

DE LA RECHERCHE À L'INDUSTRIE

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3 INVESTMENT SCENARIOS FOR FAST REACTORS

SHOAI TEHRANI Bianka, DA COSTA Pascal

International Conference on Fast Reactors and Related Fuel
Cycles: Safe Technologies and Sustainable Scenarios
(FR13)

Paris, France

4-7 March 2013 Conference ID: 41987 (T1-CN-199)

2013, MARCH 5

Context

- When Fast Reactors are technologically ready for industrial deployment around 2040, what will be their potential of penetrating the European Market ?

Research question

- What are the drivers for electricity generation investment and how do they affect potential penetration of FRs on the European Market ?

Perimeter

- Europe
- Focus on electricity companies' point of view : actual decision maker

Method

- Literature review, interviews with energy experts, structural analysis with MICMAC tool

State policy

- Climate policy: incentives for renewables and carbon emissions
- Nuclear policy: strongly pro, moderately pro or anti-nuclear position

Economics

- Market structure: concentration, grid interconnections...

Technical change

- Learning effects expected on most recent technologies...

Internal drivers of the companies

- Shareholding structure, Market share, Annual Production and Revenue...

DETAILED DRIVERS LIST

- State policy driver
- Economic driver
- Technical change driver

External drivers

➔ Identification of key drivers with structural analysis (MICMAC* tool)

Internal drivers

MATRIX OF DIRECT INFLUENCES AND DEPENDENCES

Influence of every driver on the others



- 0: No influence
- 1: Weak influence
- 2: Moderate influence
- 3: Strong influence
- 4 (P): Potential influence

	1 : Carbon tax	2 : CO2 quota	3 : Feed-in tariffs for renewables	4 : Green certificates	5 : Tenders for renewables	6 : Fiscal incentive for renewables	7 : Nuclear position	8 : Nuclear strike price	9 : Stability of policy	10 : HHI	11 : Development of grid	12 : Construction cost Euro/MW	13 : Generation cost Euro/MWh	14 : Building period	15 : Size of plant	16 : Load factor	17 : Corporate financing	18 : Project financing	19 : Hybrid financing method	20 : Other original financing method	21 : Shareholding structure	22 : Market Capitalization	23 : Annual Production	24 : Generation Mix	25 : Market share	26 : Annual revenue
1 : Carbon tax	0	3	3	3	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	3
2 : CO2 quota	3	0	3	3	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	3
3 : Feed-in tariffs for renewables	3	3	0	3	3	3	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	0	3	0	3	
4 : Green certificates	3	3	3	0	3	3	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	0	3	0	3	
5 : Tenders for renewables	3	3	3	3	0	3	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	0	3	0	3	
6 : Fiscal incentive for renewables	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	0	3	0	3	
7 : Nuclear position	4	4	0	0	0	0	0	3	0	0	0	0	0	0	0	1	1	1	1	2	0	0	3	0	3	
8 : Nuclear strike price	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	0	3	0	3	
9 : Stability of policy	3	3	3	3	3	3	3	3	0	0	3	0	0	0	0	1	1	1	1	3	0	0	3	0	0	
10 : HHI	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11 : Development of grid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	
12 : Construction cost Euro/MW	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	3	0	2	0	
13 : Generation cost Euro/MWh	3	3	3	3	3	3	0	3	0	0	0	0	0	0	2	0	0	0	0	0	3	3	3	0	3	
14 : Building period	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	
15 : Size of plant	0	0	0	0	0	0	0	0	0	0	2	3	0	3	0	3	3	3	3	0	0	3	3	3	0	
16 : Load factor	0	0	3	3	3	3	0	0	0	0	3	0	0	0	3	0	0	0	0	0	3	0	0	0	0	
17 : Corporate financing	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
18 : Project financing	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
19 : Hybrid financing method	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
20 : Other original financing method	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
21 : Shareholding structure	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	3	3	3	0	3	0	3	0	0	
22 : Market Capitalization	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	3	3	3	3	0	0	0	0	0	
23 : Annual Production	0	0	0	0	0	0	0	0	0	3	3	0	3	0	2	1	0	0	0	0	0	0	0	3	3	
24 : Generation Mix	3	3	3	3	3	3	2	0	0	0	3	1	0	1	1	0	1	1	1	1	0	0	3	0	0	
25 : Market share	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	3	3	3	0	0	0	0	0	0	
26 : Annual revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	3	0	0	3	0	

