step size: 0.00006944
```

```
----- Iteration 63 -----
pg: [450.00 347.83 198.88 ]
lambda: 9.999954
ploss: 21.7101 MW
ploss difference: -0.000076 MW
Power balance: -0.000001 MW
Current step size: 0.00006597
```

```
----- Iteration 64 -----
pg: [450.00 347.82 198.89 ]
lambda: 9.999954
ploss: 21.7100 MW
ploss difference: -0.000072 MW
Power balance: -0.000001 MW
Current step size: 0.00006267
```

----- Iteration 65 -----
pg: [450.00 347.82 198.89]
lambda: 9.999954
ploss: 21.7100 MW
ploss difference: -0.000069 MW
Power balance: -0.000001 MW
Current step size: 0.00005954

----- Iteration 66 -----
pg: [450.00 347.82 198.89]
lambda: 9.999954
ploss: 21.7099 MW
ploss difference: -0.000065 MW
Power balance: -0.000001 MW
Current step size: 0.00005656

----- Iteration 67 -----
pg: [450.00 347.81 198.90]
lambda: 9.999954
ploss: 21.7098 MW
ploss difference: -0.000062 MW
Power balance: -0.000001 MW
Current step size: 0.00005373

----- Iteration 68 -----
pg: [450.00 347.81 198.90]
lambda: 9.999954
ploss: 21.7098 MW
ploss difference: -0.000059 MW
Power balance: -0.000001 MW
Current step size: 0.00005105

----- Iteration 69 -----
pg: [450.00 347.80 198.90]
lambda: 9.999954
ploss: 21.7097 MW
ploss difference: -0.000056 MW
Power balance: -0.000001 MW
Current step size: 0.00004849

----- Iteration 70 -----
pg: [450.00 347.80 198.91]
lambda: 9.999954
ploss: 21.7097 MW
ploss difference: -0.000053 MW
Power balance: -0.000001 MW
Current step size: 0.00004607

----- Iteration 71 -----
pg: [450.00 347.80 198.91]
lambda: 9.999954
ploss: 21.7096 MW
ploss difference: -0.000050 MW
Power balance: -0.000001 MW
Current step size: 0.00004377

----- Iteration 72 -----
pg: [450.00 347.80 198.91]
lambda: 9.999954
ploss: 21.7096 MW
ploss difference: -0.000048 MW
Power balance: -0.000001 MW
Current step size: 0.00004158

----- Iteration 73 -----
pg: [450.00 347.79 198.92]
lambda: 9.999954
ploss: 21.7095 MW
ploss difference: -0.000045 MW
Power balance: -0.000001 MW
Current step size: 0.00003950

----- Iteration 74 -----
pg: [450.00 347.79 198.92]
lambda: 9.999954
ploss: 21.7095 MW
ploss difference: -0.000043 MW
Power balance: -0.000001 MW
Current step size: 0.00003752

----- Iteration 75 -----
pg: [450.00 347.79 198.92]
lambda: 9.999954
ploss: 21.7094 MW
ploss difference: -0.000041 MW
Power balance: -0.000001 MW
Current step size: 0.00003565

----- Iteration 76 -----
pg: [450.00 347.78 198.93]
lambda: 9.999954
ploss: 21.7094 MW
ploss difference: -0.000039 MW
Power balance: -0.000001 MW
Current step size: 0.00003387

----- Iteration 77 -----
pg: [450.00 347.78 198.93]
lambda: 9.999954
ploss: 21.7094 MW
ploss difference: -0.000037 MW
Power balance: -0.000001 MW
Current step size: 0.00003217

----- Iteration 78 -----
pg: [450.00 347.78 198.93]
lambda: 9.999954
ploss: 21.7093 MW
ploss difference: -0.000035 MW
Power balance: -0.000001 MW
Current step size: 0.00003056

----- Iteration 79 -----
pg: [450.00 347.78 198.93]
lambda: 9.999954
ploss: 21.7093 MW
ploss difference: -0.000033 MW
Power balance: -0.000001 MW
Current step size: 0.00002904

----- Iteration 80 -----
pg: [450.00 347.78 198.93]
lambda: 9.999954
ploss: 21.7093 MW
ploss difference: -0.000032 MW
Power balance: -0.000001 MW

Current step size: 0.00002758

----- Iteration 81 -----
pg: [450.00 347.77 198.94]
lambda: 9.999954
ploss: 21.7092 MW
ploss difference: -0.000030 MW
Power balance: -0.000001 MW
Current step size: 0.00002620

----- Iteration 82 -----
pg: [450.00 347.77 198.94]
lambda: 9.999954
ploss: 21.7092 MW
