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## An overview of the Swedish natural gas market

The natural gas market in Sweden is rather limited, only 3.5% of the total Swedish energy needs are covered by natural gas. However in those areas in Sweden where natural gas is established it covers approximately 20% of the energy needs. In Sweden approximately thirty municipalities, mainly situated at the West-Coast area and the Southern part of Sweden, have access to natural gas. However, despite the fact that the number of end-users on the Swedish natural gas market has decreased there has been a tendency of rising volumes of sold natural gas on the Swedish wholesale market for natural gas. In 2010 a record volume, 1 600 MNm<sup>3</sup> (1.6 Mtoe), of natural gas was consumed. The increase in natural gas consumption was mainly due to the start of a large gas-fired CHP plant in 2009 and cold weather during 2010. In 2011 the volume was down to 1 230 MNm<sup>3</sup> mainly due to warm weather. Another contributing factor has been the increased use of LNG in urbanised areas like for example Stockholm where natural gas has not been a traditional energy source before.

Table 1: consumption and transmission in Sweden<sup>1</sup>

	Total Consumption (TWhg)	Total Import Capacity (TWhg)
2006	11.2	15
2007	11.7	15
2008	10.7	15
2009	14.2	15
2010	19.0	22
2011	15.1	22

On the wholesale market there are currently only two companies operating<sup>2</sup> while the retail market is slightly more competitive with four active suppliers<sup>3</sup> (of which E.ON

<sup>1</sup> EI R2011:07, Sveriges el- och naturgasmarknad 2010

Gashandel Sverige AB, Dong Energy AB and Göteborgs Energi AB have approximately 90% of the market)

The Swedish natural gas market has roughly 37 000 customers and is characterized by a small number of big consumers like CHP- and district heating-units together with large, energy consuming, industry, using a large share of the total volume consumed natural gas and a bigger group of household using a small share of the total volume consumed natural gas. In the first group, circa 60 large users take approximately 80% of the natural gas. The number of households amount to 34 000 of which approximately 50% are single family houses using natural gas for heating and cooking purposes and 50% use natural gas for cooking purposes only. These consumers take 2% of the natural gas and are mainly situated in the cities of Gothenburg and Malmö.

In 2010, 266 households switched natural gas supplier, a 6.6% decrease over the previous year. The total number of switches continues to remain at a low level and is equivalent to almost 1% of the total number of domestic customers. The equivalent figure for non-domestic customers was 172, or just over 4.7% of all non-domestic customers.

Big (industrial) consumers can roughly be divided in two categories, those which:

- use natural gas for district heating
- use natural gas for producing other products like the petrochemical industry on the West coast of Sweden

Due to the fact that there is no extraction of natural gas in Sweden, besides small volumes of biogas, the entire consumed volume has to be imported from or via Denmark by using the pipeline connecting both countries.

Biogas is an emergent market but it needs to be enriched with propane to ensure that it has the same energy content and quality as the natural gas imported from the Danish Tyra Field, before it can be injected into the Swedish gas transmission grid. The producers of biogas have to accomplish these adjustments in order to comply with the requirements for injecting biogas into the Swedish gas transmission grid. This process makes it more expensive and less attractive to invest in biogas production plants, which might hamper the development of biogas in Sweden.

Another consequence of the high additional costs is that the existing biogas producers currently prefer to construct their own local networks instead of connecting the production facilities to the Swedish gas transmission grid.

Due to among others the abovementioned problems biogas is at the moment only injected in the Swedish gas distribution system in order to be delivered to special consumers like gasoline stations.

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<sup>2</sup> E.ON Gashandel Sverige AB, Dong Energy AB

<sup>3</sup> E.ON Gashandel Sverige AB, Dong Energy AB, Göteborgs Energi AB, Modity Trading AB

The responsibility to ensure that the injected biogas is of the same nature as the imported natural gas is put on the DSO.

The Swedish gas transmission grid is about 620 km long<sup>4</sup> while the Swedish gas distribution networks consist of approximately 2600 km pipeline.<sup>5</sup> There is one small LRC (lined rock cavern) storage facility (Skallen) which has a very limited capacity and is not meant for seasonal equalisation of natural gas consumption but to equalise short term consumption peaks. For seasonal storage Sweden has to rely on facilities in other countries (e.g. Denmark) or line-pack flexibility services in the Swedish gas transmission grid.