RANKING OF DRIVERS BY INFLUENCE

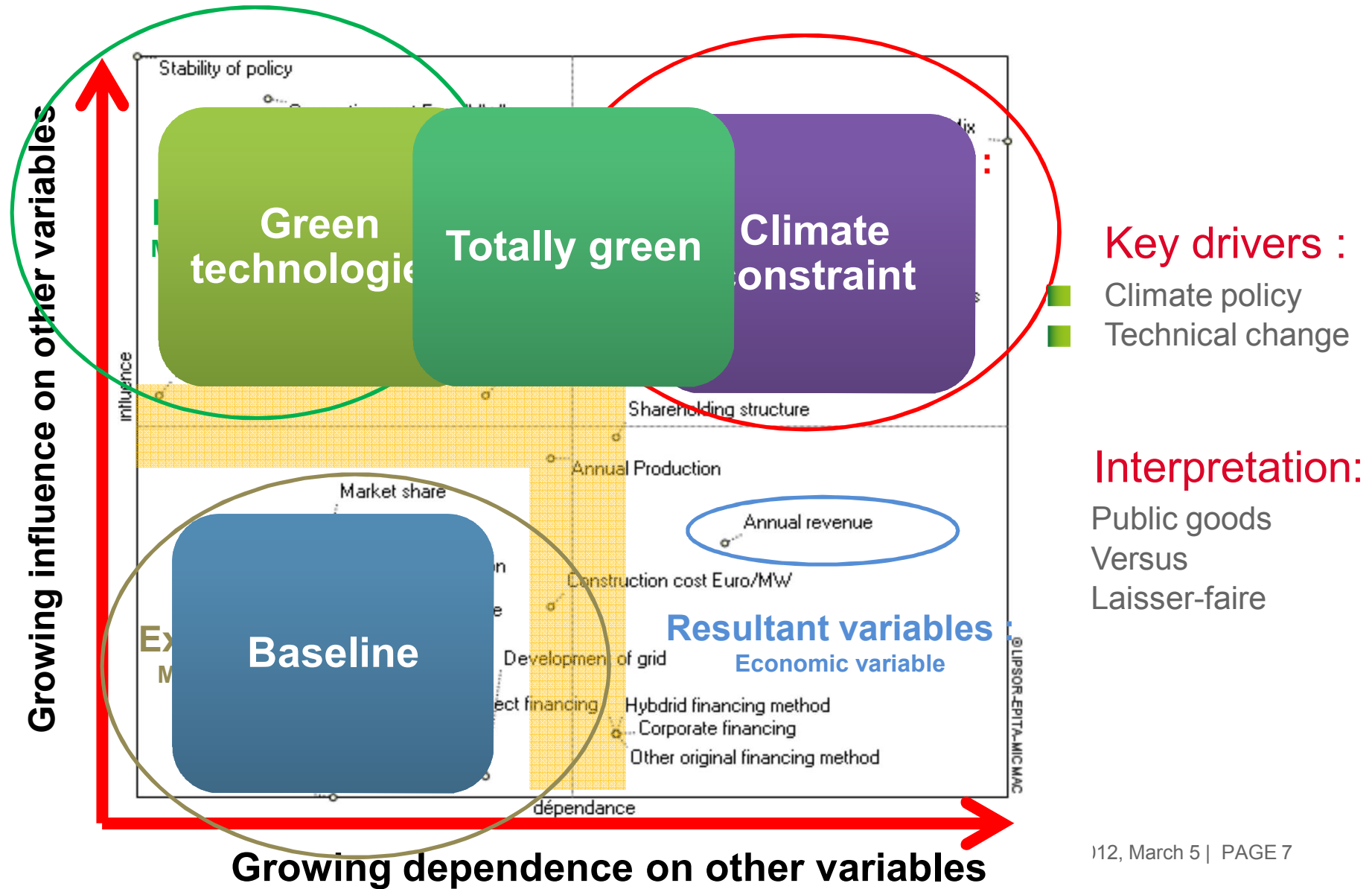
- State policy driver
- Economic driver
- Technical change driver