ploss difference: -0.000029 MW
Power balance: -0.000001 MW
Current step size: 0.00002489

----- Iteration 83 -----
pg: [450.00 347.77 198.94]
lambda: 9.999954
ploss: 21.7092 MW
ploss difference: -0.000027 MW
Power balance: -0.000001 MW
Current step size: 0.00002365

----- Iteration 84 -----
pg: [450.00 347.77 198.94]
lambda: 9.999954
ploss: 21.7091 MW
ploss difference: -0.000026 MW
Power balance: -0.000000 MW
Current step size: 0.00002247

----- Iteration 85 -----
pg: [450.00 347.77 198.94]
lambda: 9.999954
ploss: 21.7091 MW
ploss difference: -0.000024 MW
Power balance: -0.000000 MW
Current step size: 0.00002134

----- Iteration 86 -----
pg: [450.00 347.77 198.94]
lambda: 9.999954
ploss: 21.7091 MW
ploss difference: -0.000023 MW
Power balance: -0.000000 MW
Current step size: 0.00002028

----- Iteration 87 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7091 MW
ploss difference: -0.000022 MW
Power balance: -0.000000 MW
Current step size: 0.00001926

----- Iteration 88 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7091 MW
ploss difference: -0.000021 MW

Power balance: -0.000000 MW
Current step size: 0.00001830

----- Iteration 89 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7090 MW
ploss difference: -0.000020 MW
Power balance: -0.000000 MW
Current step size: 0.00001738

----- Iteration 90 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7090 MW
ploss difference: -0.000019 MW
Power balance: -0.000000 MW
Current step size: 0.00001652

----- Iteration 91 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7090 MW
ploss difference: -0.000018 MW
Power balance: -0.000000 MW
Current step size: 0.00001569

----- Iteration 92 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7090 MW
ploss difference: -0.000017 MW
Power balance: -0.000000 MW
Current step size: 0.00001491

----- Iteration 93 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7090 MW
ploss difference: -0.000016 MW
Power balance: -0.000000 MW
Current step size: 0.00001416

----- Iteration 94 -----
pg: [450.00 347.76 198.95]
lambda: 9.999954
ploss: 21.7090 MW
ploss difference: -0.000015 MW
Power balance: -0.000000 MW
Current step size: 0.00001345

----- Iteration 95 -----
pg: [450.00 347.75 198.95]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000015 MW
Power balance: -0.000000 MW
Current step size: 0.00001278

----- Iteration 96 -----
pg: [450.00 347.75 198.95]
lambda: 9.999954
ploss: 21.7089 MW

ploss difference: -0.000014 MW
Power balance: -0.000000 MW
Current step size: 0.00001214

----- Iteration 97 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000013 MW
Power balance: -0.000000 MW
Current step size: 0.00001153

----- Iteration 98 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000013 MW
Power balance: -0.000000 MW
Current step size: 0.00001096

----- Iteration 99 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000012 MW
Power balance: -0.000000 MW
Current step size: 0.00001041

----- Iteration 100 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000011 MW
Power balance: -0.000000 MW
Current step size: 0.00000989

----- Iteration 101 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000011 MW
Power balance: -0.000000 MW
Current step size: 0.00000939

----- Iteration 102 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7089 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000892

----- Iteration 103 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000937

----- Iteration 104 -----
pg: [450.00 347.75 198.96]
lambda: 9.999954