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<sup>4</sup> Since June 2011 the entire transmission grid is owned by Swedegas AB.

<sup>5</sup> E.ON Gas Sverige AB 1800 km, Öresundskraft AB 260 km, Göteborgs Energi AB 235 km, Krafringen Nät AB 172 km, Varberg Energi AB 70 km.

Table 2: Map of the Swedish Natural Gas Network



As described above the Swedish natural gas market is totally dependent on import from or through Denmark via one single pipeline (Dragör) Sweden is thus not directly linked to continental Europe but is, via Denmark, coupled to the European gas transmission system. The total import capacity of the Swedish gas transmission grid is currently approximately 22 TWh/year and with a total consumption of approximately 15 TWh/year

there are presently thus no situations where congestion on the cross-border connection occurs.

Construction and enlargement of the natural gas infrastructure in Sweden has to be done on commercial basis. The Swedish government does not finance or own any part of the Swedish gas transmission grid or the Swedish gas distribution networks. Permissions to build gas transmission pipelines (high-pressure), storages or LNG facilities are solely awarded by the Swedish government and applicants for such a permit have among other things to show a satisfying business plan in order to obtain such a permit. Even a positive recommendation given by the Swedish Energy Markets Inspectorate in an earlier stage of the process does not automatically mean that a building-permission is granted by the Swedish government.

### Market players on the Swedish natural gas market

As emphasized above the Swedish natural gas market is a relatively small market where the following actors are playing a role:

- *Gas Producers*: Producing gas and inject this into the Swedish gas transmission grid (only production of biogas exists in Sweden and even that in rather limited volumes)
- *Network Owners*: (sometimes also referred to as Network Operators): Responsible for the transfer of gas to the Gas Users. The Network Owner has all the original information regarding gas supplies within their network area. It is the Network Owner that reports metered energy amounts recorded at the injection and withdrawal points. Network Owners provide the necessary details to the Gas Suppliers, System Balance administrator (SBA) and Balance Administrators (BA's) that enable planning, settlement and invoicing in the natural gas system. Network Owners can be divided in five distribution network owners and one transmission network owner.<sup>6</sup>

Directive 73/2009/EC contains in, among others, articles 9 and 26 detailed provisions regarding the rules on unbundling. It contains among others rules on separation of network companies for natural gas, both transmission and distribution, from companies selling/trading and producing natural gas. The Swedish Natural Gas Act<sup>7</sup> has been amended in such a way that a company active in the gas network business is not allowed to produce or sell natural gas or any other type of gas which technically and safely can be injected into the Swedish natural gas system. This provision includes also the production of biogas.

- *Gas Trader* (also referred to as Gas Supplier): This is a company that buys gas from a Gas Producer, or other Gas Traders and then sells the gas to Gas Users.<sup>8</sup> A Gas Trader can operate several different undertakings simultaneously. In addition to acting as a gas supplier, they can act as a BA as well and also as a gas trader that buys and sells

<sup>6</sup> DSO's are E.ON Gas Sverige AB, Göteborgs Energi Gasnät AB, Kraftringen nät AB, Varberg Energi AB and Öresundskraft AB while Swedegas AB is the owner of the Swedish gas transmission grid.

<sup>7</sup> Naturgaslagen (2005:403)

<sup>8</sup> It has to be emphasized that, mainly due to the fact that the Swedish natural gas market only has a few suppliers, the number of switches made by household consumers is very limited (approximately 1% of the total number of household consumers per year).

firm gas. There are no barriers for, foreign, Gas Traders aiming to establish themselves on the Swedish natural gas market, no proficiency check is done by the Swedish Energy Markets Inspectorate or any other authority and there does neither exist an official register about Gas Suppliers active in Sweden.