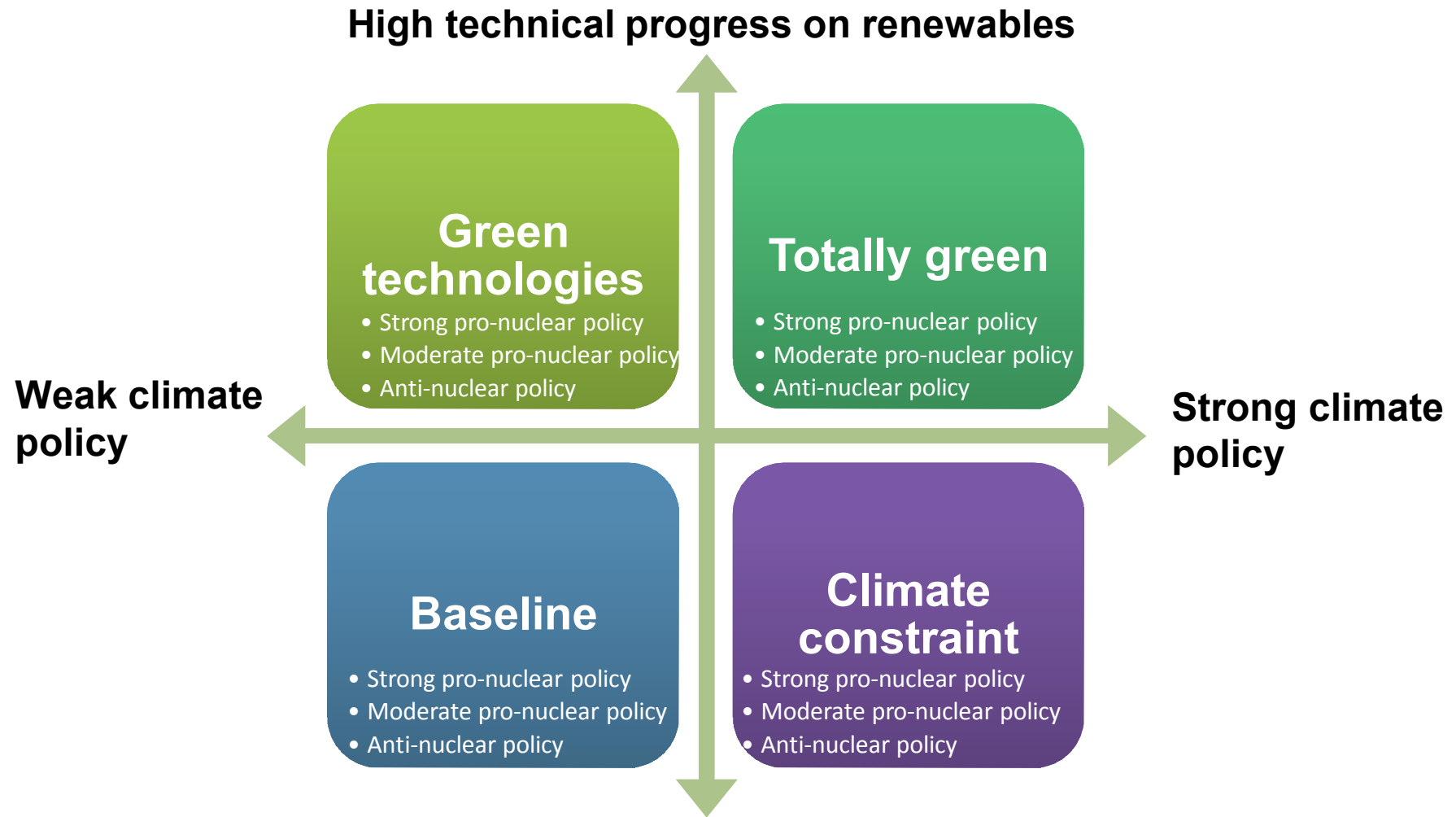
Rank	N°	Variable
1	9	Stability of policy
2	13	Generation costs (€/MWh)
3	15	Size of plant (MW)
4	16	Load factor (%)
5	1	Carbon tax (€/tCO ₂)
6	2	CO ₂ quota
7	3	Feed-in tariffs for renewables (€/MWh)
8	4	Green certificates for renewables
9	5	Tenders for renewables
10	6	Fiscal incentive for renewables
11	23	Annual Production
12	22	Market Capitalization
13	25	Market share
14	21	Shareholding structure
15	26	Annual revenue
16	24	Generation Mix
17	12	Construction costs (€/MW)
18	14	Building period (year)
19	17	Corporate financing
20	18	Project financing
21	19	Hybrid financing method (corporate and project financing)
22	20	Other original financing method
23	7	Nuclear position
24	8	Nuclear strike price (€/MWh)
25	10	HHI concentration index
26	11	Development of grid and interconnections

Most influent drivers :

- Climate policy
- Technical change

GRAPH OF DIRECT INFLUENCES AND DEPENDENCES





■ 12 possibilities considering nuclear policy

Low technical progress ■

3 favorable cases

Results

- 4 families of scenarios
 - In each of them, 3 options for national nuclear policy → 12 scenarios
 - 3 favorable to FRs :
 - “climate constraint” with strong pro-nuclear policy
 - “climate constraint” with moderate pro-nuclear policy
 - “totally green” with strong pro-nuclear policy
 - Business As Usual is not favorable to Fast Reactors
- Fast reactors deployment
- Needs strong climate policy
 - Is viable in case of important renewable progress as long as climate policy is strong