```
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000890
```

----- Iteration 105 -----

```
pg: [450.00 347.75 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000935
```

----- Iteration 106 -----

```
pg: [450.00 347.75 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000888
```

----- Iteration 107 -----

```
pg: [450.00 347.75 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000932
```

----- Iteration 108 -----

```
pg: [450.00 347.75 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000886
```

----- Iteration 109 -----

```
pg: [450.00 347.75 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000930
```

----- Iteration 110 -----

```
pg: [450.00 347.74 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000884
```

----- Iteration 111 -----

```
pg: [450.00 347.74 198.96 ]
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000928
```

----- Iteration 112 -----

```
pg: [450.00 347.74 198.97 ]
```

```
lambda: 9.999954
ploss: 21.7088 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000881
```

----- Iteration 113 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000925
```

----- Iteration 114 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000879
```

----- Iteration 115 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000923
```

----- Iteration 116 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000877
```

----- Iteration 117 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000921
```

----- Iteration 118 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000967
```

----- Iteration 119 -----

```
pg: [450.00 347.74 198.97 ]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000918
```

----- Iteration 120 -----

pg: [450.00 347.74 198.97]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000964

----- Iteration 121 -----
pg: [450.00 347.74 198.97]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000916

----- Iteration 122 -----
pg: [450.00 347.74 198.97]
lambda: 9.999954
ploss: 21.7087 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000962

----- Iteration 123 -----
pg: [450.00 347.74 198.97]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000914

----- Iteration 124 -----
pg: [450.00 347.74 198.97]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000960

----- Iteration 125 -----
pg: [450.00 347.73 198.97]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000912

----- Iteration 126 -----
pg: [450.00 347.73 198.97]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000957

----- Iteration 127 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000909

----- Iteration 128 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000955

----- Iteration 129 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000907

----- Iteration 130 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000952

----- Iteration 131 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000905

----- Iteration 132 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7086 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000950

----- Iteration 133 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000903

----- Iteration 134 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000948

----- Iteration 135 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000900

----- Iteration 136 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000945

----- Iteration 137 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000898

----- Iteration 138 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000943

----- Iteration 139 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000896

----- Iteration 140 -----
pg: [450.00 347.73 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000941

----- Iteration 141 -----
pg: [450.00 347.72 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000894

----- Iteration 142 -----
pg: [450.00 347.72 198.98]
lambda: 9.999954
ploss: 21.7085 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000938

----- Iteration 143 -----
pg: [450.00 347.72 198.99]
lambda: 9.999954
ploss: 21.7084 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW

Current step size: 0.00000891

----- Iteration 144 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000936

----- Iteration 145 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000889

----- Iteration 146 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000934

----- Iteration 147 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000887

----- Iteration 148 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000931

----- Iteration 149 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000885

----- Iteration 150 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000929

----- Iteration 151 -----

pg: [450.00 347.72 198.99]

lambda: 9.999954

ploss: 21.7084 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW
Current step size: 0.00000882

----- Iteration 152 -----
pg: [450.00 347.72 198.99]
lambda: 9.999954
ploss: 21.7084 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000927

----- Iteration 153 -----
pg: [450.00 347.72 198.99]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000880

----- Iteration 154 -----
pg: [450.00 347.72 198.99]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000924

----- Iteration 155 -----
pg: [450.00 347.72 198.99]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000970

----- Iteration 156 -----
pg: [450.00 347.72 198.99]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000922

----- Iteration 157 -----
pg: [450.00 347.71 198.99]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000968

----- Iteration 158 -----
pg: [450.00 347.71 198.99]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000920

----- Iteration 159 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7083 MW

ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000966

----- Iteration 160 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000917

----- Iteration 161 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000963

----- Iteration 162 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7083 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000915

----- Iteration 163 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000961

----- Iteration 164 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000913

----- Iteration 165 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000958

----- Iteration 166 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000910

----- Iteration 167 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954

ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000956

----- Iteration 168 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000908

----- Iteration 169 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000954

----- Iteration 170 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000906

----- Iteration 171 -----
pg: [450.00 347.71 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000951

----- Iteration 172 -----
pg: [450.00 347.70 199.00]
lambda: 9.999954
ploss: 21.7082 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000904

----- Iteration 173 -----
pg: [450.00 347.70 199.00]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000949

----- Iteration 174 -----
pg: [450.00 347.70 199.00]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000901

----- Iteration 175 -----
pg: [450.00 347.70 199.01]

```
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000946
```

----- Iteration 176 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000899
```

----- Iteration 177 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000944
```

----- Iteration 178 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000897
```

----- Iteration 179 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000942
```

----- Iteration 180 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000895
```

----- Iteration 181 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000939
```

----- Iteration 182 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7081 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000892
```