- *Balance Administrator (BA)*: Has to be appointed for every withdrawal point. For the SBA to be able to make a balancing settlement between the BAs there must also be a BA for every injection point. Through a balancing contract with the SBA, the BA assumes the daily balancing responsibilities. The BA bears the financial responsibility for maintaining the balance of gas injected and withdrawn at all of the injection and withdrawal points within their area of balancing responsibility. Balancing is achieved through continuous follow-up and, through balancing plans to the SBA, specifying energy amounts for the next day. Gas Traders can choose to either take on balancing responsibilities, or procure balancing services from another Gas Trader.<sup>9</sup>
- *System Balance administrator (SBA)*: Has the comprehensive responsibility for maintaining the balance between the injection and withdrawal of gas within the entire Swedish natural gas system. This is achieved by keeping the pressure in the transmission network within the preferred limits. This includes being ready to compensate for imbalances, which could arise due to disruptions in transfers, planned injection or withdrawal amounts etc. The SBA calculates the imbalance for respective BAs and financial responsibility is assigned through a balancing settlement.
- *System Operator (SO)*: A legal entity operating the gas transmission grid independent from the owner of the grid. Contrary to the situation in the majority of the European countries the Swedish SO, the state owned public utility Affärsverket svenska kraftnät (Svenska Kraftnät), is acting as SBA and thus responsible for short term maintenance of the balance between injection and withdrawal of natural gas in the Swedish gas transmission grid but not the owner of the transmission assets. At the same time is the owner of the transmission assets, the private owned company Swedegas AB (Swedegas), responsible for operating, daily maintenance and enlargement of the Swedish gas transmission grid and, like SvK, considered to be a TSO as well.

During 2013 this situation will change and the system balancing administration accomplished by Svenska Kraftnät will be transferred to Swedegas which means that Swedegas will be considered as both SBA of the complete Swedish gas transmission grid and the only Swedish TSO and is expected to participate in the work of ENTSO as a certified TSO. The provisions on certification are intended to support the unbundling regime applied to a TSO in the internal market.

The access to the Swedish gas transmission grid is totally open for third parties and transparent. Even on distribution networks is, in line with the requirements in regulation 715/2009/EC, unconditional third party access applicable.

- *Storage owner*: This is the owner of a facility that stores natural gas for use by the players in the Swedish natural gas market. The Storage Owner's undertaking is financed through published tariffs and regulated access to the inventory. A natural

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<sup>9</sup> There are currently four balance responsible parties acting on the Swedish natural gas market, DONG Naturgas AB, E.ON Gashandel Sverige AB, Göteborg Energi AB, Modity Trading AB.

gas storage facility serves as both an injection and a withdrawal point, which contributes to maintaining the balance and effectiveness of the natural gas system. There must always be one or more BAs responsible for the injections and withdrawals that are made.

Storage is in the Swedish natural gas market, for reasons as explained above, done in two different ways; either by using the unused capacity in the Swedish gas transmission grid (line-pack) or by using the existing storage facility. Line-pack, if existing, can be used as storage facility for balancing measures performed by SvK in its current role as SBA while the owner of the only storage facility on the Swedish natural gas market (Swedegas) is offering storage services (currently acquired by SvK) On the services offered is a fully transparent regulated third party access regime applicable with regulated tariffs. The Swedish Natural Gas Act contains a provision ensuring that the regulator should consult system users when developing the tariffs for storage and for storage in transmission pipelines or the methodology underlying their calculation. This is in line with the provisions in directive 2009/73/EC according to which member states shall designate or require natural gas undertakings which owns storage facilities to designate one or more storage system operators.<sup>10</sup>

- *Gas user:* This is a user of gas that may be everything from a heavy industry to a household consumer that heats their home with gas or use it for cooking.

Regarding the position of household consumers the Swedish legislator has adapted the requirements from directive 2009/73/EC aiming to strengthen and clarify the position of both industrial consumers and household consumers. However even before implementing the level of consumer protection was already considerably high and in line with the provisions in the directive, except the provisions for vulnerable customers. With introducing a definition of “vulnerable customer” in the Swedish Natural Gas Act<sup>11</sup> this group has got an increased protection according to the aim of the abovementioned directive. There is however no separate legislation for vulnerable energy customers in Sweden but an ADR-system is in place for all consumers including energy issues.<sup>12</sup>

### **Legislative inquiry, The Future Balancing Regime for Gas (FRANS)<sup>13</sup>**

On the 3rd of June 2010 the Swedish government decided to establish a special committee in order to perform an overhaul of the Swedish natural gas legislation (FRANS inquiry). The issues of interest consist among others of rules for the overall balancing of the Swedish gas transmission grid and the Swedish market model for gas. The situation described in this report concerning balancing and market model has taken into account the by the special committee proposed changes. The reason for establishing this special committee was to perform an inquiry in order to streamline the implementation of the

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<sup>10</sup> The same requirement is made for LNG facilities but taken into account that there is currently no LNG facility which is connected to the Swedish gas transmission grid this provision was considered irrelevant for implementation into Swedish national legislation.