International perspective

- Results are valid for Europe, other drivers being likely to be more important in other countries : high growth and demand (Asia)
- With strong contrasts between European countries

Further research

- Finer modeling of drivers with unclear influence (clustered and excluded variables):
Influence of weak signals

THANK YOU FOR YOUR ATTENTION

Commissariat à l'énergie atomique et aux énergies alternatives
Centre de Saclay | 91191 Gif-sur-Yvette Cedex
T. +33 (0)1 69 08 65 23 | F. +33 (0)1 69 08 35 66

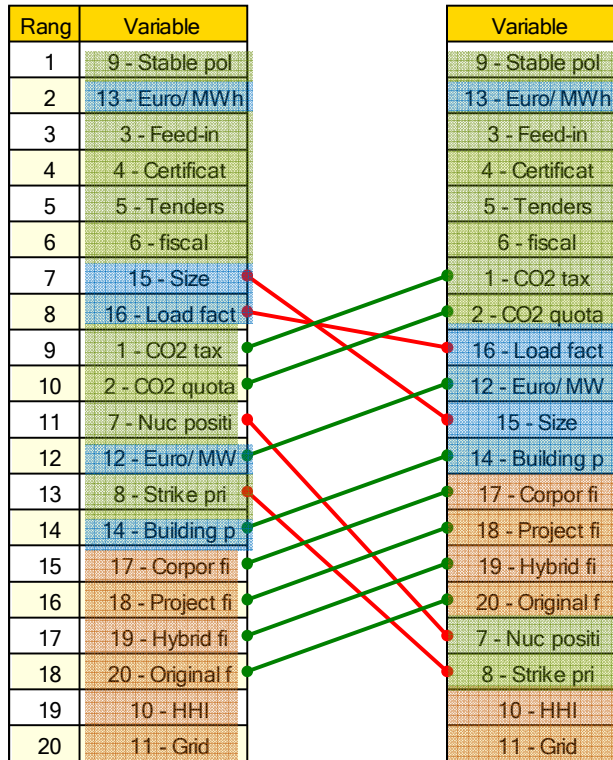
Direction de l'Energie Nucléaire
Institut de Technico-Economie des
Systèmes Energétiques

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RANKING OF DRIVERS BY INFLUENCE

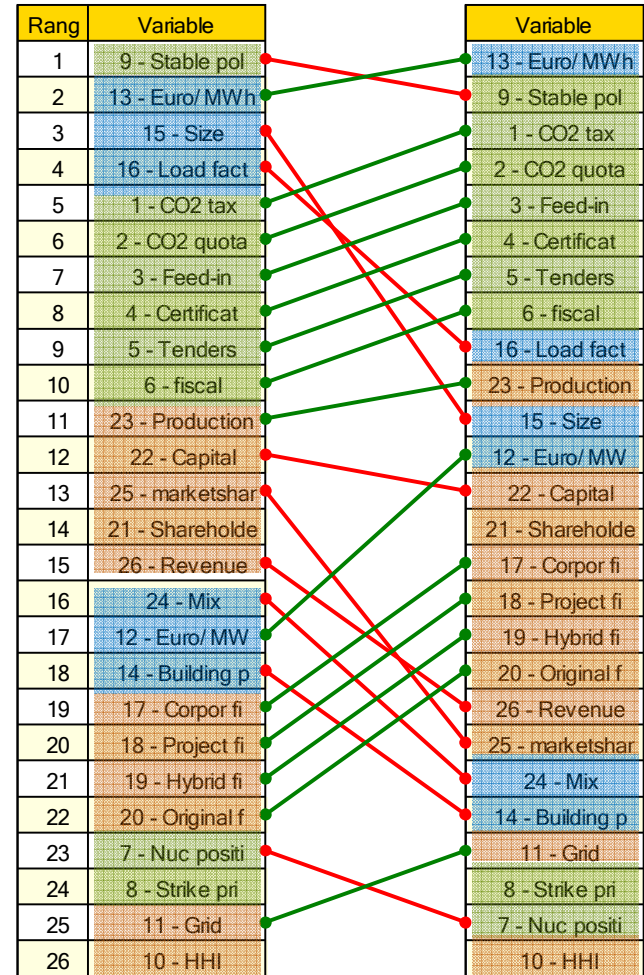
- State policy driver
- Economic driver
- Technical change driver

Direct influence Indirect influence



Ranking of external drivers only

Direct influence Indirect influence



Ranking of internal and external drivers

GRAPH OF DIRECT INFLUENCES AND DEPENDENCES FOR DRIVERS EXTERNAL TO COMPANIES ONLY