----- Iteration 183 -----

```
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000937
```

```
----- Iteration 184 -----
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000890
```

```
----- Iteration 185 -----
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000935
```

```
----- Iteration 186 -----
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000888
```

```
----- Iteration 187 -----
pg: [450.00 347.70 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000932
```

```
----- Iteration 188 -----
pg: [450.00 347.69 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000886
```

```
----- Iteration 189 -----
pg: [450.00 347.69 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000930
```

```
----- Iteration 190 -----
pg: [450.00 347.69 199.01 ]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000883
```

----- Iteration 191 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000928

----- Iteration 192 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7080 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000881

----- Iteration 193 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000925

----- Iteration 194 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000972

----- Iteration 195 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000923

----- Iteration 196 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000969

----- Iteration 197 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000921

----- Iteration 198 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000967

----- Iteration 199 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000918

----- Iteration 200 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000964

----- Iteration 201 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000916

----- Iteration 202 -----
pg: [450.00 347.69 199.02]
lambda: 9.999954
ploss: 21.7079 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000962

----- Iteration 203 -----
pg: [450.00 347.68 199.02]
lambda: 9.999954
ploss: 21.7078 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000914

----- Iteration 204 -----
pg: [450.00 347.68 199.02]
lambda: 9.999954
ploss: 21.7078 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000960

----- Iteration 205 -----
pg: [450.00 347.68 199.02]
lambda: 9.999954
ploss: 21.7078 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000912

----- Iteration 206 -----
pg: [450.00 347.68 199.02]
lambda: 9.999954
ploss: 21.7078 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW

Current step size: 0.00000957

----- Iteration 207 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7078 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000909

----- Iteration 208 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7078 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000955

----- Iteration 209 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7078 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000907

----- Iteration 210 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7078 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000952

----- Iteration 211 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7078 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000905

----- Iteration 212 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7078 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000950

----- Iteration 213 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7077 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000902

----- Iteration 214 -----

pg: [450.00 347.68 199.03]

lambda: 9.999954

ploss: 21.7077 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW
Current step size: 0.00000948

----- Iteration 215 -----
pg: [450.00 347.68 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000900

----- Iteration 216 -----
pg: [450.00 347.68 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000945

----- Iteration 217 -----
pg: [450.00 347.68 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000898

----- Iteration 218 -----
pg: [450.00 347.68 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000943

----- Iteration 219 -----
pg: [450.00 347.67 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000896

----- Iteration 220 -----
pg: [450.00 347.67 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000941

----- Iteration 221 -----
pg: [450.00 347.67 199.03]
lambda: 9.999954
ploss: 21.7077 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000893

----- Iteration 222 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7077 MW

ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000938

----- Iteration 223 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000891

----- Iteration 224 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000936

----- Iteration 225 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000889

----- Iteration 226 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000933

----- Iteration 227 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000887

----- Iteration 228 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000931

----- Iteration 229 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000885

----- Iteration 230 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954

ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000929

----- Iteration 231 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000975

----- Iteration 232 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7076 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000926

----- Iteration 233 -----
pg: [450.00 347.67 199.04]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000973

----- Iteration 234 -----
pg: [450.00 347.66 199.04]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000924

----- Iteration 235 -----
pg: [450.00 347.66 199.04]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000970

----- Iteration 236 -----
pg: [450.00 347.66 199.04]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000922

----- Iteration 237 -----
pg: [450.00 347.66 199.04]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000968

----- Iteration 238 -----
pg: [450.00 347.66 199.05]

```
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000920
```

----- Iteration 239 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000966
```

----- Iteration 240 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000917
```

----- Iteration 241 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000963
```

----- Iteration 242 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7075 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000915
```

----- Iteration 243 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000961
```

----- Iteration 244 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000913
```

----- Iteration 245 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000958
```

----- Iteration 246 -----

```
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000910
```

```
----- Iteration 247 -----
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000956
```

```
----- Iteration 248 -----
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000908
```

```
----- Iteration 249 -----
pg: [450.00 347.66 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000954
```

```
----- Iteration 250 -----
pg: [450.00 347.65 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000906
```

```
----- Iteration 251 -----
pg: [450.00 347.65 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000951
```