<sup>11</sup> Vulnerable customers are defined as those people who are in need of general social welfare legislation.

<sup>12</sup> The ADR is called Allmänna Reklamations Nämnden.

<sup>13</sup> SOU 2011:46, the Future Balancing Regime for Gas

rules and requirements laid down in the Third Energy Package and the security of supply regulation 994/2010/EC. The main tasks of the special committee were thus:

- to identify if there is a need to adjust the Swedish market model for gas in order to fulfil the EU legislation and requirements as laid down in especially the Third Energy Package and, if needed, establish a proposal for relevant adjustments of the national legislation
- to suggest adjustments of the national legislation needed to secure the accomplishment of regulation 994/2010/EC within Sweden.

After consultation with the European Commission, an overall assessment done by the special committee has led to the conclusion drawn by the special committee that the Swedish market model for gas is considered to fulfil the requirements as laid down in the current European legislation. The information achieved from the Commission does not serve as a guarantee that future changes to the Swedish market model for gas are not necessary, changes in the existing European legal framework or expansion of the Swedish natural gas market might result in a new assessment and a need for adjustments. For today's situation the special committee considered however, based on the assessment of the Commission, that there is no necessity for any adjustments.

### **The Swedish Market Model for gas**

The market model for the Swedish natural gas market has been designed and developed between the starting point of the liberalization in 2000 and its finalization in 2007 and is based on the Swedish electricity market model. Thus the Swedish natural gas market achieved a simple, reliable and transparent market model which is tailor-made for its relatively small scale activities.

The Swedish natural gas market is characterized by a continuous existence of over-capacity in the gas transmission grid in combination with the fact that there is only one way of supply and no transit at all. This resulted in a market model where an entry fee in the, single, entry point of the Swedish gas transmission system is not necessary, and no need for capacity trading between shippers and the TSO exists.

With regard to the exit-entry points it can be said that there is no real entry-point in the Swedish gas transmission grid. The Interconnection Point (IP) is actually situated in the Danish gas transmission grid and having access to the exit-point means automatically having access to the Swedish gas transmission grid. Shippers booking and getting access to capacity on the IP in Denmark can thus supply customers in Sweden without any problem. In a certain way this can be considered as a system of bundled products on the IP and explains the absence of booking procedures for capacity in Sweden.

Capacity in the Swedish gas transmission grid is contracted between the end users and the DSOs respectively TSO and from this point of view the Swedish gas transmission and distribution grid could be considered as one single distribution network area similar to any area within other EU member states.



To sum up, the main differences compared to most other countries in the EU are that there is no need for capacity trading in the entry point at the Swedish gas transmission grid. There is, due to the lack of congestion, no need for a secondary market where unutilized capacity is made available for trading and the balancing regime is, due to the significant volume of line-pack, more TSO driven than in the majority of the other EU member states.

### **A short description of the Swedish balancing model**

Maintaining balance in the Swedish gas transmission grid is of primary importance to all the players on the Swedish natural gas market.

The responsibility for the balancing and operation of the Swedish gas transmission grid is today shared by two market players, Svenska Kraftnät and Swedegas.<sup>14</sup>

The system balancing regime consists of the short term balancing administration, embracing the complete Swedish natural gas market and occurs in different stages including planning, implementation and balance settlement.

Svenska Kraftnät is responsible for the short term balancing administration which among others includes nomination, matching and allocation of gas. Both the daily balancing settlement and the final monthly and financial settlement are carried out by Svenska Kraftnät. At the same time Swedegas is responsible for the technical operation as well as the capacity allocation within the Swedish gas transmission grid.

During 2013 the balancing responsibilities of Svenska Kraftnät will be merged with those of Swedegas in the sense that system balancing administration which currently is accomplished by Svenska Kraftnät will be transferred to Swedegas. This will, as said earlier, result in a situation where only one certified and appointed legal entity is performing the entire TSO function, i.e. Swedegas. This does however not mean that the TSO always has to be the same legal entity as the one acting as SBA. By introducing a legal distinction in the Swedish Natural Gas Act between the role as the SBA and the role as a TSO, the flexibility of the Swedish legislation has been increased. Any market player that is considered as being suitable by the Swedish government will be able to act as the SBA, notwithstanding whether it is acting as a TSO or not. It is important to notice that the Swedish legislations allow more than one TSO but only one SBA at the time. The motivation for this is that the system balancing administration comprises the entire Swedish natural gas market.

As stated above the Swedish gas transmission grid contains a significant volume of unused capacity. There is a large flexibility in linepack of about 25% of a winter's day's consumption for the whole market. This line-pack flexibility is used for maintaining the short term balance in the Swedish natural gas transmission grid and utilized in a way that the need for the TSO to take balancing actions is very low.

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<sup>14</sup> June 2011 E.ON Gas Sverige AB sold its part of the Swedish gas transmission grid to Swedegas AB

Available flexibility has to be distributed between the BAs, daily before the day of delivery, in accordance with the average monthly capacity needs of the end users. The distribution is based on average monthly capacity needs per BA. The calculation is done by the Network Owners for each of the networks respectively. After this the Network Owner will report the average monthly capacity per BA to the SBA on the 15th of the month prior to delivery.

In accordance with the reported capacity, the SBA calculates the present share of the total available flexibility within linepack during the following month which has to be reported to the BA's by the SBA on the 25th day of the month prior to delivery.

The conditions for using flexibility through the balancing account are regulated within the balancing contract between the SBA and BA's. Nomination by BA's for one gas day is done daily on a regular occurrence. Re-nominations can be done on additional occasions.

The SBA reviews each BA's nominations. The nominated trade exchange is then matched to the foreign trade exchange with foreign SBA. The SBA also matches exchanges between the domestic BA's to verify that the planned balance in the flexibility account stays within the limits allowed.

If the matching reveals differences between the information provided by the BA's, the 'lesser rule' shall apply. This means that the lower values are used. If the BA's planned balance is not within the allowable limits after matching, the SBA has the right to adjust the nomination by the necessary amount.

After reviewing and, if necessary, adjusting the nominations, the SBA approves the nominations and reports the approved nominations to the respective BA's. The approved nominations are the basis for the SBA's settlements.

## **Balancing settlements**

The Swedish natural gas system is divided into network areas for balancing settlement purposes. These areas consist of one network area for the gas transmission grid and one network area for each gas distribution network (Every network area is assigned a network area ID by the SBA) The SBA determines the make-up of the network areas for balancing settlement. Within a network area there must always be a BA which has the responsibility for network losses.

Usage profile shares are used to allot gas supplies to profile settlement customers for the balancing settlement purposes of the respective BA's and Gas suppliers. Preliminary usage profile shares are calculated by the Network Owners and describe the gas suppliers' and BAs' supplies to the profile settlement customers within the actual network area.

When the results from the daily and monthly meter readings have passed the quality control, the final usage profile shares are calculated by the Network Owner for the BA's and gas suppliers within the network area. The final usage profile shares are given as a

percentage of the network area's total non-metered gas usage. These are to be reported no later than the 15th of the following month to the BAs and gas suppliers concerned.

Preliminary allocation is performed by the Network Owner daily. It is the basis for the SBA's preliminary balancing settlement. The preliminary allocated supplies are reported to the BA, gas supplier and the SBA no later than 10:30 on the day after the delivery.

Final allocation is done by the Network Owner monthly, after the fact and is the basis for the SBA's final balancing settlement. The final allocated hour series are reported no later than the 15th day of the month following to the SBA, BA's and Gas Suppliers.

In practice the model is created so that the BA's physically compensates for their own imbalances over time. Each Network Owner is given a balance account where his cumulated imbalances are positioned. The balance account has limits for cumulated negative imbalance and for cumulated positive imbalance - the total limit for all accounts being set from a safe linepack variation of the system. Each Network Owner has a share of the total limits for the accounts that is dependent on the load of his customer portfolio.