```
----- Iteration 252 -----
pg: [450.00 347.65 199.05 ]
lambda: 9.999954
ploss: 21.7074 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000904
```

```
----- Iteration 253 -----
pg: [450.00 347.65 199.05 ]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000949
```

----- Iteration 254 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000901

----- Iteration 255 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000946

----- Iteration 256 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000899

----- Iteration 257 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000944

----- Iteration 258 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000897

----- Iteration 259 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000942

----- Iteration 260 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000895

----- Iteration 261 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000939

----- Iteration 262 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7073 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000892

----- Iteration 263 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000937

----- Iteration 264 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000890

----- Iteration 265 -----
pg: [450.00 347.65 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000935

----- Iteration 266 -----
pg: [450.00 347.64 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000888

----- Iteration 267 -----
pg: [450.00 347.64 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000932

----- Iteration 268 -----
pg: [450.00 347.64 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000886

----- Iteration 269 -----
pg: [450.00 347.64 199.06]
lambda: 9.999954
ploss: 21.7072 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW

Current step size: 0.00000930

----- Iteration 270 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7072 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000976

----- Iteration 271 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7072 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000928

----- Iteration 272 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7072 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000974

----- Iteration 273 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7071 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000925

----- Iteration 274 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7071 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000972

----- Iteration 275 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7071 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000923

----- Iteration 276 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7071 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000969

----- Iteration 277 -----

pg: [450.00 347.64 199.07]

lambda: 9.999954

ploss: 21.7071 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW
Current step size: 0.00000921

----- Iteration 278 -----
pg: [450.00 347.64 199.07]
lambda: 9.999954
ploss: 21.7071 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000967

----- Iteration 279 -----
pg: [450.00 347.64 199.07]
lambda: 9.999954
ploss: 21.7071 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000918

----- Iteration 280 -----
pg: [450.00 347.64 199.07]
lambda: 9.999954
ploss: 21.7071 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000964

----- Iteration 281 -----
pg: [450.00 347.63 199.07]
lambda: 9.999954
ploss: 21.7071 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000916

----- Iteration 282 -----
pg: [450.00 347.63 199.07]
lambda: 9.999954
ploss: 21.7071 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000962

----- Iteration 283 -----
pg: [450.00 347.63 199.07]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000914

----- Iteration 284 -----
pg: [450.00 347.63 199.07]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000959

----- Iteration 285 -----
pg: [450.00 347.63 199.07]
lambda: 9.999954
ploss: 21.7070 MW

ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000912

----- Iteration 286 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000957

----- Iteration 287 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000909

----- Iteration 288 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000955

----- Iteration 289 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000907

----- Iteration 290 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000952

----- Iteration 291 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000905

----- Iteration 292 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954
ploss: 21.7070 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000950

----- Iteration 293 -----
pg: [450.00 347.63 199.08]
lambda: 9.999954

```
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000902
```

```
----- Iteration 294 -----
pg: [450.00 347.63 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000948
```

```
----- Iteration 295 -----
pg: [450.00 347.63 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000900
```

```
----- Iteration 296 -----
pg: [450.00 347.63 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000945
```

```
----- Iteration 297 -----
pg: [450.00 347.62 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000898
```

```
----- Iteration 298 -----
pg: [450.00 347.62 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000943
```

```
----- Iteration 299 -----
pg: [450.00 347.62 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000896
```

```
----- Iteration 300 -----
pg: [450.00 347.62 199.08 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000940
```

```
----- Iteration 301 -----
pg: [450.00 347.62 199.09 ]
```

```
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000893
```

----- Iteration 302 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7069 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000938
```

----- Iteration 303 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000891
```

----- Iteration 304 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000936
```

----- Iteration 305 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000889
```

----- Iteration 306 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000933
```

----- Iteration 307 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000980
```

----- Iteration 308 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000931
```

----- Iteration 309 -----

```
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000978
```

```
----- Iteration 310 -----
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000929
```

```
----- Iteration 311 -----
pg: [450.00 347.62 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000975
```

```
----- Iteration 312 -----
pg: [450.00 347.61 199.09 ]
lambda: 9.999954
ploss: 21.7068 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000926
```

```
----- Iteration 313 -----
pg: [450.00 347.61 199.09 ]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000973
```

```
----- Iteration 314 -----
pg: [450.00 347.61 199.09 ]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000924
```

```
----- Iteration 315 -----
pg: [450.00 347.61 199.09 ]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000970
```

```
----- Iteration 316 -----
pg: [450.00 347.61 199.09 ]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000922
```

----- Iteration 317 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000968

----- Iteration 318 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000920

----- Iteration 319 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000965

----- Iteration 320 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000917

----- Iteration 321 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000963

----- Iteration 322 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7067 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000915

----- Iteration 323 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000961

----- Iteration 324 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000913

----- Iteration 325 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000958

----- Iteration 326 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000910

----- Iteration 327 -----
pg: [450.00 347.61 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000956

----- Iteration 328 -----
pg: [450.00 347.60 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000908

----- Iteration 329 -----
pg: [450.00 347.60 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000953

----- Iteration 330 -----
pg: [450.00 347.60 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000906

----- Iteration 331 -----
pg: [450.00 347.60 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000951

----- Iteration 332 -----
pg: [450.00 347.60 199.10]
lambda: 9.999954
ploss: 21.7066 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW

Current step size: 0.00000904

----- Iteration 333 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000949

----- Iteration 334 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000901

----- Iteration 335 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000946

----- Iteration 336 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000899

----- Iteration 337 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000944

----- Iteration 338 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000897

----- Iteration 339 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000942

----- Iteration 340 -----

pg: [450.00 347.60 199.11]

lambda: 9.999954

ploss: 21.7065 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW
Current step size: 0.00000895

----- Iteration 341 -----
pg: [450.00 347.60 199.11]
lambda: 9.999954
ploss: 21.7065 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000939

----- Iteration 342 -----
pg: [450.00 347.60 199.11]
lambda: 9.999954
ploss: 21.7065 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000892

----- Iteration 343 -----
pg: [450.00 347.59 199.11]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000937

----- Iteration 344 -----
pg: [450.00 347.59 199.11]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000890

----- Iteration 345 -----
pg: [450.00 347.59 199.11]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000935

----- Iteration 346 -----
pg: [450.00 347.59 199.11]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000981

----- Iteration 347 -----
pg: [450.00 347.59 199.11]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000932

----- Iteration 348 -----
pg: [450.00 347.59 199.11]
lambda: 9.999954
ploss: 21.7064 MW

ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000979

----- Iteration 349 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000930

----- Iteration 350 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000976

----- Iteration 351 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000928

----- Iteration 352 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7064 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000974

----- Iteration 353 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000925

----- Iteration 354 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000972

----- Iteration 355 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000923

----- Iteration 356 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954

ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000969

----- Iteration 357 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000921

----- Iteration 358 -----
pg: [450.00 347.59 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000967

----- Iteration 359 -----
pg: [450.00 347.58 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000918

----- Iteration 360 -----
pg: [450.00 347.58 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000964

----- Iteration 361 -----
pg: [450.00 347.58 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000916

----- Iteration 362 -----
pg: [450.00 347.58 199.12]
lambda: 9.999954
ploss: 21.7063 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000962

----- Iteration 363 -----
pg: [450.00 347.58 199.12]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000914

----- Iteration 364 -----
pg: [450.00 347.58 199.12]

```
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000959
```

----- Iteration 365 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000911
```

----- Iteration 366 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000957
```

----- Iteration 367 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000909
```

----- Iteration 368 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000955
```

----- Iteration 369 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000907
```

----- Iteration 370 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000952
```

----- Iteration 371 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000905
```

----- Iteration 372 -----

```
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7062 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000950
```

```
----- Iteration 373 -----
pg: [450.00 347.58 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000902
```

```
----- Iteration 374 -----
pg: [450.00 347.57 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000948
```

```
----- Iteration 375 -----
pg: [450.00 347.57 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000900
```

```
----- Iteration 376 -----
pg: [450.00 347.57 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000945
```

```
----- Iteration 377 -----
pg: [450.00 347.57 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000898
```

```
----- Iteration 378 -----
pg: [450.00 347.57 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000943
```