At the end of the day the imbalance for each Network Owner is calculated and added to the balance account (the SBA is thus making a settlement for the BA's at the end of the day). The imbalance that the BA has within the "tolerance" is put on his imbalance account, and will be carried over to the next day. In that way the Network Owner can physically compensate for a day where he is short, with another day where he is long. If he has imbalance outside the "tolerances" it will be cashed out (for balance gas). There is no fee for imbalances within the "tolerances".

With this model the need for the TSO to take actions for balancing the system is very low - the balancing is done by the BA's. The TSO has no flexibility contracts with Gas Supplier or Storage Owner. If a balancing action is needed it is done market based (the TSO asks for bids from the Network Owners).

## **Metering and meter reading**

The reporting of metered values is always done in actual time. Consequently, summer or winter time applies respectively to all reporting. The gas day runs from 06:00 one day to 06:00 the following day.

- Daily reading is done at withdrawal points with a yearly usage greater than or equal to 3.0 GWh (NCV), or that have a peak monthly usage greater than or equal to 500 MWh (NCV). The Network Owner collects the daily meter readings from all the withdrawal and junction points directly after the gas day ends. The metered values are to be reported to the adjacent Network Owner no later than 09:00 the following day.
- At least monthly reading is mandatory at withdrawal points with a yearly usage greater than or equal to 0.3 GWh (NCV). Final reporting includes gas usage during the entire month, starting from 06:00 on the first day of the month.

- Yearly reading is done at withdrawal points with a yearly usage less than 0.3GWh (NCV). These points shall have yearly meter readings, at a minimum. Final reporting includes gas usage during a period of one year and will be sent directly after the meter reading has been taken.

Withdrawal points with a calculated yearly usage of less than 1200 kWh (NCV) are exempted from metering requirements.

In a recently published report<sup>15</sup> the Swedish Energy Markets Inspectorate did not recommend the introduction of smart meters for all customers on the Swedish natural gas market. This would in practice result in unreasonable high additional costs for household consumers and might have as a consequence that this group of consumers decide to exchange natural gas as an energy source for electricity. In the report it was recommended:

- to introduce obligatory installation of smart meters for consumers between 300MWh and 3000 MWh
- to make installation of smart meters voluntary but possible for consumers between 300 MWh and 30MWh
- not to introduce smart metering for consumers with a yearly consuming less than 30 MWh

Table 3: Meter reading per customer type<sup>16</sup>

Meter reading	Consumption	Customer	Number of customers and % with installed smart meters
Daily	At least 3000 MWh a year or 500 MWh a month	Big gas consuming industries	258 (100% installed smart meters)
Monthly	30-3000 MWh a year	Small industrial customers	Approximately 1600 (30% installed smart meters)
Yearly	1.2-30 MWh a year	Household consumers (cooking + heating and central heating for at least 10 households)	Almost 16000 (3% installed smart meters)
Not at all	Less than 1.2 MWh a year	Household consumers (cooking)	19000

## Conclusion

Despite the fact that the Swedish natural gas market is a small one does it function relatively well and is it managed in an effective cooperative manner by the market players. The applied balancing model, including the important role the TSO's are playing

<sup>15</sup> EI R2012:01, Smarta mätare i det svenska naturgassystemet (Smart metering in the Swedish natural gas system)

<sup>16</sup> EI R2012:01, Smarta mätare i det svenska naturgassystemet, Pöyry

offering line-pack services and thus providing security in the system, is working well and is fulfilling the requirements of transparent and non-discriminatory behaviour.

Also the method used for balance settlement with a balance account for every Network Owner is a very efficient way of running the market. In this method imbalances are cumulated and positioned. A settlement is made at the end of the day when the imbalance is put on the imbalance account which will be carried over to the next day. There is no general fee for imbalances.

The main concern and undoubtedly the major challenge for the near future is the question how to cover the expected shortage in the supply of natural gas when the Danish Tyra field will be empty. As shown above does Sweden not have any extraction of natural gas at all and is the volume of produced biogas on a national level still insufficient to compensate the decreased supply from the Danish Tyra field. In combination with the absence of cross border pipelines to other natural gas extracting countries this will undeniably give rise to situations where Gas Suppliers might get problems to provide the consumers on the Swedish natural gas market with natural gas.