```
----- Iteration 379 -----
pg: [450.00 347.57 199.13 ]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000896
```

----- Iteration 380 -----
pg: [450.00 347.57 199.13]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000940

----- Iteration 381 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000893

----- Iteration 382 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7061 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000938

----- Iteration 383 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000985

----- Iteration 384 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000936

----- Iteration 385 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000983

----- Iteration 386 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000933

----- Iteration 387 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000980

----- Iteration 388 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000931

----- Iteration 389 -----
pg: [450.00 347.57 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000978

----- Iteration 390 -----
pg: [450.00 347.56 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000929

----- Iteration 391 -----
pg: [450.00 347.56 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000975

----- Iteration 392 -----
pg: [450.00 347.56 199.14]
lambda: 9.999954
ploss: 21.7060 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000926

----- Iteration 393 -----
pg: [450.00 347.56 199.14]
lambda: 9.999954
ploss: 21.7059 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000973

----- Iteration 394 -----
pg: [450.00 347.56 199.14]
lambda: 9.999954
ploss: 21.7059 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000924

----- Iteration 395 -----
pg: [450.00 347.56 199.14]
lambda: 9.999954
ploss: 21.7059 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW

Current step size: 0.00000970

----- Iteration 396 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000922

----- Iteration 397 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000968

----- Iteration 398 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000919

----- Iteration 399 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000965

----- Iteration 400 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000917

----- Iteration 401 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000963

----- Iteration 402 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7059 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000915

----- Iteration 403 -----

pg: [450.00 347.56 199.15]

lambda: 9.999954

ploss: 21.7058 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW
Current step size: 0.00000961

----- Iteration 404 -----
pg: [450.00 347.56 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000913

----- Iteration 405 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000958

----- Iteration 406 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000910

----- Iteration 407 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000956

----- Iteration 408 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000908

----- Iteration 409 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000953

----- Iteration 410 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000906

----- Iteration 411 -----
pg: [450.00 347.55 199.15]
lambda: 9.999954
ploss: 21.7058 MW

ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000951

----- Iteration 412 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7058 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000904

----- Iteration 413 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000949

----- Iteration 414 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000901

----- Iteration 415 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000946

----- Iteration 416 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000899

----- Iteration 417 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000944

----- Iteration 418 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000897

----- Iteration 419 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954

ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000942

----- Iteration 420 -----
pg: [450.00 347.55 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000895

----- Iteration 421 -----
pg: [450.00 347.54 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000939

----- Iteration 422 -----
pg: [450.00 347.54 199.16]
lambda: 9.999954
ploss: 21.7057 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000986

----- Iteration 423 -----
pg: [450.00 347.54 199.16]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000937

----- Iteration 424 -----
pg: [450.00 347.54 199.16]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000984

----- Iteration 425 -----
pg: [450.00 347.54 199.16]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000935

----- Iteration 426 -----
pg: [450.00 347.54 199.16]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000981

----- Iteration 427 -----
pg: [450.00 347.54 199.16]

```
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000932
```

----- Iteration 428 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000979
```

----- Iteration 429 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000930
```

----- Iteration 430 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000976
```

----- Iteration 431 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000928
```

----- Iteration 432 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7056 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000974
```

----- Iteration 433 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000925
```

----- Iteration 434 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000971
```

----- Iteration 435 -----

```
pg: [450.00 347.54 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000923
```

```
----- Iteration 436 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000969
```

```
----- Iteration 437 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000921
```

```
----- Iteration 438 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000967
```

```
----- Iteration 439 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000918
```

```
----- Iteration 440 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000964
```

```
----- Iteration 441 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000916
```

```
----- Iteration 442 -----
pg: [450.00 347.53 199.17 ]
lambda: 9.999954
ploss: 21.7055 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000962
```

----- Iteration 443 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000914

----- Iteration 444 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000959

----- Iteration 445 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000911

----- Iteration 446 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000957

----- Iteration 447 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000909

----- Iteration 448 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000955

----- Iteration 449 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000907

----- Iteration 450 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000952

----- Iteration 451 -----
pg: [450.00 347.53 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000905

----- Iteration 452 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7054 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000950

----- Iteration 453 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7053 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000902

----- Iteration 454 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7053 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000947

----- Iteration 455 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7053 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000900

----- Iteration 456 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7053 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000945

----- Iteration 457 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7053 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000898

----- Iteration 458 -----
pg: [450.00 347.52 199.18]
lambda: 9.999954
ploss: 21.7053 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW

Current step size: 0.00000943

----- Iteration 459 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7053 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000990

----- Iteration 460 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7053 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000940

----- Iteration 461 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7053 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000987

----- Iteration 462 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7053 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000938

----- Iteration 463 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7052 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000985

----- Iteration 464 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7052 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000936

----- Iteration 465 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7052 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW

Current step size: 0.00000982

----- Iteration 466 -----

pg: [450.00 347.52 199.19]

lambda: 9.999954

ploss: 21.7052 MW

ploss difference: -0.000010 MW

Power balance: -0.000000 MW
Current step size: 0.00000933

----- Iteration 467 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7052 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000980

----- Iteration 468 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7052 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000931

----- Iteration 469 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7052 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000978

----- Iteration 470 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7052 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000929

----- Iteration 471 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7052 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000975

----- Iteration 472 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7052 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000926

----- Iteration 473 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000973

----- Iteration 474 -----
pg: [450.00 347.51 199.19]
lambda: 9.999954
ploss: 21.7051 MW

ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000924

----- Iteration 475 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000970

----- Iteration 476 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000922

----- Iteration 477 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000968

----- Iteration 478 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000919

----- Iteration 479 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000965

----- Iteration 480 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000917

----- Iteration 481 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000963

----- Iteration 482 -----
pg: [450.00 347.51 199.20]
lambda: 9.999954

```
ploss: 21.7051 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000915
```

```
----- Iteration 483 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000961
```

```
----- Iteration 484 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000913
```

```
----- Iteration 485 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000958
```

```
----- Iteration 486 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000910
```

```
----- Iteration 487 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000956
```

```
----- Iteration 488 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000908
```

```
----- Iteration 489 -----
pg: [450.00 347.50 199.20 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000953
```

```
----- Iteration 490 -----
pg: [450.00 347.50 199.20 ]
```

```
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000906
```

----- Iteration 491 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000951
```

----- Iteration 492 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7050 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000903
```

----- Iteration 493 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7049 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000949
```

----- Iteration 494 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7049 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000901
```

----- Iteration 495 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7049 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000946
```

----- Iteration 496 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7049 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000994
```

----- Iteration 497 -----

```
pg: [450.00 347.50 199.21 ]
lambda: 9.999954
ploss: 21.7049 MW
ploss difference: -0.000010 MW
Power balance: -0.000000 MW
Current step size: 0.00000944
```

----- Iteration 498 -----

```
pg: [450.00 347.50 199.21 ]  
lambda: 9.999954  
ploss: 21.7049 MW  
ploss difference: -0.000010 MW  
Power balance: -0.000000 MW  
Current step size: 0.00000991
```

```
----- Iteration 499 -----  
pg: [450.00 347.49 199.21 ]  
lambda: 9.999954  
ploss: 21.7049 MW  
ploss difference: -0.000010 MW  
Power balance: -0.000000 MW  
Current step size: 0.00000942
```

```
----- Iteration 500 -----  
pg: [450.00 347.49 199.21 ]  
lambda: 9.999954  
ploss: 21.7049 MW  
ploss difference: -0.000010 MW  
Power balance: -0.000000 MW  
Current step size: 0.00000989
```

WARNING: Maximum iterations reached. Solution may not have fully converged.

```
===== Final Results =====  
Generator 1: 450.0000 MW (min: 200, max: 450)  
Generator 2: 347.4937 MW (min: 150, max: 350)  
Generator 3: 199.2112 MW (min: 100, max: 225)  
Total generation: 996.7049 MW  
Total demand: 975.0000 MW  
Total losses: 21.7049 MW  
Power balance: -0.0000 MW  
Generator 1 cost: 3695.00 $/h (marginal cost: 8.9000 $/MWh)  
Generator 2 cost: 3035.73 $/h (marginal cost: 9.6699 $/MWh)  
Generator 3 cost: 1712.59 $/h (marginal cost: 9.3858 $/MWh)  
Total cost: 8443.32 $/h
```

```
Incremental costs at operating point:  
Generator 1 incremental cost: 9.1470 $/MWh  
Generator 2 incremental cost: 10.3151 $/MWh  
Generator 3 incremental cost: 9.8571 $/MWh
```

